PSYCHOPHYSIOLOGY

THE INTERNATIONAL JOURNAL OF THE
SOCIETY FOR PSYCHOPHYSIOLOGICAL RESEARCH

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Saturday, October 1, 2022

2022 Hybrid Annual Meeting of the Society for Psychophysiological Research

Pre-Conference Workshops: Wednesday, September 28, 2022.
Annual Meeting: Wednesday, September 28-Saturday, October 1, 2022.
Website: www.sprweb.org

This Supplement contains the abstracts from each presentation in the Symposia, Big Ideas and Poster Sessions being presented at the 2022 SPR Hybrid Annual Meeting scheduled for September 28–October 2.

All authors are listed in the Index to Abstract Authors. In addition, abstract topics are listed in the Index to Abstract Descriptors.

The 2022 Hybrid Annual Meeting Program includes three Pre-Conference Workshops, three Invited Addresses, two Presidential Addresses, two Big Idea Sessions, three Early Career Award Addresses, and multiple Symposia. Specific research topics will be covered in the Symposia. The majority of the research reports will be discussed at the four Poster Sessions, one being a virtual Poster Session.

We welcome our first face-to-face meeting attendees since 2019! All sessions will be live-streamed for our virtual audience. Poster presenters are contributing short videos and pdfs of their research which will be accessible to both audiences.

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

Jan Wessel
2022 Program Committee Chair

Program Committee (2021–2022)
Jan Wessel, University of Iowa (2022 Program Chair)
Dan Foti, Purdue University (2019–21 Program Chair)
Marta Andreatta, Erasmus University Rotterdam (2023 Program Chair)
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Marco Steinhauser, Katholische Universität Eichstätt
Virginia Sturm, University of California, San Francisco
Jakub Szewczyk, University of Illinois, Urbana-Champaign
Robert Whelan, Trinity College Dublin

Pre-Conference Workshops (available at an additional fee)
Wednesday, September 28, 2022
9:00 a.m.-4:30 p.m. PDT

Pre-Conference Workshop #1: Micro ERP Boot Camp
Emily S. Kappenman, PhD
San Diego State University

Pre-Conference Workshop #2: Methods for Analyzing Neural Oscillations and Aperiodic Activity
Bradley Voytek, PhD
University of California, San Diego

Pre-Conference Workshop #3: Multi-Level Modeling Workshop
Elizabeth Page-Gould, PhD
University of Toronto, Toronto, Ontario

Program Highlights

Wednesday, September 28, 2022

5:00 p.m.-6:30 p.m. PDT
Psychophysiology: Using *Psychophysiology's* Guideline Articles as a Resource and as a Guide for Publishing in the Journal

7:00 p.m.-9:00 p.m. PDT
Opening Reception and Poster Session 1

Thursday, September 29, 2022

8:30 a.m.-10:00 a.m. PDT
Big Idea Session: New Methods in Psychophysiology

10:30 a.m.-12:00 p.m. PDT
Presidential Symposium on Diversity, Representation, and Inclusion

1:35 p.m.-2:35 p.m. PDT
Invited Address
Interpreting the Mechanisms and Meaning of Human MEG/EEG Signals with the Human Neocortical Neurosolver Software
Stephanie R. Jones, PhD
Brown University

6:10 p.m.-8:10 p.m. PDT
Poster Session 2

Friday, September 30, 2022

8:30 a.m.-10:00 a.m. PDT
Faces of the Future Flash Talks

10:30 a.m.-11:30 a.m. PDT
Invited Address
Reflections on Cortico-Subcortico-Cortical Circuitry in Action, Perception, and Cognition
Sonja A. Kotz, PhD, MSc
Maastricht University

11:30 a.m.-1:00 p.m. PDT
Virtual Poster Session

1:00 p.m.-2:30 p.m. PDT
Big Idea Session: Psychophysiology of Cognitive Control and Executive Functions

3:00 p.m.-4:30 p.m. PDT
Presidential Symposium: Transcranial Focused Ultrasound Neuromodulation: A Novel Tool in Psychophysiology

4:30 p.m.-5:30 p.m. PDT
Invited Address
Probing the Role of the Cerebellum in Sensorimotor Learning and Cognition
Rich Ivry, PhD
University of California, Berkeley

6:00 p.m.-8:00 p.m. PDT
Poster Session 3

10:00 p.m. PDT
Student Social

Saturday, October 1, 2022

10:30 a.m.-11:30 a.m. PDT
Presidential Address 2022
Beyond Peaks and Troughs: Multiplexed Performance Monitoring Signals in the EEG
Prof. Dr. med. Habil. Markus Ullsperger
Otto-von-Guericke University, Magdeburg

11:30 a.m.-12:30 p.m. PDT
Presidential Address 2020–21
Salience: Inter- and Intraindividual Differences and Implications for Social and Clinical Behavior
Bruce D. Bartholow, PhD
University of Missouri, Columbia

12:45 p.m.-3:00 p.m. PDT
SPR Business Meeting and Awards Luncheon
(Register for the luncheon on the registration form.)

3:15 p.m.-3:45 p.m. PDT
Early Career Award Address
The Role of ERPs in Psychological Science: Past, Present, and Future
Emily S. Kappenman, PhD
San Diego State University, San Diego, CA

3:45 p.m.-4:15 p.m. PDT
Early Career Award Address
Disengaged: The Significance of Blunted LPPs Across Psychiatric Health and Disease
Annmarie MacNamara, PhD
Texas A&M University, College Station

4:15 p.m.-4:45 p.m. PDT
Early Career Award Address
Static and Dynamic Markers of Affect Regulation: Integrating Psychophysiological Indices Across Time and Contexts
Jonathan P. Stange, PhD
University of Southern California, Los Angeles

9:00 p.m. PDT
Saturday Night Social

ABSTRACT

Symposia Abstracts

Thursday, September 29, 2022

8:30 a.m.-10:00 a.m. PDT
Symposium 1.1
STUDYING MOTIVATION – LESSONS FROM TRAITS, STATES AND COGNITIVE CONTROL

Session Chair: Katharina Paul
University of Hamburg
Discussant: John Allen
University of Arizona

Descriptors: Effort, Approach Motivation, Inter-Individual Differences

Should I join my friends for a beer or should I finish my grant proposal? In this symposium we present recent scientific findings on why we reach for some goals and not others from three perspectives, where motivation is conceptualized as (1) an interindividual-trait, (2) a transient state, and (3) a driving factor in decision making and cognitive control. Regarding the first, Katharina Paul presents data from a large-scale study to assess if inter-individual differences of trait approach motivation can be captured by means of neurophysiological markers (frontal alpha asymmetry), in particular during motivational contexts. Regarding the second, Ricardo Wilhelm shows how motivational intensity influences action preparation (beta activity) during situations triggering intrinsic or extrinsic motivation. Introducing the cognitive control perspective, Akina Umemoto discusses ACC correlates of motivated but effort-based decision making (FMT, RewP) when subjects face physical efforts. Monja Froböse complements this perspective by testing the neuropharmacological, i.e., catecholaminergic, modulation of motivation to assert cognitive control and behavior during differently motivating contexts. All results will be discussed and integrated by John Allen, an expert on studying motivation and emotional influences on decision making. Our symposium connects researchers from multiple labs, with diverse ethnical backgrounds, who are actively globally connected. Together, we aim to stimulate an active exchange between different approaches to study motivation and motivated behavior.

IS FRONTAL ALPHA ASYMMETRY AN INDEX OF TRAIT APPROACH MOTIVATION IN MOTIVATIONAL CONTEXTS? EVIDENCE FROM A LARGE-SCALE DATASET

Katharina Paul, Jan Wacker
University of Hamburg

For many years, resting frontal alpha asymmetry (ASY) has been put forward as a marker of trait approach motivation, however according to recent meta-analyses, associations with self-reports of relevant traits are either very small or non-existent. Aiming to explain this lack of replicability, it was suggested that individual differences due to traits (i.e., ASY) should be pronounced in situations where individuals show differences in their predisposition to approach. In order to test this idea, we drew on data from the ongoing CoScience project, which allows to test this probably small association with sufficient statistical power ($n = 720$). We quantified ASY during a resting period, a picture viewing task, and a gambling task, with the rationale that the later would trigger approach motivation (in some individuals more than others) due to the positive nature of the pictures and the offered monetary incentives, respectively. Preliminary analyses ($n = 250$) showed that while associations between self-reports of approach motivation and ASY were absent during the resting phase, positive associations were found during picture viewing when pictures were rated as positive. These new results inform the conceptualization of ASY and imply recommendations on how future studies should study inter-individual differences. Following the principles of the CoScience project, the preregistered final analyses are complemented by a multiverse analysis in order to test the robustness of the presented results against the researcher's degrees of freedom during data analysis.

S4 | wileyonlinelibrary.com/journal/psyp *Psychophysiology.* 2022;59(Suppl. 1):S4–S35.

MOTOR-PREPARATION ACROSS MULTIPLE MANIPULATIONS OF MOTIVATIONAL INTENSITY

Ricardo Wilhelm[1], Matthew Miller[2], Philip Gable[3]
[1]*Laureate Institute for Brain Research,* [2]*Auburn University,* [3]*University of Delaware*

Approach motivation is critical in dictating an individual's effort to accomplish or attain a goal by triggering the impetus to act. Past work on motivation has largely focused on how types of motivation (e.g., extrinsic or intrinsic) influence behavior. However, focusing on the motivational intensity, or strength, of the motivational context may better reveal the unique differences in different types of motivators. Motivational intensity suppresses neural patterns of beta band frequency over the motor cortex and reflects motor-action preparation. Four experiments investigated neural motor-action preparation to different manipulations of motivation: expectancy of social performance comparisons (Experiment 1), achievement (Experiment 2), autonomous (Experiment 3), and extrinsic (Experiment 4) motivation. Experiments 1 and 2 found that social performance comparisons and achievement-based intrinsic motivation enhanced motor preparation (decreased beta activity), while high autonomy-based intrinsic motivation relative to low autonomy (Experiment 3) did not Extrinsic motivators (e.g., reward) enhanced motivational intensity compared to a high autonomy condition of motivation (Experiment 4). These findings suggest that beta suppression appears to be a neural mechanism sensitive to approach motivational intensity. Motivational intensity within different manipulations of motivation, rather than strict dichotomous motivation categories, appears to be a primary mechanism for understanding the role of motivation on neural correlates of action preparation.

DECISION, MAINTENANCE, AND VALUE OF PHYSICAL EFFORT ARE ASSOCIATED WITH FRONTAL MIDLINE THETA AND REWARD POSITIVITY

Akina Umemoto[1], Hause Lin[2,3], Clay Holroyd[4,5], Michael Inzlicht[6]
[1]*Columbia University,* [2]*University of Regina,* [3]*Massachusetts Institute of Technology,* [4]*University of Victoria,* [5]*Ghent University,* [6]*University of Toronto*

Should I go for a run, or should I stay and watch Netflix? Effort-based decision making depends on evaluating the value of effort-related costs against potential rewards, and only when the rewards outweigh their effort costs do effortful behaviors tend to get carried out. Here we used two electrophysiological correlates of ACC activation, frontal midline theta (FMT) and the reward positivity (RewP), to examine ACC function in value-based decision making tasks requiring physical effort. We investigated whether FMT power is sensitive to different decision processes (i.e., decision, selection, and execution of effort), and whether the RewP is sensitive to the subjective value of reward and effort choice. In Study 1 (n = 64) and Study 2 (n = 38, pre-registered report), participants chose to execute a baseline low-effort or a high-effort behavior (that required squeezing a hand-dynamometer) to obtain smaller or larger rewards, respectively, while their brainwaves were recorded. Results indicate the role of FMT power in effort-based decision making, although further replication is needed. RewP amplitude increased with increasing effort, and single-trial RewP and delta power were positively associated with subjective values of effort choice derived from behavioral modelling of choices, suggesting that RewP reflects cost–benefit calculation of the effortful option. These results point to a unique role for ACC in motivating and persisting at effortful behavior by integrating decision costs and reward values. Implications for reduced motivation in depressed adolescent will be discussed.

EFFECTS OF METHYLPHENIDATE ON THE MOTIVATION OF FLEXIBLE AND FOCUSED COGNITIVE CONTROL

Monja Froböse[1], Jennifer Swart[2], Jennifer Cook[3], Dirk Geurts[4], Sean Fallon[2], Hanneke den Ouden[2], Roshan Cools[2]
[1]*Heinrich Heine University Düsseldorf,* [2]*Radboud University,* [3]*University of Birmingham,* [4]*Radboud Medical Centre*

Our constantly changing environment requires an adaptive balance between focus and flexibility: We should suppress irrelevant new input, but respond flexibly when new input is relevant. Accumulating evidence indicates a role of catecholamine transmission in this cognitive flexibility/stability tradeoff. Moreover, recent studies suggest that shifts in the tradeoff might reflect drug-induced changes in the motivation of cognitive control.

We assessed the role of catecholamine transmission in the degree to which distinct flexible versus stable component processes of working memory are altered by incentive motivation. To this end, we administered 20 mg of methylphenidate or placebo in a within-subject design to 100 healthy, young adults. On drug, they performed an adapted delayed match-to-sample task to probe distractor inhibition (i.e. focus) and flexible updating in separate blocks that promised gains, absence of losses or no monetary outcomes for good performance. We expected to replicate that methylphenidate improves distractor inhibition and hypothesized that methylphenidate would alter the effect of motivation on task performance. Preliminary results indicate that both methylphenidate and incentive motivation improved overall task performance, however methylphenidate did not alter the strength of the motivational effect on task execution. These findings suggest that both methylphenidate and incentive motivation independently improved overall working memory performance instead of selectively shifting the flexibility/stability tradeoff.

8:30 a.m.-10:00 a.m. PDT
Symposium 1.2
LITTLE BRAIN, BIG QUESTIONS: EXAMINATION OF CEREBELLAR ACTIVITY FROM MOVEMENT TO COGNITION AND AFFECT

Session Chair: Krystal Parker
University of Iowa
Discussant: Krystal Parker
University of Iowa

Descriptors: cerebellum, cognition, EEG
The cerebellum is traditionally viewed as a motor structure which is "silent" to non-invasive electroencephalographic measurements. However, recent findings call this narrative into question. Indeed, new work suggests that cerebellar activity during vestibular stimulus processing may be detectible at the level of the scalp. Additionally, cerebellar activation is observed during a range of cognitive tasks via fMRI. Finally, work with neuropsychiatric populations suggests that individuals with cerebellar damage can exhibit cognitive or mood symptoms even when not exhibiting motor symptoms. In this symposium, speakers will share the latest findings regarding cerebellar involvement in learning, cognition, and mood regulation. Speakers will also cover new ways of investigating cerebellar activity including the electrocerebellogram (ECeG) and cerebellar modulation via tDCS/TMS. Although the story regarding the function of the cerebellum is still unfolding, new research suggests that it is more complex, and more interesting, than was previously imagined.

CEREBELLAR MODULATION OF COGNITION AND COGNITIVE NETWORKS

Catherine Stoodley, Laura Rice, Anila D'Mello
American University

Different cerebellar subregions are engaged during motor and non-motor behaviors, reflecting the topographic layout of cerebro-cerebellar connections. Anterior cerebellar regions contain the well-characterized sensorimotor homunculus, whereas posterolateral cerebellar hemispheres are engaged during a range of cognitive tasks and are functionally connected to cortical networks that support cognition. We examined the impact of cerebellar neuromodulation with transcranial direct current stimulation (tDCS) on both brain and behavior in two studies. First, cerebellar neuromodulation impacted behavioral performance and neural activation patterns in a regionally-specific manner in young adults. Active tDCS targeting the right posterolateral cerebellum improved performance on a sentence completion task and increased activation within functionally-connected cerebral cortical networks. Neuromodulation targeting the anterior cerebellum did not significantly impact cognitive task performance. Second, we determined the behavioral and neural impacts of cerebellar tDCS on brain activation patterns and performance of a social cognition task in neurotypical young adults and young adults with a diagnosis of autism. Across groups, better performance was associated with fewer autism symptoms and greater cerebellar activation. In the autism group, cerebellar tDCS improved performance, increased cerebellar activation, and resolved atypical functional connectivity patterns. These findings support the cerebellar modulation of cognition through its functional impact on broader cortical networks.

CEREBELLAR ABNORMALITIES IN PSYCHIATRIC DISORDERS: FROM PSYCHOTIC DISORDERS TO TRANSDIAGNOSTIC PSYCHOPATHOLOGY

Jerillyn Kent, Scott Sponheim, William Hetrick
The University of Texas at Dallas

The theory of cognitive dysmetria, originally proposed by Dr. Nancy Andreasen, is a prominent theoretical model of cerebellar contributions to psychotic disorders. This theory postulates that cerebellar dysfunction disrupts the smooth temporal coordination of motor, cognitive, and affective information, thereby potentially contributing to both motor abnormalities and cardinal symptoms of psychotic disorders. I will review this theoretical model, with an emphasis on neurobiological and psychological plausibility. Next, I will present some of our work investigating cerebellar abnormalities in the psychosis spectrum that supports this theoretical model. Specifically, I will present both behavioral and neuroimaging findings indicating cerebellar dysfunction in individuals with psychotic disorders using postural sway and eyeblink conditioning as probes of cerebellar integrity. I will also present data investigating cerebellar integrity in biological first-degree relatives of individuals with psychotic disorders, and discuss implications for the relationship of cerebellar abnormalities to genetic liability for psychotic disorders. Finally, I will briefly review literature implicating cerebellar abnormalities in transdiagnostic psychopathology, including bipolar disorder and neurodevelopmental disorders, and discuss the theoretical implications of transdiagnostic cerebellar dysfunction.

CEREBELLAR TRANSCRANIAL MAGNETIC STIMULATION IN PATIENTS WITH BIPOLAR DISORDER

Victoria Muller Ewald, Nicholas Trapp, Aaron Boes, Krystal Parker
University of Iowa

Recent work has implicated cerebellar abnormalities in the pathophysiology of bipolar disorder, including dysfunctional interactions between the cerebellum and the medial frontal cortex. In the present double blinded clinical trial, we sought to increase cerebellar-medial frontal cortical connectivity through cerebellar transcranial-magnetic stimulation (TMS). Effects of TMS on clinical symptoms and cognition were evaluated via clinical scales (MADRS, YMRS, CGI, Columbia Suicide scale) and cognitive tasks (NIH cognitive toolbox, supra-second interval-timing task, stop-signal task). Effects of TMS on medial frontal activity was evaluated via electroencephalography. Men and women suffering from BD (n = 34) were randomly divided into active and sham treatment groups. Neuro-navigated TMS of the cerebellar vermis, or sham treatment, was provided 2x/day for 5 days (total of 10 sessions). A theta-burst stimulation protocol was administered resulting in a total of 200 stimuli per session. We found that scores on clinicals scales improved for both sham and active groups, with no significant differences between groups. Additionally, although individuals with BD were impaired in the supra-second interval timing task, cerebellar TMS treatment did not rescue performance. Finally, although effects of cerebellar TMS on frontal activity differed between sham and active groups during the stimulation itself, these effects were not long-lasting.

NON-INVASIVE ELECTROPHYSIOLOGICAL RECORDING OF THE HUMAN CEREBELLUM DURING MOTOR LEARNING AND TIMING

Neil Todd, Sendhil Govender, James Colebatch
UNSW Sydney

Using high-density EEG and source analysis methods we have been able to estimate the origins of evoked potentials from vestibular stimuli as including cerebellar sources, which we refer to as vestibular cerebellar evoked potentials (or VsCEPs). In the course of this work, we also discovered that it is possible to record the spontaneous activity of the cerebellum, known as the electrocerebellogram (or ECeG), which has a much higher frequency power spectral profile than is typical of EEG. The likely climbing-fibre (CF) origin of the VsCEPs is supported by their polarity, magnitude, latency and laterality, all consistent with the known properties of the olivo-cerebellar projections, and the presence of post-CF response (CFR) pausing in the high-frequency ECeG. Given the inhibitory action of Purkinje cells, the post-CFR pausing can be linked to downstream facilitation of target motor neurones in spinal and brainstem reflex pathways and thus

interpreted according to the Marr/Albus/Ito learning theoretic perspective as the signalling pathway linking unconditional stimuli and unconditioned responses in classical conditioning.

8:30 a.m.-10:00 a.m. PDT
Symposium 1.3
NON-INVASIVE BRAIN STIMULATION: FROM BASIC MECHANISM TO CLINICAL APPLICATIONS

Session Chairs: Martin Herrmann[1], Markus Junghöfer[2]
[1]University of Würzburg, [2]University of Muenster

Descriptors: Non-invasive brain stimulation, Emotion, Brain imaging

Non-invasive brain stimulation (NIBS) enables the modulation of multiple mental processes. NIBS therefore cover a broad spectrum of applications, which we will try to partially reflect here: In a first, more basic work by Miles Wischnewski, it is shown that the effect of transcranial magnetic stimulation (TMS) depends on the brains actual EEG-specific state. Specifically, he shows that real time EEG-data can be used to trigger TMS. Next, Lisa McTeague will present studies on utilizing concurrent TMS-fMRI to causally probe neurocircuit integrity. This includes responses both at rest and under varying levels of motivational and cognitive foreground load. In Thomas Kroker's presentation, transcranial direct current stimulation (tDCS) of the vmPFC is shown to modulate loss-aversion and financial decision-making, with effects found in neural (MEG) and behavioral levels. In another MEG study by Miguel Escrig and coworkers, transcranial static magnetic stimulation (tSMS) of the vmPFC is shown to evoke a depression-like pattern of emotional stimulus processing. Finally, in Lisa Cybinski's presentation, a study of the modulation of mental processes is transformed into a randomized clinical trial. Specifically, the hypothesis of whether stimulation of the left frontal cortex before exposure therapy enhances therapeutic rTMS effects is tested. Resting-state fMRI is used to provide neurophysiological support for the selection of the target region.

OSCILLATION PHASE-SPECIFIC MODULATION OF CORTICAL EXCITABILITY USING CLOSED-LOOP TRANSCRANIAL MAGNETIC STIMULATION

Miles Wischnewski, Zachary Haigh, Sina Shirinpour, Ivan Alekseichuk, Alexander Opitz
University of Minnesota

Transcranial magnetic stimulation (TMS) activates neurons in the cortex non-invasively. TMS has proven as a valuable tool within cognitive neuroscience and in the treatment of psychiatric disorders, however, responses to TMS are subject to inter- and intra-individual variability. To tackle this variability, attempts have been made to provide individualized TMS based on ongoing brain states. Using such closed-loop systems electroencephalography (EEG) data is read-out and analyzed in real-time. TMS is triggered instantly (within a couple of milliseconds) to provide EEG state-specific neuromodulation. This technology allows for targeting different neural oscillation phases, which has been shown to modulate corticospinal excitability. In a recent study in twenty healthy volunteers, we showed a double dissociation between cortical alpha and beta oscillation phase on motor cortex excitability. Specifically, TMS at the alpha oscillation trough and beta oscillation peak led to increased corticospinal output, whereas TMS at alpha peak and beta trough led to decreased corticospinal output. Thus, our results imply modulation of cortical activity is optimal when phase is considered. The next step is to verify feasibility real-time closed-loop TMS in clinical populations. This will allow for personalized neuromodulation treatments, where stimulation parameters are adapted based on ongoing neural activity.

CONCURRENT TMS-FMRI: CAUSAL PERTURBATION AND MAPPING OF NEUROCIRCUITRY

Lisa McTeague[1], Marlen Gonzalez[2], James Lopez[1], Logan Dowdle[3], Ryan Webler[3], Mark George[1]
[1]*Medical University of South Carolina,* [2]*Cornell University,* [3]*University of Minnesota*

Transcranial magnetic stimulation delivered concurrent with functional magnetic resonance imaging (TMS-fMRI) extends conventional correlational imaging to causal neurocircuit mapping. Single pulses of

TMS (spTMS) can be delivered to superficial cortical regions, and the activity in the connected networks mapped with the BOLD response. In the current talk, we will present the findings of three studies of healthy participants utilizing TMS-fMRI. In the first study we investigated whether probing three nodes of the cognitive control network would differentially influence the fronto-parietal and cingular-opercular subnetworks. In the second study we investigated whether state dependence, particularly emotional arousal induced by natural scenes, would influence the responsiveness of the fronto-parietal and somato-motor networks to spTMS. In the third study we examined whether variations in cognitive load secondary to a visual n-back would influence the responsiveness of the fronto-parietal and default networks secondary to spTMS. Therapeutic repetitive TMS is most commonly applied to the left dorsolateral prefrontal cortex toward the aim of improving cognitive and emotional regulation. Our findings suggest that other superficial cortical regions are similarly robust targets for influencing the networks integral to adaptive emotion and cognition. Furthermore, our findings suggest that modifying the cognitive or emotional engagement of the participant in a foreground task enhances neurocircuit responsiveness to spTMS, pointing to a potential means of improving therapeutic rTMS.

NONINVASIVE STIMULATION OF THE VENTROMEDIAL PREFRONTAL CORTEX INCREASES RATIONALITY OF HUMAN DECISION-MAKING IN A FINANCIAL GAMBLING PARADIGM

Thomas Kroker[1], Mirek Wyczesany[2], Maimu Rehbein[1], Kati Roesmann[1,3], Ida Wessing[1], Markus Junghöfer[1]
[1]*University of Muenster*, [2]*Jagiellonian University*, [3]*University of Siegen*

The framing-effect is a bias that affects decision-making depending on whether the available options are presented with positive or negative connotations. Even when the outcome of two choices is equivalent, people have a strong tendency to avoid the negatively framed option because losses are perceived about twice as strongly as gains of the same amount (i.e., loss-aversion). The ventromedial prefrontal cortex (vmPFC) is crucial for rational decision-making, and dysfunctions in this region have been linked to impulsive behavior and gambling addiction. Using a financial decision-making task in combination with magnetoencephalographic neuroimaging (MEG), we show that excitatory compared to inhibitory non-invasive transcranial direct current stimulation

(tDCS) of the vmPFC reduces framing-effects and adverse responses to loss-probabilities ultimately leading to increased total gains. Behavioral and neural data consistently suggest that this improved rational decision-making is predominately consequence of reduced loss-aversion. This tDCS driven reduced loss-aversion (i.e. attenuated negativity-bias) dovetails with our previous findings of a relatively reduced 'negativity-bias' of emotional scene and face processing after excitatory compared to inhibitory vmPFC-tDCS. These findings recommend further research towards clinical applications of vmPFC-tDCS in psychiatric disorders showing vmPFC dysfunctions during safety and reward processing such as anxiety, depression or addiction.

TRANSCRANIAL STATIC MAGNETIC STIMULATION OF THE VENTROMEDIAL PREFRONTAL CORTEX EVOKES A 'NEGATIVITY BIAS' IN THE PROCESSING OF EMOTIONAL SCENES: MAGNETOENCEPHALOGRAPHIC CORRELATES

Miguel Escrig[1], Mamen Pastor[2], Jan-Philipp Meurer[3], Lorenz Vier[3], Markus Junghöfer[3]
[1]*Universidad Europea de Valencia*, [2]*Universitat Jaume I*, [3]*University of Münster*

Transcranial Static Magnetic Field Stimulation (tSMS) is a quite novel non-invasive brain stimulation method recently applied in affective and cognitive neuroscience. It has been shown that tSMS, independent of its polarity (south, north) can attenuate the excitability of visual and prefrontal cortex regions. Using fMRI and MEG we showed in previous studies, that excitatory compared to inhibitory transcranial Direct Current Stimulation (tDCS) of the ventromedial Prefrontal Cortex (vmPFC) enhanced the processing of positive relative to negative emotional scenes and faces predominately within right hemispheric visual cortex regions. Here, we test the hypothesis that inhibitory tSMS compared to sham tSMS could elicit an inverse depression like 'negativity bias'. Two independent groups of participants were stimulated for 20 minutes at two different days with either verum or sham tSMS (Group1: south pole vs sham; Group2: north pole vs sham, balanced order of verum or sham stimulation), and passively viewed negative and positive emotional scenes in the MEG before and directly after stimulation. In fact, both south-pole and north-pole verum tSMS increased negative compared to positive scene processing within right hemispheric visual cortex regions. Timing and localization of the neural cluster

PSYCHOPHYSIOLOGY SPR

showing a negativity-bias after verum but a positivity-bias after sham tSMS in both groups was highly convergent to our previous tDCS findings. Implications for occupational safety but also clinical relevance for mood disorders will be discussed.

AUGMENTING EXPOSURE-BASED THERAPY IN ACROPHOBIA WITH INTERMITTENT THETA BURST STIMULATION

Lisa Cybinski[1], Dominik Gall[1], Daniel Gromer[1], Tommi Raij[2,3], Florian Gundelach[1], Stefan Unterecker[1], Angelika Erhardt[1,4], Andreas Mühlberger[1,5], Jürgen Deckert[1], Thomas Polak[1], Paul Pauli[1], Martin Herrmann[1]

[1]University of Wuerzburg, [2]Harvard Medical School, [3]Massachusetts General Hospital, [4]Max Planck Institute of Psychiatry, [5]University of Regensburg

Transcranial magnetic stimulation (TMS) could be useful to augment exposure-based therapy for anxiety disorders, but it is limited as the optimal treatment target area is still unknown. In this double-blinded, randomized, placebo-controlled clinical trial of 76 patients with acrophobia, the left frontal cortex was stimulated using the activating intermittent theta burst (iTBS) protocol. For this purpose, we used individual structural MRI data in a TMS neuronavigation system. For individual TMS targeting, we used FreeSurfer morphing techniques to map previously published cortical surface areas on each participant's brain. These surface areas were selected from laboratory studies identifying frontal TMS targets associated with enhanced fear extinction processes. Therefore, in the present study, we tested the hypotheses of whether stimulation of the left frontal cortex before exposure therapy enhances therapeutic TMS effects. Furthermore, we will show whether TMS effects are modulated by the distance of the actually stimulated area from the individually calculated maximum of functional connectivity with the ventromedial cortex using resting-state fMRI measures.

PRESIDENTIAL SYMPOSIUM ON DIVERSITY, REPRESENTATION, AND INCLUSION

Session Chair: Lisa Gatzke Kopp
Pennsylvania State University

WHAT, WHEN, AND FOR WHOM? REFLECTIONS ON THE ROLE OF SEX, GENDER AND HORMONES IN ANXIETY, MOOD AND ASSOCIATED COGNITIVE FUNCTIONS

Jason Moser, Courtney Louis
Michigan State University

Descriptors: affective symptoms, cognitive function, hormones

Extant research suggests that anxiety and mood symptoms are higher and more impairing in females than males. Such findings have led to investigations into the possible mechanisms involved in these sex differences, with hormones being prime candidates. A mostly parallel line of work has also noted sex differences in and hormone influences on cognitive functions that are often associated with anxiety and mood problems. I will review work from our research group that began with a chance finding suggesting that the association between anxiety and error monitoring brain activity was larger in females than males. Since this initial finding, we have revealed a nuanced role for hormones -- estradiol and progesterone -- in anxiety, mood and associations between these symptoms and cognitive function. Three main themes have emerged from our work: 1) that direct associations between hormonal fluctuations across the menstrual cycle and anxiety, mood and associated cognitive functions are few and small, 2) that average levels of hormones between persons play a stronger role in associations between anxiety and cognitive function than fluctuations within a person, and 3) that hormones and cognitive functions have unique links to different facets of anxiety and mood in females. I conclude with reflections on methodical challenges involved in conducting this work, the importance of separating sex assigned at birth from gender, the role of investigator positionality, reducing biases in reporting and interpretation of findings, and the need to pay greater attention to intersectionality.

NEURAL MECHANISMS OF PERCEIVING EYE GAZE AND EMOTIONAL FACIAL EXPRESSIONS DURING MOTHERHOOD

Shadi Bagherzadeh Azbari[1], Andrea Hildebrandt[2], Olaf Dimigen[1], Werner Sommer[1]
[1]Humboldt University of Berlin, [2]Carl von Ossietzky Universität Oldenburg

Descriptors: Facial Expressions, Motherhood, ERPs

Humans as social species intensely use their faces for transmitting social signals. Therefore, emotional expressions of faces and eye gaze are highly relevant for social interaction. Since the post-partum period has been suggested to be special for eye contact behavior and facial expression decoding, we investigated the associations of motherhood with neural signals of eye contact and the perception of emotion expressions. Event-related brain potentials (ERPs) were recorded from 59 mothers of infants and 55 nullipara women during a task, where gaze changes had to be detected in the faces of adults and infants with happy, angry, and neutral expressions that were initially presented with direct or averted gaze. The N170 amplitude was larger to averted than direct gaze in the initial gaze presentation and to gaze changes from direct to averted than from averted to direct in the gaze change phase. This effect was more pronounced to the infant than adult faces in both participant groups. For the Early Posterior Negativity (EPN) component, we replicated classic effects for emotion in both the initial gaze phase and gaze change phase from 200 to 400 ms. In the gaze change phase largest EPN amplitudes were found in response to angry infant faces and to happy adult faces in combination displaying direct gaze. As a major new finding, in the initial gaze phase (250–300 ms) we found group differences in response to infant faces, indicating heightened sensitivity of the eye contact detecting system for infant faces dependent on motherhood status.

HORMONAL STATUS EFFECTS ON THE ELECTROPHYSIOLOGICAL CORRELATES OF PERFORMANCE MONITORING IN WOMEN

Myrthe Jansen[1,2], Danielle Hamstra[1,2], Mischa de Rover[1,2], Ellen de Bruijn[1,2], Willem van der Does[1,2,3]
[1]Department of Clinical Psychology, [2]Leiden Institute for Brain and Cognition (LIBC), [3]Leiden University Treatment and Expertise Center (LUBEC)

Descriptors: electrophysiological performance monitoring, female hormones, negative affect

Fluctuations in female hormonal levels are thought to play a role in the increased prevalence of mood and anxiety disorders in women. We investigated whether female hormonal status, specifically menstrual cycle phase and oral contraceptive (OC) use, impact two putative, electrophysiological biomarkers for internalizing disorders, the error-related negativity (ERN) and error positivity (Pe). We also examined the relationship between the ERN and negative affect (NA) across the menstrual cycle. Participants were healthy, pre-menopausal women who were naturally cycling (NC) or using OCs. Using a counterbalanced within-subject design, NC women (N = 42) performed a Flanker task during the early follicular (EF) and midluteal (ML) phase (when estrogen and progesterone are both low and both high, respectively), while OC users (N = 42) performed this task during active OC use and during their pill-free week. Estradiol and progesterone levels were assessed using saliva samples. We found no differences in the ERN, Pe or NA between the two cycle phases in NC women. We did observe a negative relation between phase-related changes in the ΔERN and changes in NA. Exploratory mediation analysis additionally showed a negative indirect effect of phase-related changes in estradiol on NA via the ΔERN. Additionally, we observed increased ΔPe amplitudes in OC users compared to NC women. These findings suggest that hormonal status may impact the neural correlates of performance monitoring and error sensitivity, and that this could be a potential mechanism through which ovarian hormones influence mood.

SEX AND AGE MODERATE THE RELATIONSHIP BETWEEN THE REWARD POSITIVITY AND SYMPTOMS OF DEPRESSION IN AN ADULT COMMUNITY SAMPLE

Roslyn Harold[1], Kayla Donalson[2], David Rollock[1], Roman Kotov[2], Greg Perlman[2], Katherine Jonas[2], Dan Foti[1]
[1]Purdue University, [2]Stony Brook University

Descriptors: Lifespan development, Sex, Depression

The Reward Positivity (RewP) is a neurophysiological index of reward sensitivity that is blunted in those at risk for and with depression. There is emerging evidence that this link between a blunted RewP and depression vulnerability may be specific to female-sexed people, although few studies have directly tested the moderating role of sex. The developmental trajectory of this association is also not well understood, given that studies have focused primarily on adolescence and young adulthood, with relatively few studies in middle and older adulthood. We sought to address these gaps by testing how sex and age may moderate

the RewP-depression association within an adult community sample ($N = 192$; 44.8% female; age: $M = 51.34$ years, range = 31–71). Symptoms of depression were evaluated using a clinical interview, and the RewP was elicited using a simple guessing task. There was a three-way interaction between depression symptom severity, age, and sex in predicting RewP amplitude ($\beta = .337$, $t = 2.016$, $p = .045$). More severe depression symptoms were associated with a blunted RewP specifically among younger female-sexed people (-1 SD age = 41.37, $\beta = -.34$); this association tapered at the mean sample age (age = 51, $\beta = -.02$) and was reversed among older female-sexed people ($+1$ SD age = 61.25, $\beta = .30$). This pattern of effects suggests that among female-sexed individuals, developmental processes continue to shape the association between reward sensitivity and depression throughout adulthood, highlighting the importance of modeling depression pathophysiology using a lifespan developmental framework.

3:00 p.m.-4:30 p.m. PDT
Symposium 2.1
DISENTANGLING MULTIPLEXED CONTRIBUTIONS TO ERROR AND REWARD PROCESSING ALTERATIONS IN PSYCHIATRY

Session Chair: Hans Kirschner
Otto-von-Guericke University

Descriptors: Reward Processing, Error Processing, EEG
The recognition of the importance of performance monitoring impairments in a variety of psychiatry disorders has led to intensive research into its behavioral and neurobiological correlates. However, the origins of and cognitive mechanisms that potentially contribute to performance monitoring impairments both within and across clinical populations are not as clear-cut as one would expect. In this symposium, a diverse line-up of experts at different careers stages (PhD student to professor) from Norway, Austria, the US, and Germany will combine data obtained from a wide range of human participants ranging from pre-clinical to clinical samples and different experimental designs to better characterize multiplexed contributions to electrophysiological error and reward processing correlates. Firstly, Rebecca Overmeyer will present data showing that performance monitoring alterations along the dimensions of impulsivity and compulsivity depend on motivational context. Thereafter, Daniela Pfabigan will demonstrate how the opioid system might exert diverging influence on automatic and more elaborate error processing stages. In the third talk, James Cavanagh will present data suggesting that the reward positivity is influenced by both cortical computations of reward surprise and affective (hedonic) factors. In major depression, a smaller reward positivity is primarily due to affective factors but does not reflect a deficit in information encoding. Finally, Hans Kirschner will present data indicating shared and distinct reward processing differences in depression and schizophrenia.

MOTIVATIONAL CONTEXT AND ERROR PROCESSING IN IMPULSIVITY AND COMPULSIVITY

Rebecca Overmeyer, Tanja Endrass
Technische Universität Dresden

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, only 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.

DIVERGING EFFECTS OF THE OPIOID SYSTEM ON ERROR PROCESSING

Daniela Pfabigan[1], Markus Rütgen[2], Sara Kroll[3], Igor Riečanský[2], Claus Lamm[2]
[1]University of Oslo, [2]University of Vienna, [3]University of Zurich

Opioid use disorder (OUD) and substance use disorders (SUDs) in general go along with impairments in cognitive control processes such as behavioural inhibition and error processing. First evidence suggests that the opioid system plays a role during error processing, thus it might constitute a neurochemical mechanism generally contributing to cognitive control impairments in OUD and other SUDs. To address this hypothesis, we systematically investigated the influence of external opioid administration and opioid blockade on error processing. In a between-subject double-blind design, participants received either 0.2 mg of the partial opioid agonist buprenorphine (BUP; often used in OUD and pain therapy), 50 mg of the opioid antagonist naltrexone (NAL; used to treat OUD and alcohol use disorder), or a placebo (CONTROL) before completing a Flanker task, during which EEG was recorded. We observed changes in initial error detection – indexed by diminished ERN amplitudes - in participants receiving NAL, compared to BUP and CONTROL participants. In contrast, later error processing stages – indexed by Pe amplitudes – were influenced by the opioid agonist BUP, but no effects of a blockade via NAL were observed in this stage. Our results provide a mechanistic understanding of the opioid system and its role in error processing suggesting that an imbalance of the opioid system might exert diverging influence on automatic and more elaborate error processing stages. This is of particular interest for patients in pain therapies and patients in treatment for alcohol and opioid use disorders.

THE REWARD POSITIVITY IS A NEXUS OF MULTIDIMENSIONAL VALUE

James Cavanagh[1], Chris Pirrung[1], Garima Singh[1], Trevor Jackson[1], Mark Lavelle[1], Darin Brown[2]
[1]University of New Mexico, [2]Pitzer College

The Reward Positivity (RewP) is specifically elicited by reward receipt and it is sensitively modulated by the degree of positive prediction error during reinforcement learning. Yet, the RewP also is modulated by state and trait affect, suggesting that it has a more complex computational role than reinforcement surprise. This is a critical problem to solve: if we want a mechanistic understanding of psychiatric distress, we need to understand what aspect of this signal (e.g., information vs. affect) is altered in special populations. Here we report on a series of investigations that have parsed the moderators and separable source generators of the RewP. Four separate experiments verify that affective "liking" of picture feedback boosts the RewP independent of other factors. This hedonic moderation of the RewP is absent in major depression, whereas is boosted for cue-relevant stimuli in individuals with high levels of alcohol use. Findings from MEG have verified separate generators for information vs. affective moderators of the RewP. Positive prediction errors are generated from ventrolateral areas. However, major depressive disorder is characterized by a deficit in subgenual cingulate and ventromedial activities. Together, these findings reveal that the RewP is simultaneously influenced by cortical computations of reward surprise as well as hedonic liking, and they suggest that a smaller RewP in major depression is primarily due to affective (hedonic) factors, not a deficit in information encoding.

SHARED AND SELECTIVE BIASES IN REWARD PROCESSING IN DEPRESSION AND SCHIZOPHRENIA

Hans Kirschner[1], Adrian Fischer[2], Thomas Frodl[1,3], Tilmann Klein[1,4], Markus Ullsperger[1,4]
[1]Otto-von-Guericke University, [2]Freie Universität Berlin, [3]RWTH Aachen University, [4]Center for Behavioral Brain Sciences

Emerging evidence indicates reward processing abnormalities in patients diagnosed with major depressive disorder (MDD) and schizophrenia (SZ). Specifically, findings are consistent in associating both conditions with disrupted phasic striatal dopaminergic signaling, which is critical for reinforcement learning. Here, we aimed to characterise possible abnormalities in reward processing in MDD and SZ. Participants performed a probabilistic learning task providing factual and counterfactual feedback. The sample consisted of 31 MDD, 24 SZ, and 33 matched healthy controls. We combined computational modelling and EEG to study distinct learning effects within each group. Both patient groups showed decreased task performance. Patients with MDD demonstrated stronger negative learning and increased choice stochasticity. Patients with SZ attributed higher initial values to stimuli leading to biased choice behavior and were less able to utilize simple decision heuristics. On the neural level, there was no tracking of expected values in patients with SZ and MDD for factual feedback.

Moreover, outcome and prediction error (PE) encoding was less pronounced in the P3b in patients with SZ during both, factual and counterfactual feedback processing. Specific to counterfactual feedback, we observed enhanced allocation of attention in MDD that was quantified in larger P3a and exclusive coding of PE and outcome in the FRN in SZ. Taken together, we demonstrate shared and distinct abnormalities in reward processing across patient groups, that may inform future treatments and research.

3:00 p.m.-4:30 p.m. PDT
Symposium 2.2
SPEECH-IN-NOISE COMPREHENSION THROUGH LIFESPAN: NEW ADVANCES FROM COGNITIVE NEUROSCIENCE

Session Chairs: Claude Alain[1], Kimmo Alho[2]
[1]*Rotman Research Institute,* [2]*University of Helsinki*

Descriptors: Auditory perception, speech, hearing loss
Non-invasive brain research methods have greatly advanced our understanding of how we process sounds in adverse listening environments. Studies using unimodal or multimodal presentation of single words and sentences have revealed complex neural networks involved in processing speech-in-noise. The present symposium will present recent findings on speech processing with an emphasis on adverse listening situations. We will discuss the role of attention, listening effort, multi-modal sensory integration and treatment (e.g., cochlear implant) in speech-in-noise comprehension. Non-invasive brain research methods have greatly advanced our understanding of how we process sounds in adverse listening environment. Studies using unimodal or multimodal presentation of single words and sentences have revealed complex neural network involved in processing speech-in-noise. The present symposium will present recent findings on speech processing with an emphasis on adverse listening situations. We will discuss the role of attention, listening effort, multi-modal sensory integration and treatment (e.g., cochlear implant) in speech-in-noise comprehension.

DYNAMICS OF AUDITORY REFLECTIVE ATTENTION IN SPEECH-IN-NOISE PERCEPTION

Vanessa Chan, Claude Alain
Rotman Research Institute

The ability to listen to speech in noisy environments is supported not only by mechanisms of sound segregation and auditory streaming, but also by higher-order cognitive functions such as semantics, attention, and memory. Major strides have been made to understand how each of these cognitive functions contributes to comprehension of incoming speech signals, leading to the emergence of predictive models of speech comprehension in noise. While most studies have focused on the effects of prior contextual information on speech-in-noise (SIN) processing, less is understood about the mechanisms involved in the effects of subsequent contextual information, where a noisy signal is followed by context. Our research characterizes the involvement of subsequent semantic contextual information across three studies, informed by an auditory attention-to-memory approach. In a behavioral study comparing the effects of prior and subsequent semantic context on identification of a word in noise, we found that a subsequent cue word that was related to a target word in noise could boost identification of the target, although not as well as presenting it prior to the target. Using EEG, we showed that different temporal dynamics underly performance. These findings are discussed in the context of models of SIN processing, semantic priming, and attention-to-memory.

BRAIN ACTIVITY DURING SELECTIVE ATTENTION TO AUDIO-VISUAL DIALOGUES

Kimmo Alho
University of Helsinki

Human listeners have a remarkable ability to attend to a particular speaker in the presence of irrelevant speech. However, few studies have used naturalistic audio-visual situations during measurements of brain activity associated with this cocktail-party phenomenon. In our recent functional magnetic resonance imaging studies, participants attended to emotionally neutral dialogues of a female and male speaker seen on a screen in the presence of irrelevant speech in the background. The perceptual quality of dialogues was manipulated by noise-vocoding and masking facial movements. In control conditions, the participants were asked to ignore the speech stimuli and attend to a fixation cross and count its rotations. Activity in the superior temporal gyrus (STG) was higher for higher auditory and visual quality. Attention to the dialogues enhanced activity in STG in relation to the control condition, as well as in the orbitofrontal cortex and posterior cingulate gyrus. In previous studies, the latter areas were activated during moral judgment and theory-of-mind tasks.

Thus, attended audio-visual speech appears to activate brain networks of social cognition even when this speech is emotionally neutral and there is no demand for social decision-making. In one of our studies comparing brain activity during coherent and incoherent dialogues with unrelated speech lines drawn from different dialogues, higher activity was observed in the STG for coherent than incoherent dialogues. This suggests that speech contextual coherence may facilitate its processing in auditory cortical areas.

CAN BILATERAL COCHLEAR IMPLANTS HELP CHILDREN COMPREHEND SPEECH IN NOISE MORE EASILY?

Karen Gordon
University of Toronto

Cochlear implants have enabled children who are deaf to hear and develop spoken language. However, they still struggle to hear in challenging/noisy environments. Cortical evoked potential responses from adolescents using a unilateral cochlear implant for most of their lives reveal abnormal activity in fronto-parietal networks associated with attention. This is consistent with resting state fMRIs in children with unilateral deafness. Bilateral cochlear implantation improves speech understanding in noise in children; however, benefits decrease as the delay to bilateral input increases. This is due, in part, to the establishment of an aural preference which can be difficult to reverse. Also troubling is evidence that binaural processing has not been restored by bilateral cochlear implant use in young children. Efforts to provide better access to binaural cues and support listening in noise will be discussed.

BRAIN ACTIVITY IS ALTERED DURING AUDITORY SPATIAL SELECTIVE ATTENTION IN PEOPLE WITH HEARING LOSS

Andrew Dimitrijevic, Brandon Paul
SunnyBrook Hospital

Cochlear implants (CI) have enabled hearing ability in people with profound hearing loss. Even though audibility may be restored, CI users find it difficult to pay attention to one person talking when another person is talking nearby. The neural origins of this problem are unknown. Previous work in normal hearing (NH) adults has shown that selective attention to one talker in a two-talker paradigm is associated with two neural markers in the electroencephalogram (EEG): 1) increased "neural tracking" (entrainment of brain signals) of the attended stream compared to the ignored stream and 2) increased power of 8–12 Hz EEG rhythms (i.e., alpha rhythms) in the hemisphere ipsilateral to the spatial location of the attended talker, which reflects an increased suppression of the cortical side representing the ignored speech. Here we examined these two signatures in groups of bilateral (two CIs) CI users and NH adults to identify neural correlates of selective attention impairment. CI users showed differences in neural tracking in the attend versus ignore streams. However, the greatest difference between the CI and NH group was observed in the alpha power dynamics, such that greater degrees of alpha lateralization was observed in the CI group. Top-down and bottom-up neural processing differences between groups will be discussed.

3:00 p.m.-4:30 p.m. PDT
Symposium 2.3
PSYCHOPHYSIOLOGY IN NONHUMAN PRIMATES AS A TRANSLATIONAL BRIDGE

Session Chair: Vincent Costa
Oregon Health and Science University

Descriptors: decision making, interoception, amygdala
An increase in technologies available to monitor physiological signals in nonhuman animals has created opportunities to integrate psychophysiological measurements with causal and invasive neuroscience methods that can only be implemented in nonhuman animals. This integrative approach is especially powerful when it involves nonhuman primates, because of detailed homologies among brain regions across primates and the ability to use similar if not identical tasks to those tested in humans. This symposium highlights the work of three primate neuroscience labs that are all using psychophysiology to augment rhesus macaque models of affective learning, decision making, social interactions, and interoception. Vincent Costa will discuss how in the absence of verbal reports, pupillometry can be used to assess subjective beliefs about the value of choices during affective learning and necessity of the amygdala and ventral striatum in forming those beliefs. Peter

Rudebeck will discuss his use of heart rate as a proxy for bodily arousal, to determine how bodily arousal during value-based decision making influences neural coding of choices and rewards by neurons in the anterior cingulate and orbitofrontal cortex. He will also explain the critical role played by amygdala inputs to these regions in determining how bodily arousal biases neural coding and behavior. Eliza Bliss Moreau will discuss how she uses cardiovascular psychophysiology in the multiple laboratory and naturalistic contexts to understand how affect is similarly embodied across the lifespan in humans and nonhuman primates.

PUPILLOMETRY AS A MEASURE OF SUBJECTIVE BELIEFS DURING REINFORCEMENT LEARNING

Vincent Costa
Oregon Health and Science University

Reinforcement learning allows humans and monkeys to predict future outcomes and to update their beliefs about value in the world. These predictions and beliefs can be inferred through computational modeling of humans and monkeys choices in multi-arm bandit tasks, where one action is more valuable than another. Adopting this approach, we have quantified the effects of targeted lesions of the amygdala or ventral striatum in rhesus macaques on explicit measures of reinforcement learning. We found that the amygdala and ventral striatum are critical for learning from positive feedback and consistently choosing the more valuable option. But we have also found that the same lesion dependent deficits in learning and choice consistency are not present when the same computational models are used to quantify trial by trial changes in pupil size after a choice is made. Instead, changes in pupil size reflected the monkeys' expectation that a choice would be rewarded or not. We found reduced discrimination of high and low value actions in the lesion compared to the control groups using changes in pupil size as a readout, and using a Bayesian modeling framework, also found that pupil size tracked differences in the lesion and control groups beliefs about which action was more valuable. These results suggest that pupillometry measurements during reinforcement learning are a better readout of subjective beliefs used to infer the likelihood of reward rather learning processes (e.g., value updating or action selection) that are under the direct control of motivational circuits.

INTERACTION BETWEEN DECISION-MAKING AND INTEROCEPTIVE REPRESENTATIONS OF BODILY AROUSAL IN FRONTAL CORTEX

Peter Rudebeck
Icahn School of Medicine at Mount Sinai

Decision-making and arousal are intimately linked. Behavioral investigations have classically shown that either too little or too much bodily arousal is detrimental to decision-making, indicating that there is an inverted 'U' relationship between bodily arousal and performance. How these processes interact at the level of single neurons as well as the neural circuits involved are unclear. Here we recorded neural activity from orbitofrontal cortex (OFC) and dorsal anterior cingulate cortex (dACC) of macaque monkeys while they made reward-guided decisions. Heart rate (HR) was also recorded and used as a proxy for bodily arousal. Recordings were made both before and after subjects received excitotoxic lesions of the bilateral amygdala. In intact monkeys, higher HR facilitated reaction times (RTs). Concurrently, a set of neurons in OFC and dACC selectively encoded trial-by-trial variations in HR independent of reward value. After amygdala lesions, HR increased and the relationship between HR and RTs was altered. Concurrent with this change, there was an increase in the proportion of dACC neurons encoding HR. Applying a novel population-coding analysis, we show that after bilateral amygdala lesions the balance of encoding in dACC is skewed away from signaling either reward value or choice direction towards HR coding around the time that choices are made. Taken together, the present results provide insight into how bodily arousal and decision-making are signaled in frontal cortex.

AFFECTIVE PSYCHOPHYSIOLOGY IN RHESUS MONKEYS FROM WOMB-TO-TOMB

Eliza Bliss-Moreau
University of California, Davis

Rhesus monkeys are increasingly used in translational science because of their striking similarities to humans in terms of their central and peripheral nervous system organization and the complex socioaffective systems in which they live, making them good models for human health and disease. In this talk, we give an overview of how we have recently deployed psychophysiology in rhesus monkeys to ask and answer questions about how affect is embodied across the lifespan. We demonstrate striking similarities between rhesus and humans in terms of the representation of valence, particularly by the

parasympathetic nervous system, and age-related changes in valence and arousal-based responding in cardiac psychophysiology. We demonstrate that monkeys can detect their own heartbeats, using a paradigm from the human infant literature, opening up the possibility of studying the neural mechanisms of interoceptive capacity. Finally, we demonstrate that social context modulates infant autonomic nervous system responding, consistent with theories developed largely with humans. Implications for evolutionary theory and translational neuroscience will be discussed.

3:00 p.m.-4:30 p.m. PDT
Symposium 2.4
USING INTERNATIONAL, CROSS-LABORATORY COLLABORATIONS TO ADVANCE NEUROSCIENTIFIC METHODOLOGY

Session Chair: Vanja Ković
University of Belgrade
Discussant: Suzy Styles
Nanyang Technological University

Descriptors: EEG, open science, replicability
The challenges of reproducibility, replicability, and transparency are widely discussed in recent literature in science in general, and neuroscientific research specifically, and the scientific community is in search of solutions that would be widely accepted. Collaborations that are international, cross-laboratory, long-distance, multidisciplinary, and diverse in the level of research experience, are particularly well poised to tackle this challenge. With the technological advances, establishing them has been made easier than ever, helping launch a few of such attempts that will be presented at this symposium. *ARTEM-IS* provides templates for documenting methodology of EEG studies by leveraging insights from systematic reviews of EEG methods and design guidelines derived from the experience of other fields. Anđela Šoškić will present the ARTEM-IS template for ERP research and discuss how the community is involved in developing ARTEM-IS templates. *#EEGManyLabs* project is a community-driven initiative to replicate 20 of the most influential EEG studies in the literature. Yuri Pavlov will review the current state of the project and highlight key challenges and proposed solutions for coordinating large-scale multi-site collaborations. *EEGManyPipelines* aims to investigate a) how different analysts approach a given EEG data set, and b) how analysis methodologies affect final results. Nastassja Fischer and Yu-Fang Yang will discuss this project and the challenges of running a large-scale Many-Analysts study in the field of neuroscience.

LEVERAGING COMMUNITY EXPERTISE TO IMPROVE METHODS REPORTING IN EEG RESEARCH WITH ARTEM-IS

Anđela Šoškić[1], Vanja Ković[1], Suzy Styles[2]
[1]University of Belgrade, [2]Nanyang Technological University

ARTEM-IS stands for Agreed Reporting Template for EEG Methodology - International Standard. The ARTEM-IS INCF Working Group leverages insights obtained from systematic reviews of EEG methodology and template design guidelines derived from the experience of fields in which checklists and templates have been used for decades (e.g., aviation, surgery), to create templates for documenting the methodological decisions and details of an EEG study or pipeline. In this talk, the ARTEM-IS template for ERP will be presented. It is the first ARTEM-IS template, and the prototype for other EEG domains, which may follow. It includes nine sections with items that require documenting not only the decision-making outcomes, but also process: (1) study information, (2) experimental design and sampling, (3) equipment, (4) data acquisition, (5) pre-processing, (6) measurement, (7) channel selection, (8) results visualization, and (9) other. In addition to presenting the tool, this talk will address the issues of how the community is involved in developing ARTEM-IS templates, and the channels for recruiting new contributors. In the process of developing ARTEM-IS templates, community involvement is invaluable in achieving an outcome that would have the most utility for EEG stakeholders, and that would be widely adopted. As ARTEM-IS templates are in the process of development, the Working Group is open to new members (https://www.incf.org/sig/incf-working-group-artem).

#EEGMANYLABS - A LARGE-SCALE COLLABORATIVE ASSESSMENT OF THE REPLICABILITY OF EEG RESEARCH

Yuri Pavlov[1,2]
[1]University of Tuebingen, [2]Ural Federal University

#EEGManyLabs project – a large-scale international collaborative replication effort – aims to examine some of the foundational findings using electroencephalography (EEG). The project has identified 27 of the most influential and continually cited studies in the field with a plan to directly test the replicability of key findings from 20 of these studies in teams of at least three independent laboratories. The replications will update our confidence in widely cited phenomena and allow us to create a library

of effect sizes that will inform the design of future experiments. Through generating the largest collection of open access EEG datasets in history, the project will help to better understand the factors that contribute to variation in EEG findings. Finally, through demonstrating the feasibility of large-scale multi-site projects involving a large body of EEG researchers, we expect to facilitate a cultural shift away from small-scale single laboratory experiments towards high-powered, community driven collaborations. In the talk, we will review the current state of the project and highlight key challenges and proposed solutions for coordinating large-scale multi-site collaborations.

EEGMANYPIPELINES - THE EFFECT OF ANALYTICAL VARIABILITY ON EEG RESEARCH RESULTS

Nastassja Fischer[1], Yu-Fang Yang[2]
[1]Nanyang Technological University, [2]Freie Universität Berlin

The analytical flexibility of EEG has called into question the robustness of EEG findings. Because there are a myriad of ways to process and analyse EEG data, analysis pipelines differ a lot from study to study. To what extent different, but plausible pipelines create various conclusions and assumptions is still unknown. The EEGManyPipelines project is inspired by other recent projects involving many independent analysis teams to investigate a) how different analysts approach a given data set and b) how analysis approaches affect the obtained results. Participants in this project will be given access to an EEG dataset and will be asked to analyse it using an analysis pipeline that they consider is suitable for their research. Participants will then send us their findings as well as a thorough description of the analysis pipeline. These reports will be used to map the variety of analytic pipelines as well as the impact of pipeline parameters on the final results. EEGManyPipelines will assist examine the robustness of EEG findings across alternative studies, identify potential (sub)optimal analysis pipelines, and suggest standards for describing EEG analyses in publications in this way. As a result, we believe that EEGManyPipelines will contribute to increasing the credibility of EEG research and the quality of analysis, as well as inspiring new guidelines for conducting and publishing EEG investigations.

4:40 p.m.-6:10 p.m. PDT
Symposium 3.1
NEURAL SIGNATURES OF EMOTION PROCESSING AND REGULATION AND THEIR ROLE IN PSYCHOPATHOLOGY

Session Chairs: Julia Klawohn[1], Anja Riesel[2]
[1]MSB Medical School Berlin, [2]Universität Hamburg

Descriptors: emotion, mental health, ERPs
Alterations in emotional reactivity and deficits in emotion regulation are involved in the development of various mental disorders. The use of EEG signatures of emotion processing and -regulation can provide insight into underlying dynamics and pathogenic mechanisms. This symposium will examine new findings on neural signatures of emotion regulation (LPP, Nc, N1) as markers of deficits, mechanisms, and risk associated with mental health issues. Firstly, Anna Weinberg will present findings linking neural responses to socio-affective stimuli to the emergence of psychopathology across development, spanning from infancy to early adulthood. Then, Kreshnik Burani will present data from adolescent girls indicating that reactivity to positive emotional images is linked to lower depressive symptoms through its association with self-reported positive emotional intensity, pointing to a potential protective mechanism. Congruously, Kayla Wilson will present novel findings on the durability and boundary conditions of techniques for positive emotion up-regulation. Focusing on negative emotionality then, Anja Riesel examines the impact of anxiety and avoidance on ERPs during repeated processing of aversive pictures in both subclinical and clinical participant groups. Finally, Julia Klawohn will present results suggesting the LPP to emotional pictures may be a promising prognostic marker predicting response to CBT intervention in OCD. Collectively, this symposium highlights the great potential of ERPs of emotional reactivity and -regulation for psychophysiological research on mental health.

UNDERSTANDING THE ROLE OF NEURAL RESPONSES TO SOCIO-AFFECTIVE STIMULI IN THE DEVELOPMENT OF PSYCHOPATHOLOGY

Anna Weinberg, Aislinn Sandre
McGill University

Psychophysiological research has long sought to identify measures of affective processing implicated in the

development of mental illness. Neural responses to socio-affective content, in particular, are promising measures of affective dysfunction, and may be useful in understanding pathways to psychopathology; however, there are questions about how variation in these measures emerges across development, as well as how these neural measures might relate to real-world affective dysfunction. This talk will focus on the effects of family history of psychopathology and exposure to stressful life experiences on neural responses to socio-affective content, focusing particularly on the Late Positive Potential (LPP) and the Negative Central (Nc). In study one, I will present data from a sample of 7-month-old infants, showing an association between maternal symptoms of depression and infant neural responses to mother and stranger emotional faces. In study two, I will discuss research from an adolescent sample examining the effects of interactions between interpersonal stress and pubertal development on neural responses to emotional faces. And in study three, I will present data from a young adult sample demonstrating associations between a history of childhood maltreatment and neural responses to ambiguous emotional faces, as well as the effect of maltreatment history on learning from socio-emotional stimuli. Combined, these data suggest that abnormal neural responses to socio-affective stimuli, as indexed by the Nc and LPP, may help identify pathways to psychopathology.

THE ROLE OF POSITIVE EMOTIONALITY IN THE ASSOCIATION BETWEEN THE LATE POSITIVE POTENTIAL AND DEPRESSIVE SYMPTOMS IN ADOLESCENCE

Kreshnik Burani[1], Julia Klawohn[2], David Klonsky[3], Brady Nelson[4], Greg Hajcak[1]
[1]Florida State University, [2]MSB Medical School Berlin, [3]University of British Columbia, [4]Stony Brook University

The late positive potential (LPP) is an index of emotional engagement that has been shown to be reduced in relation to increased depressive symptoms and in major depressive disorder (MDD). It is unclear, however, how the LPP relates to different dimensions of emotional experience, such as intensity, frequency, and persistence of pleasant versus unpleasant emotions. In this talk, I will present cross-sectional data from an adolescent sample (N = 208) comprised of girls between 10 to 16 years old. The LPP to positive, negative, and neutral stimuli was assessed. Self-report measures of depressive symptoms and dimensions of emotional experience were also collected using the Children's Depression Inventory and the Multidimensional Emotion Questionnaire, respectively.

The LPP to positive compared to neutral stimuli was associated with positive emotional intensity, but not frequency or persistence of positive emotions, which in turn related to reduced depressive symptoms. Therefore, an increased LPP response to positive stimuli may relate to decreased depression through its association with increased emotional intensity. Future research should examine this association using longitudinal data and assess whether the results are evident in both girls and boys.

POSITIVE EMOTION UP-REGULATION: DURABILITY, GENERALIZATION AND EFFECTIVENESS UNDER WORKING MEMORY LOAD

Kayla Wilson, Yuhan Cheng, Annmarie MacNamara
Texas A&M University

Limited techniques for upregulating positive emotion have been examined, and there is little knowledge of the factors that may modulate the success of positive emotion upregulation. Here, we tested the effectiveness and durability of savoring to increase the picture-elicited late positive potential (LPP). We also assessed whether savoring would generalize to similar but previously unseen stimuli, as well as the effectiveness of savoring and reappraisal when performed under ongoing cognitive demands, both of which may be important for the applicability of these techniques to everyday life. Results showed that savoring increased the LPP; $F(1,48) = 19.41$, $p < .001$ and subjective emotion $F(1,48) = 81.28$, $p < .001$, and that effects persisted 30 minutes later during passive picture viewing $F(1,48) = 7.31$, $p = .009$, $N = 49$. In addition, savoring generalized to previously unseen stimuli, but only for certain picture categories, $F(2,164) = 7.20$, $p = .001$, $N = 84$, suggesting greater real-life relevance of savoring for certain types of situations/stimuli. In a separate sample, both savoring and reappraisal were effective at increasing the LPP, $F(1,74) = 7.08$, $p = .01$, and effects were not compromised by high working memory load, $BF_{10} = .17$, $N = 77$, suggesting that they are robust to ongoing cognitive demand. Results support savoring as a viable alternative to emotion regulation techniques that have emerged from the negative emotion regulation literature, and shed light on the durability and boundary conditions of positive emotion upregulation.

CHANGES IN THREAT PROCESSING IN ANXIETY AND ANXIETY DISORDERS: FINDINGS FROM EVENT-RELATED POTENTIALS DURING REPEATED PRESENTATION OF EMOTIONAL IMAGES

Anja Riesel[1], Kai Härpfer[1], Hannes Carsten[1], Norbert Kathmann[2], Franziska Kausche[1]

[1]Universität Hamburg, [2]Humboldt-Universität zu Berlin

Avoidance is a core symptom of anxiety disorders that interferes with the success of exposure therapy. Using ERPs (N1, LPP), we examined the neural and temporal dynamics of emotional imagery processing in anxiety. In the first experiment (N = 134), we examined the processing of aversive images and its modulation by avoidance and anxiety dimensions (anxious apprehension, anxious arousal). Aversive pictures were associated with increased attention allocation (N1) and deepened processing (LPP) compared to neutral pictures. As expected, deepened processing (LPP) was lower during avoidance. Individuals with high levels of anxious apprehension showed increased automatic attention allocation (N1), followed by decreased elaborated processing (LPP) for aversive stimuli, consistent with vigilance-avoidance models of anxiety. In summary, avoidance and high anxious apprehension lead to similar neural changes in the processing of aversive images that may conflict with long-term adaptation. The findings supported the conceptualization of anxious apprehension as a habitual avoidance strategy. In a second currently ongoing project (current: n = 101; targeted N = 160), we compare healthy participants (current: n = 21) to three clinical samples (current: obsessive–compulsive disorder n = 21, social phobia n = 32, specific phobia n = 27) during repeated presentation of neutral, positive, aversive, and symptom-relevant pictures. The results promise to provide interesting insights into the processing of emotional stimuli in anxiety and may provide interesting starting points for interventions.

NEURAL CORRELATES OF EMOTIONAL REACTIVITY AS PROGNOSTIC MARKERS OF CBT RESPONSE IN OCD

Julia Klawohn[1,2], Björn Elsner[1], Sandra Paul[3], Janika Wolter-Weging[1], Anja Riesel[4], Rosa Grützmann[1], Norbert Kathmann[1]

[1]Humboldt-Universität zu Berlin, [2]MSB Medical School Berlin, [3]Universität Heidelberg, [4]Universität Hamburg

Cognitive-behavioral therapy (CBT) has been established as an effective treatment for obsessive–compulsive disorder (OCD). Yet, a significant number of patients does not sufficiently respond to CBT. Neurocognitive biomarkers could help identify individuals at risk for non-response and provide insight into underlying mechanisms. In this talk, two independent investigations will be presented examining whether the late positive potential (LPP), a neural correlate of emotional reactivity, could serve as a prospective predictor of therapy response in a naturalistic outpatient setting. In study 1, the LPP to negative compared to neutral pictures was examined in a group of patients with OCD ($n = 46$). We found higher LPP amplitudes to negative stimuli were predictive of lower self-reported OCD symptoms after completion of CBT, controlling for pre-treatment symptoms. Further, LPP reactivity was negatively correlated with self-reported habitual use of suppression in everyday life. In study 2, we replicated and extended this finding in a relatively large independent sample of patients with OCD ($n = 100$). Results showed gender-moderated prediction of therapy response by LPP to unpleasant and pleasant emotional stimuli, respectively. Female patients with higher reactivity to pleasant and unpleasant stimuli were more likely to benefit from CBT. These findings suggest that patients, especially women, with initially higher emotional reactivity benefit more from CBT, possibly through lower emotional avoidance. Thus, the LPP constitutes a promising prognostic marker for CBT success in OCD.

4:40 p.m.-6:10 p.m. PDT
Symposium 3.2
FEAR AND LOATHING IN VR: PSYCHOPHYSIOLOGICAL FEAR AND ANXIETY RESPONSES IN VIRTUAL REALITY

Session Chair: Johannes Rodrigues
Julius-Maximilians University of Würzburg
Discussant: Travis Baker
Rutgers University Newark

Descriptors: virtual reality, anxiety, fear and defensive responses, EEG and ECG

Virtual reality (VR) provides the opportunity to investigate psychophysiological responses to situations or virtual behavior in realistic, yet controllable and less artifact prone scenarios. In this context, negative and arousing experiences inducing anxiety, fear and withdrawal responses can safely be explored. To validate VR, Benjamin Schöne shows that a real-life and a virtual height exposure are mostly indistinguishable on electrophysiological level (alpha- and theta-band oscillations) as well with respect heart-rate variability as opposed to a conventional

2D laboratory setup. Second, Galit Karpov investigated the relation of theta-band and gamma-band oscillations in EEG to defensive behavior and threat proximity in a virtual risk–reward interaction task. Here, theta responses were linked to learning of proximal threats, while gamma responses were linked to distal threat learning. Third, Johannes Rodrigues examined the link of the cardiac defensive reaction and orienting response to different types of avoidance behavior in a virtual T-maze, while frontal asymmetry was previously shown to be independent of this choice. Fourth, Joanna Kisker presents mobile EEG data from a mixed VR cave with frightful or neutral contexts. The participants' distinct behavioral responses were only partially reflected in established electrophysiological markers, indicating both, caveats and ecological validity. Finally, discussant Travis Baker will unfold challenges and opportunities of VR in the context of extreme emotional, behavioral and psychophysiological responses.

THE REALITY OF VIRTUAL REALITY

Benjamin Schöne, Joanna Kisker, Leon Lange, Thomas Gruber, Roman Osinsky
Osnabrück University

Virtual reality (VR) has become a popular tool for investigating behavior and brain functions. Nevertheless, it is unclear whether VR constitutes an actual form of reality or is more like an advanced simulation. Determining the nature of VR has been mostly achieved by presence measurements, defined as the feeling of being submerged in the experience. However, subjective measurements might be prone to bias and do not allow for a comparison with real-life experiences. Here we show that real-life and VR height exposures are mostly indistinguishable on a psychophysiological level while both differ from a conventional 2D laboratory setting. Using a fire-truck, participants experienced either a real-life, a virtual or a 2D-laboratory height exposure. Behavioral and psychophysiological results suggest that identical exogenous and endogenous cognitive as well as emotional mechanisms are deployed to process the real-life and the virtual experience. Alpha- and theta-band oscillations in line with heart-rate variability, indexing vigilance and anxiety, were barely indistinguishable between those two conditions, while they differed significantly from the laboratory setup. Sensory processing, as reflected by beta-band oscillations, exhibits a different pattern for all conditions, indicating room for improving VR on a haptic level. In conclusion, the study shows that VR setups are technologically capable of mimicking reality, thus paving the way for the investigation of real-world cognitive and emotional processes under controlled laboratory conditions.

OSCILLATIONS DYNAMICS DURING PROXIMAL AND DISTAL THREAT IN A VIRTUAL ROOM

Galit Karpov, Mei-heng Lin, Drew Headley, Travis Baker
Rutgers University, Newark

According to the Predator Imminence Theory, optimal defensive responses depend on the proximity of a threat. In humans, theta (4-8 Hz) and gamma (30+ Hz) oscillations are typically expressed by threat cues during fear conditioning tasks. However, whether these oscillatory responses also reflect the association between defensive behavior and threat proximity is largely unknown. To investigate this issue, we recorded EEG from twenty-six (14 female) students engaged in 4 blocks (120 trials) of a virtual Risk–Reward Interaction task (RRI). In this RRI task, conditioned stimuli (CS) where either presented in the same room location (proximal) as the subject or in another room location (distal). To examine threat and spatial processing, one CS predicted an aversive tone (threat CS) in which subjects had to learn to avoid the room location; while the other a monetary outcome (reward CS), in which subjects had to learn to approach the room location. On average, subjects learned the task after two blocks. Here, we report two main EEG findings. First, an increase in right posterior theta power was observed across all CS conditions, but was strongest for the proximal threat CS. Second, gamma power over central-parietal channel Pz was strongest for the distal threat CS. Both theta and gamma power decreased overtime, indicating an effect of learning. Together, these results demonstrate that oscillatory processes differentiate between spatial proximity information early on during threat identification, likely optimizing the selection of the appropriate defensive response.

FOLLOW YOUR HEART: CARDIAC DEFENSIVE REACTIONS AND ORIENTING RESPONSES CORRESPOND TO AVOIDANCE BEHAVIOR TYPE CHOICES IN A VIRTUAL T-MAZE, WHILE FRONTAL ASYMMETRY IS LINKED TO APPROACH AND AVOIDANCE

Johannes Rodrigues, Mathias Müller, Johannes Hewig
Julius-Maximilians Universität Würzburg

Frontal asymmetry has shown to be related to approach and avoidance patterns in a virtual T-maze. Yet, influences of the type of avoidance behavior have not been found.
Looking for other markers to disentangle the behavioral choices of avoidance on psychophysiological level, heart rate responses were investigated. While trait or stimulus valence related differences in heart rate change are well known, a

distinction of the cardiac response pattern related to different behavioral responses during identical motivational context has been neglected so far. We investigated heart rate change during movement via joystick in the negatively valent motivational condition of a virtual T-maze in two studies. Two specific avoidance response types could be identified in previous studies: a backwards withdrawal and a forward approach to a zone of safety. The short-term heart rate change was related to the avoidance behavior pattern in a virtual T-maze, showing either a defensive response when facing the zone of safety or an orienting reaction if facing the negative entity while withdrawing backwards. These differences were found independently of the stimuli used in the two studies (monster vs. man). Furthermore, the choice of avoidance behavior was linked to gender. These findings stress the importance of the behavioral responses concerning the investigation of psychophysiological measurements and reveal possible reasons for variance in heart rate pattern across gender. Additionally, the different sensitivity and specificity of different psychophysiological measurements is emphasized.

COMPLEX FEAR RESPONSES IN VIRTUAL REALITY: A MOBILE EEG STUDY

Joanna Kisker, Leon Lange, Kira Flinkenflügel, Michael Kaup, Nils Labersweiler, Falk Tetenborg, Paula Ott, Christopher Gundler, Thomas Gruber, Roman Osinsky, Benjamin Schöne
Osnabrück University

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

4:40 p.m.-6:10 p.m. PDT
Symposium 3.3
LEARNING AND CONTROL OF TASK REPRESENTATIONS: EVIDENCE FROM BEHAVIORAL, NEUROMODULATION, AND MULTIMODAL NEUROIMAGING STUDIES

Session Chairs: Kai Hwang, Jiefeng Jiang
University of Iowa

Descriptors: Task representations, Cognitive control, Learning
Our daily lives comprise a variety of tasks, e.g., making coffee in the morning, driving to work, and working with word processors. These tasks require subjects to select actions while considering a multitude of information, including context, goals, instructions, sequences, and experiences. These diverse sources of information form task representations to jointly guide behavior. In this symposium, we will report recent behavioral and neuroimaging studies that investigate the organization, operation, learning, and formation of task representations. We will address the following questions: (1) Given that task representations encode multiple types of task-relevant information from contexts to actions, what are the interactive dynamics between constituent representations (Hwang)? (2) For task representations to facilitate cognitive control, task-relevant information must be maintained and selected, what are the neural dynamics that prioritize and suppress representations (Riddle)? (3) Complex tasks are often composed of multiple related simpler tasks. What are the organizational principles of task representations built from compositional relations, and how do such organizational principles affect task performance (Jiang)? (4) Tasks often involve sequences of multiple steps. How does the brain segment our continuous experience to represent steps within a task, while separating sequences belonging to different tasks (Wen)? Altogether, our symposium will provide an up-to-date review on the behavioral and neural processes of task representations supporting adaptive behavior.

DYNAMICS OF TASK REPRESENTATIONS SUPPORT FLEXIBLE COGNITIVE CONTROL

Kai Hwang

University of Iowa

The hierarchical organization of task representations allows humans to maintain goals, integrate information across varying contexts, and select appropriate actions for flexible cognitive control. However, several important properties of task representations, for example the structure and interactive dynamics, have been difficult to study with traditional behavioral and neuroimaging techniques. In this talk, I will present several studies in which we combined temporally-resolved representation similarity analysis and functional connectivity modeling approaches to investigate key properties and operations of task representations. From EEG data, we found that human participants formed multiple representations of task-relevant contexts and features from the environment, beyond simple stimulus–response mappings. These representations are encoded in the delta to beta frequency ranges (2–20 Hz), hierarchically structured, with higher-order contextual representations dominantly influencing subordinate task features and response representations. The cascade of this interactive dynamic predicts trial-by-trial behavior. From fMRI data, We further found that flexible control over task representations recruited thalamocortical interactions, where thalamic evoked responses shaped and updated cortical cognitive activity in response to changing task contexts. Altogether, these results revealed the dynamics, structure, and updating operations of task representations that subserve flexible cognitive control.

WORKING MEMORY REPRESENTATIONS ARE SELECTED BY FRONTAL–PARIETAL THETA CONNECTIVITY AND SUPPRESSED BY PARIETAL-OCCIPITAL ALPHA POWER

Justin Riddle

University of North Carolina, Chapel Hill

Control over working memory requires the suppression of irrelevant information and the prioritization of relevant information. However, the neural oscillatory substrate of these cognitive control processes was unknown. In a previous study, we demonstrated that rhythmic transcranial magnetic stimulation (TMS) increased working memory capacity when theta-frequency TMS was delivered to anterior middle frontal gyrus (MFG) and when alpha-frequency TMS was delivered to inferior intraparietal sulcus (IPS). In our follow-up study, we replicated these behavior effects and investigated the neural oscillatory substrate of these behavioral improvements with concurrent electroencephalography (EEG) and rhythmic TMS. We found that when presented with a lateralized retrospective cue during the delay of a working memory task, alpha power in parietal-occipital cortex increased contralateral to irrelevant information, and that posterior alpha lateralization was increased with alpha-TMS to IPS. Furthermore, frontal to parietal theta-frequency functional connectivity increased with the retrospective cue and that theta-TMS to MFG further enhanced connectivity. Altogether, these findings provide causal evidence for a role of posterior alpha lateralization in representation suppression and frontal–parietal theta connectivity in representation prioritization.

INTERFERENCE AND INTEGRATION IN HIERARCHICAL TASK LEARNING

Jiefeng Jiang

University of Iowa

A key feature of human task learning is shared task representation: Simple, subordinate tasks can be learned and then shared by multiple complex, superordinate tasks as building blocks to facilitate task learning. An important yet unanswered question is how superordinate tasks sharing the same subordinate task affects the learning and memory of each other. Leveraging theories of associative memory, we hypothesize that shared subordinate tasks can cause both interference and facilitation between superordinate tasks. These hypotheses are tested using a novel experimental task which trains participants to perform superordinate tasks consisting of shared, trained subordinate tasks. Across three experiments, we demonstrated that sharing a subordinate task can (1) impair the memory of previously learned superordinate tasks and (2) integrate learned superordinate tasks to facilitate new superordinate task learning without direct experience. Ongoing EEG decoding analysis further showed reinstatement of integrated tasks following the onset of superordinate tasks. These findings shed light on the organizational principles of task knowledge and their consequences on task learning.

REPRESENTATION OF MULTI-STEP EVENTS AND ITS EFFECT ON TEMPORAL MEMORY

Tanya Wen

Duke University

Our lives comprise of sequences of steps (e.g., sip coffee) that make up events (e.g., eat breakfast). Moving from one event to another creates a boundary that segments continuous experience into distinct episodes. Our intuition about memory suggests the order of within-event experiences (did I have coffee before the bagel?) is often more difficult to recall than the order of events per se (did I have breakfast or do the dishes first?). In a series of behavioral experiments, we showed that whether temporal order memory for cross-boundary items were enhanced or impaired relative to within-event items depended on whether the encoding context was present or absent during the memory test. Using fMRI, we examined neural representation of event identity, component items, and sequential position. Univariate time course analyses indicated that within-event progress was tracked by a tonically increasing global response, plus an increasing phasic step response specific to multiple-demand (MD) regions. Cross-event boundaries evoked a widespread response at episode onset, plus a marked offset response specific to default mode network (DMN) regions. RSA analysis showed that both networks represented the content and position of individual steps, however the DMN preferentially represented event identity while the MD network preferentially represented step-level information. The results suggest collaboration of multiple brain regions in multi-step events, with MD regions involved in processing the detail of individual steps, and DMN adding representation of the overarching context.

Friday, September 30, 2022

1:00 p.m.-2:30 p.m. PDT
Symposium 4.1
THE ROLE OF CEREBROVASCULAR RISK FACTORS IN COGNITIVE, ANATOMICAL, AND FUNCTIONAL BRAIN AGING

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

Descriptors: Aging, Cerebrovascular reactivity, Risk factors for dementia

Aging is typically accompanied by declines in cognitive control and memory functions, as well as by volumetric brain tissue reductions, albeit with large individual differences. Changes in cerebrovascular function play a central role in the development of age-related cognitive and brain decline, mild cognitive impairment, and ultimately dementia. This symposium will include four research talks overviewing these findings. The talks will focus on the specific influence of cerebrovascular risk factors on adult development and age-related decline, and on how they explain much of the variability in aging trajectories. We will also emphasize that interventions focused on exercise and dietary behaviors are able to prevent, mitigate, or reverse these risks, and how they contribute to maintaining or restoring plasticity and function in old age.

HIGH BLOOD PRESSURE AND AGING: CAN WE TELL THEIR EFFECTS APART?

J. Richard Jennings

University of Pittsburgh

There is an extraordinary overlap between the effects on cognition and cardiovascular system of hypertension and aging. Over the age of 60, more individuals are hypertensive than those who are not. Decrements with age in cognitive function are well known as are cardiovascular changes such as the stiffening of arterial walls, leading to increased pulse wave velocity. Heightened blood pressure is similarly associated with both mild cognitive deficits and increased pulse wave velocity (with age controlled). These influences of heightened blood pressure are particularly notable in middle aged samples. In a sense the blood pressure effects are a precursor of aging effects. Structural and functional MRI measures differ not only between those with and without hypertension, but also between normotensive individuals differing in blood pressure level. Evidence will be reviewed that blood pressure treatment does not reverse brain indices of the disease, that blood pressure treatment outcome is predicted by brain indices, and that progression of blood pressure can be predicted by brain indices. Taken together, the evidence points to the speculative hypothesis that essential hypertension is primarily a brain disease, with widespread consequences for cognitive and brain aging.

PATTERNS OF COGNITIVE CONTROL DECLINE IN OLDER ADULTS WITH AND WITHOUT CARDIOVASCULAR RISK FACTORS

Frini Karayanidis
University of Newcastle

Cognitive control processes, such as set-shifting and interference control, are supported by the prefrontal cortex and its extensive connections with other cortical and subcortical areas. These cognitive processes and the neural networks that support them are especially sensitive to increasing age. Older adults show poorer average performance and greater variability on cognitive control tasks than their younger counterparts. This pattern of performance is associated with structural and functional deterioration in frontal brain areas and frontal networks. This talk will present recent work showing that the increased prevalence of cerebrovascular risk factors in older adults strongly contributes to cognitive decline with increasing age and may explain the pattern of heterogeneity in cognitive decline trajectories. Evidence from a number of studies will focus on patterns of decline in set-shifting ability as a function of age, cerebrovascular risk factors, and minor neurological ischemic events (i.e., transient ischemic attack and minor stroke). This work shows that cerebrovascular risk factors are stronger predictors of cognitive control profiles across the adult lifespan than age or neurological events.

EFFECTS OF PHYSICAL ACTIVITY INTERVENTIONS ON BRAIN HEALTH IN LATE ADULTHOOD

Kirk Erickson
University of Pittsburgh

Decades of cognitive aging research demonstrate downward trends in nearly all cognitive domains and metrics of brain health. In contrast, physical activity has been shown to be effective at improving brain health in late adulthood. Yet, there remains muddiness and mixed findings in the literature including a poor understanding of the mechanisms that link physical activity to improvements in brain health outcomes in humans and the factors that moderate the effects of exercise on neurocognitive health. This presentation will focus on recent research findings on exercise and brain health in late adulthood and will discuss the evidence for several levels of mechanisms and moderators of these effects including possible molecular and cellular changes, modification of cardiometabolic pathways, the differential effects of various dose parameters, and possible genetic modifiers. The talk will conclude with a discussion of ongoing studies and future research directions that will influence how exercise is viewed as both a method for prevention of decline and as a therapeutic for brain health. Overall, physical activity is an important modifiable lifestyle that carries significant consequences for learning, memory, and brain health in late adulthood.

TAKING THE PULSE OF AGING: HOW ARTERIAL ELASTICITY AND CEREBROVASCULAR REACTIVITY RELATE TO BRAIN ANATOMY AND FUNCTION

Monica Fabiani, Gabriele Gratton
University of Illinois, Urbana-Champaign

The stiffening of the brain's arteries (arteriosclerosis) greatly contributes to cognitive and brain aging and ultimately to brain pathologies such as dementia and stroke. Our lab has developed a methodology for studying pulsatile arterial function in the brain using diffuse optical tomography (Pulse-DOT). Pulse-DOT provides maps of cerebral arterial elasticity (based on the shape of the pulse wave, Pulse Relaxation Function, or PReFx; and on pulse wave velocity, or pulse transit time, PTT), as well as of the ability of the arterial system to adapt to changes due to various functional challenges (cerebrovascular reactivity, CVR). Data collected in cross-sectional and challenge studies indicate that these measures are strongly correlated with age, cardiorespiratory fitness, blood pressure, and other risk factors for dementia, and predict changes in brain volume and function (including variability in resting-state fMRI connectivity), as well as changes in cognitive function (such as in fluid intelligence) in aging. Further, our data indicate that local changes in pulse parameters (such as PReFx and PTT) are associated with changes in brain anatomy and cognitive function occurring at the same locations. These data support the idea that variations in cerebrovascular function may play an important mediating role in the development of cognitive aging and dementia.

1:00 p.m.-2:30 p.m. PDT
Symposium 4.2
FROM BENCH TO BEDSIDE: ADVANCEMENTS IN QUANTIFYING AND MODULATING NEURAL CIRCUIT DYSFUNCTION IN SUBSTANCE USE DISORDERS

Session Chair: Travis Baker
Rutgers University
Discussant: Bruce Bartholow
University of Missouri

Descriptors: Addiction, Reward Cue Processing, Transcranial Magnetic Stimulation

Decades of animal models have taught us that addiction is, indeed, a disorder of dysregulated neural circuits. However, there are currently no circuit-based biomarkers or treatments for human patients. In recent years, a new frontier in electrophysiological research has emerged for identifying and quantifying neural circuits and proximal functions in substance use disorders (SUDs), offering a translatable bridge between animal models and human patients. In this symposium, we will showcase the bench-to-bedside potential of electrophysiological research for the discovery of aberrant neural mechanisms underlying SUD and for identifying new targets for non-invasive brain stimulation treatment. We begin with Dr. Cofresí who will present recent electrophysiological and conditioning data in humans based on rodent models of drug cue reactivity-related relapse risk. Garima Singh will then present a recent study using the reward positivity to quantify the affective processing of alcohol cues in individuals with alcohol use disorders. Next, Dr. Biernacki will present results demonstrating that prefrontal TMS can restore reward and decision-making functioning in SUD samples, as objectively measured with ERPs and computational modeling. Finally, Dr. Steele will discuss challenges facing the clinical applications of EEG and TMS with an exemplar of TMS applied to reduce cocaine use. Together, electrophysiology shows tremendous promise in understanding and treating SUDs, and a path forward will be the primary topic of discussion to summarize this work (Discussant: Dr. Bartholow).

SECOND-ORDER ALCOHOL CUE CONDITIONING IN THE HUMAN LABORATORY: PRELIMINARY STUDIES OF INDIVIDUAL DIFFERENCES

Roberto Cofresí[1], Kimberly Fleming[2], Todd Schachtman[1], Thomas Piasecki[1], Bruce Bartholow[1]
[1]*University of Missouri*, [2]*Allegheny Health Network*

Drug cue reactivity often persists despite abstinence. Preclinical models suggest this persistent reactivity reflects over-attribution of incentive value, which transforms drug cues into desired, reward-like stimuli that can motivate drug seeking and reinforce new learning in the absence of reward receipt. Empirical demonstrations of such phenomena in humans are rare, however. This talk presents initial findings from a series of second-order classical conditioning experiments in humans that examine the reward-like properties of alcohol cues as an index of incentive value attribution. Experiment 1 indicated that individuals reporting little alcohol use perceived an arbitrary visual stimulus to be *less* pleasant after it was repeatedly paired with alcohol images, whereas individuals reporting heavier alcohol use perceived the same stimulus to be *more* pleasant after the same treatment. Experiment 2 indicated that individuals reporting heavier alcohol use perceived an arbitrary visual stimulus to be *more* pleasant after it was repeatedly paired with alcohol odors. Among these individuals, the arbitrary visual stimulus elicited larger P3 amplitude following its repeated pairings with alcohol odors, indicating a conditioned increase in its incentive value. Thus, we find that alcohol cues can reinforce new learning in the absence of alcohol receipt. These findings suggest that persistent alcohol cue reactivity in humans may reflect over-attribution of incentive value, and demonstrate the promise of efforts to translate preclinical models into the human psychophysiology laboratory.

THE REWARD POSITIVITY IS ENHANCED IN INDIVIDUALS WITH ALCOHOL USE DISORDER

Garima Singh, Ethan Campbell, Jeremy Hogeveen, Eric Claus, Katie Witkiewitz, James Cavanagh
University of New Mexico

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 55 participants (AUD = 28, Control = 27). Participants completed a reinforcement learning task with picture feedback (puppy or alcohol images over a green or red screen). Although there was no between group differences in puppy image ratings, there was a significant group difference in alcohol images (F [1,50.8] = 32.22, p < .001). Within AUD group, there

was significant positive correlation between AUDIT score and RewP amplitudes ($\rho = 0.343$, $p = .037$), signifying the influence of increase in alcohol consumption on the magnitude of RewP. Across all participants, there was a positive correlation between image "liking" ratings difference and RewP amplitudes difference ($\rho = 0.252$, $p = 0.05$), 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.

MODULATION OF REWARD-RELATED BIOMARKERS IN SUBSTANCE USE DISORDERS

Kathryn Biernacki, Travis Baker
Rutgers University

An extensive literature has detailed the potentiating effects of drugs of abuse on the mesocorticolimbic reward system, which dysregulates the brain's system for reward-guided behavior. While conventional treatments for substance use disorders (SUD) primarily focus on clinical endpoints (e.g., abstinence, craving), there are no clinical useful biomarkers of reward-related processes for SUD, and without such markers, it is more challenging to develop interventions that target aberrant reward processes that sustain SUD. In this talk, I will present recent findings supporting the proposal that the reward positivity and model-derived prediction error signals can be used to detect abnormalities in reward functioning in SUD, can define new targets for transcranial magnetic stimulation (TMS) interventions, and more objectively measure the efficacy and outcome of TMS. First, I will present findings from a series of experiments demonstrating that individuals with SUD fail to elicit a reward positivity during a simple reward task. Next, we present results demonstrating that robot-assisted prefrontal 10-Hz TMS can recover the reward positivity in an SUD population, as well as enhance reward-guided decision making. Finally, we present recent computational modeling data highlighting the application of TMS to enhance positive reward prediction error learning and response vigor in healthy controls, and its implications for the treatment of opioid use disorder.

Together, our work bolsters the utility of TMS in the treatment of reward-related neural dysfunction in SUD.

ADDRESSING "KNOWN UNKNOWNS" IN THE APPLICATION OF TRANSCRANIAL MAGNETIC STIMULATION TO TREAT SUBSTANCE USE DISORDERS: AN EXEMPLAR OF CHRONIC NEUROMODULATION FOR COCAINE USE DISORDER

Vaughn Steele
Yale School of Medicine

Developing new, effective treatments for substance use disorders (SUDs), is of immense importance. A potential treatment is therapeutically inducing neuroplastic change in targeted dysregulated circuits with repetitive transcranial magnetic stimulation (rTMS). By applying rTMS and noninvasively stimulating cortical structures to induce subcortical neuroplastic change, rTMS ameliorates symptoms that are consequent of dysregulations in disease-related circuits, such as craving, and reduces drug use. Nonetheless, progress toward treatment applications for SUDs has been stymied by what we dub "known unknowns". Neural measures such as event-related potentials (ERPs) and functional magnetic resonance imaging (fMRI) are useful in addressing two of the six "known unknowns", cortical target selection and subcortical circuit engagement. Using an example of error-related measures from ERP and fMRI, I present an application of machine learning classifiers to address "known unknowns" of applying rTMS in a SUD sample. Machine learning classifiers are used to identify patterns, not readily observable, in complex datasets holding promise toward precision in diagnosis, treatment assignment, predicting individuals at greatest risk, and rTMS targeting. To highlight these findings, an exemplar study where rTMS is applied chronically to reduce cocaine use is discussed to highlight the feasibility and clinical efficacy of the approach. This study exemplifies the potential for addressing "known unknowns" to develop an effective intervention for SUDs.

1:00 p.m.-2:30 p.m. PDT
Symposium 4.3
THE PSYCHOPHYSIOLOGY OF EFFORT: CARDIOVASCULAR AND PUPILLARY CORRELATES OF EFFORTFUL PROCESSING

Session Chairs: Michael Richter[1], Guido Gendolla[2]
[1]*Liverpool John Moores University,* [2]*University of Geneva*
Discussant: Michael Richter
Liverpool John Moores University

Descriptors: effort, pupil response, cardiovascular reactivity
The use of physiological measures to examine effort-related processes has strongly increased over the last decades with pupil dilation response and cardiovascular reactivity being amongst the most frequently examined correlates of effort. This symposium will showcase the variety of the current psychophysiological research on effort by bringing together four researchers who employ these two types of measures to examine different effort-related topics. Dorothea Wendt will discuss the reliability and sensitivity of the task-evoked pupil response as an indicator of effortful listening presenting empirical studies that examined these qualities in speech-in-noise paradigms. Adriana Zekveld will illustrate how the various effort-related processes involved in processing speech in noise (listening, speech processing, retention and recall preparation) can be disentangled using different components of the pupil response. Christopher Mlynski will present work on fatigue and its effect on the active, effortful resistance against an unwanted behaviour urge using effort-related cardiovascular measures as correlate of effortful resistance. Guido Gendolla will discuss empirical work that shows that the increased cardiovascular response induced by primed cognitive conflict can be prevented by goal shielding. The symposium will be concluded by Michael Richter integrating the four presentations by elaborating on the similarities and difference in how pupillary and cardiovascular measures are used to examine effort-related processes.

INVESTIGATING THE RELIABILITY AND SENSITIVITY OF TASK EVOKED PUPIL RESPONSE DURING SPEECH PERCEPTION AS AN INDICATOR OF INDIVIDUAL'S LISTENING EFFORT

Dorothea Wendt[1,2]
[1]*Eriksholm Research Centre,* [2]*Technical University of Denmark*

Recordings of the pupillary response have been used in numerous studies to assess listening effort during a speech-in noise task. Most studies focused on averaged response across listeners, while less is known about Task Evoked Pupil Response (TEPR) as an indicator of the individuals' listening effort. Two different studies will be presented that investigate the reliability and sensitivity of the TEPR in a speech-in noise task. In a first study, the reliability of the TEPR was tested at different acoustic conditions by varying the Signal to Noise Ratio (SNR). Results indicate that reliability was mainly affected by the normalization procedure, i.e., highest reliability across all conditions was found when the data were baseline-corrected and normalized to the individual pupil response range, while SNR had less of an impact on the reliability. In a second study, the sensitivity of the TEPR was studied by assessing the Just Noticeable Difference of perceived Effort (JND in Effort) and its relationship to changes in TEPR. The JND in Effort was defined as the minimum decrease in SNR necessary for a listener to perceive a difference in listening effort between target and reference sentence. In addition, TEPR was obtained at JNDs in SNRs i.e., the minimum decrease in SNR necessary for a listener to perceive a difference clarity. Pupillometry data showed that while there are no changes in the TEPR between reference and target sentences at the JND in SNR, a trend towards a change in TEPR (for the target as compared to the reference) at the JND in Effort was found.

THE INFLUENCE OF MEMORY DEMANDS AND INTELLIGIBILITY ON THE PUPIL RESPONSE TO SENTENCES PRESENTED IN NOISE

Adriana Zekveld[1], Patrycja Książek[1,2], Lorenz Fiedler[2], Sophia Kramer[1], Dorothea Wendt[2,3]
[1]*Vrije Universiteit Amsterdam,* [2]*Eriksholm Research Centre,* [3]*Technical University of Denmark*

Listening to speech in noisy conditions can be effortful. In addition, listening effort is affected by the memory demands imposed by the task. In the current study, we assessed the sensitivity of time-specific components in the

pupil dilation response to sentence intelligibility (speech-to-noise ratio [SNR] of -4 dB versus +1 dB) and delayed recall of sentence-final words (recall or no recall). Thirty normally hearing adults (mean age 43.1 years) performed the "Sentence-final Word Identification and Recall test". In this test, lists of seven sentences are presented in noise. Participants repeat the sentence-final word directly after each sentence and, if instructed, they also recall these words after each list. We tested the effects of SNR and recall on the baseline pupil size and three time-specific components in the pupil response as identified by a principal component analysis. Having to recall the sentence-final words reduced the contribution of the early and middle pupil component reflecting 'listening' and 'speech processing', but increased the baseline pupil size prior to each sentence, depending on the SNR. The contribution of the middle and late component reflecting 'speech processing' and 'preparing to repeat' was greater in the low as compared to the high SNR conditions. Finally, the contribution of the 'preparing to repeat' component declined across the list in all conditions, but especially in recall conditions. We will furthermore present the preliminary results of a pilot study further examining the interaction between memory load and speech intelligibility.

FATIGUE AND SELF-CONTROL: AN EMERGING ANALYSIS OF BEHAVIORAL RESTRAINT INTENSITY

Christopher Mlynski
University of Vienna

This talk will present findings from an experiment designed to test a recently formulated analysis concerned with fatigue's influence on behavioral restraint. The analysis argues that fatigue should not impact behavioral restraint performance directly, but rather should do so indirectly by determining how intensively people resist urges to act. It argues further that fatigue's influence on the intensity is multifaceted, depending on the level of fatigue, the magnitude of the unwanted urge, and the importance of resistance. In theory, fatigue should have the potential for prompting people to (1) resist urges more intensively, (2) disengage and thus give in to urges to act, or (3) confirm their pre-existing inclination to disengage and thus give in to urges to act. The analysis implies that fatigue should consistently impair control only under certain restraint conditions. It also addresses key concerns that have been raised concerning the influential limited resource analysis of self-control developed by Baumeister and colleagues.

PRIMED COGNITIVE CONFLICT AND SHIELDING EFFECTS ON EFFORT-RELATED CARDIAC RESPONSE

Guido Gendolla, Yann Bouzidi
University of Geneva

This talk presents two experiments ($N = 221$ university students) that investigated the impact of primed cognitive conflict on effort-related cardiac response in tasks that were not conflict-related themselves. Cognitive conflict research usually investigates manifest conflict in cognitive control tasks. Unfortunately, there conflict is confounded with objective response difficulty (e.g., in incongruent Stroop task trials). This makes conclusions about the effortfulness of cognitive conflict itself difficult. To resolve this problem, we administrated pictures of congruent vs. incongruent Stroop task stimuli as conflict primes (Dreisbach & Fischer, 2012) in easy cognitive tasks. As predicted, primed cognitive conflict increased cardiac pre-ejection period (PEP) responses in an easy attention task in Experiment 1. Accordingly, cognitive conflict itself is indeed effortful. In Experiment 2, we could replicate this conflict effect in an easy short-term memory task. Moreover, as further predicted, the primed cognitive conflict effect on PEP reactivity disappeared when participants could personally choose task characteristics. This latter effect corresponds to other recent evidence showing that personal action choice shields against incidental affective influences on action execution and especially on effort-related cardiovascular response (e.g., Falk et al., 2022; Gendolla et al., 2021).

Saturday, October 1, 2022

8:30 a.m.-10:00 a.m. PDT
Symposium 5.1
MULTIMODAL SOCIO-EMOTIONAL COMMUNICATION: BASIC MECHANISMS AND FUNCTIONING IN ALTERED SENSORY AND CENTRAL CONDITIONS

Session Chairs: Carly Anderson[1], Stefan Schweinberger[2]
[1]*University College London,* [2]*Friedrich Schiller University of Jena*

Descriptors: Communication, Perception, Language
Successful human communication goes far beyond understanding the heard linguistic message. Complementing language, socio-emotional information is conveyed simultaneously via multimodal cues from faces and voices. There is mounting evidence that socio-emotional interaction skills are important for quality of life but may be affected in altered conditions

of sensory (e.g., deafness) or central origin (e.g., prosopagnosia, phonagnosia, amusia) and by experience (e.g., language exposure, training). This symposium covers a wide range of approaches to understand perceptual and cognitive processes underlying socio-emotional communication, including assessments of neurophysiological (e.g., EEG, fNIRS, fMRI), physiological (e.g., eye tracking), and behavioral data in various target populations. Jason Barton begins by reporting neurocognitive associations and dissociations between face and voice recognition in patients with visual disorders. Next, Carly Anderson reports the importance of visual speech signals in hearing and deaf adults, and the impact on non-verbal socio-emotional processing. Christine Nussbaum then presents her current research on the link between musicality and neurocognitive mechanisms of vocal emotion perception. Finally, Stefan Schweinberger and Celina von Eiff discuss the perspective of parameter-specific facial and vocal caricaturing as a method to train and enhance socio-emotional skills. Together, this symposium takes an interdisciplinary approach to offer new perspectives on the mechanisms of multimodal socio-emotional communication and its alterations.

VOICES, MUSIC AND THE MCGURK EFFECT: AUDITORY STUDIES IN PATIENTS WITH THE COMPLEX VISUAL DISORDERS OF PROSOPAGNOSIA AND ALEXIA

Jason Barton, Andrea Albonico, Sherryse Corrow
University of British Columbia

The status of auditory processing is seldom investigated in visual perceptual disorders, yet this is of interest for at least two reasons. First, in some cases the neurologic damage may occur in regions with converging multi-modal representations. Our studies have shown that the amnestic variant of prosopagnosia, which is due to anterior temporal lesions, can be associated with impaired voice recognition (phonagnosia) when the lesions are bilateral, and impaired pitch discrimination (acquired amusia) with right or bilateral lesions. In parallel, we have also found an association between developmental prosopagnosia and congenital amusia. Second, visual dysfunction can impact audiovisual integration in the perception of speech signals. In studies of acquired lesions, patients with acquired alexia from left occipital lesions also have difficulty with lip reading, leading to anomalous audiovisual speech integration in the McGurk effect. This was not found in patients with acquired prosopagnosia from right occipital lesions, suggesting a hemispheric dissociation between

face processing for identity and speech. However, while patients with developmental prosopagnosia can lipread, they show anomalous McGurk effects, suggesting that their dysfunction may be more diffusely distributed. Together, these studies show that patients with visual dysfunction can have abnormal auditory experiences, an effect that has likely been under-appreciated in the past.

BENEFITS OF VISUAL SPEECH PROCESSING FOR LANGUAGE COMPREHENSION: A CHALLENGE FOR NON-LINGUISTIC SOCIO-EMOTIONAL PROCESSING?

Carly Anderson[1,2], Nadia Gregoire-Mitha[2], Mairéad MacSweeney[1], Jason Barton[2]
[1]*University College London,* [2]*University of British Columbia*

Altered sensory and language experience can shape the saliency of communicative cues and attention to the face. For example, increased visual attention to the mouth has been demonstrated in deaf individuals, who rely on visual speech (lipreading), compared to hearing individuals. Increased visual attention to the mouth has also been demonstrated in hearing bilingual, compared to monolingual, infants, which is likely to help them distinguish between their two languages. Here we address whether increased attention to the mouth, to support speech processing, impacts effective processing of non-verbal socio-emotional information from other facial regions. For instance, following the talker's eye-gaze direction is a fundamental skill for language development, conversational turn taking, and inferring emotional state. We first present our previous cortical and behavioral evidence of the adaptive benefit of lipreading during the recovery of auditory speech perception in deaf cochlear implant users. We then present current data examining the modulating effect of visual speech on eye-gaze following in hearing monolingual and bilingual adults. The data illustrate a positive association in bilingual adults, whereby those who are more proficient lipreaders show a greater level of sensitivity to the talker's eye gaze. We consider how individual differences in sensory and language experience/skill may influence face scanning strategies and better inform our understanding of multimodal mechanisms underlying human communication.

LINKS BETWEEN MUSICALITY AND VOCAL EMOTION PERCEPTION: ACOUSTIC PARAMETERS AND ELECTROPHYSIOLOGICAL CORRELATES

Christine Nussbaum
Friedrich Schiller University of Jena

Musicality is linked to increased vocal emotion perception abilities, but the nature of this association is poorly understood. Based on their superior auditory capacities, people with high levels of musicality may be more proficient and flexible in the processing of different vocal parameters that inform emotional quality. We pursue this question using a novel voice manipulation approach, which allows a precise control of the emotional quality expressed by single vocal parameters, such as fundamental frequency contour (F0) and timbre. In our first event-related potential study, ERPs and behavioral data converged in showing that both F0 and timbre support emotion processing but do so differently for different emotions: Whereas F0 was most relevant for responses to happy, fearful, and sad voices, timbre was most relevant for responses to voices expressing pleasure. In our second study, we currently ask how musical expertise modulates the processing of these acoustic markers, by comparing musicians and non-musicians regarding their vocal emotion recognition performance and electrophysiological correlates. This data will inform us to which degree the association between musicality and vocal emotion perception is based on a quantitatively or qualitatively different processing of voice acoustics.

TRAINING SOCIO-EMOTIONAL SKILLS: PERSPECTIVES FROM PARAMETER-SPECIFIC MORPHING AND CARICATURING

Stefan Schweinberger, Celina von Eiff
Friedrich Schiller University of Jena

The idea to use digitally modified stimuli with enhanced diagnostic information to improve communication goes back at least to the seminal work by Tallal et al. (1996) on speech comprehension in language-learning impaired children. Using state-of-the-art methods of *parameter-specific facial and vocal morphing and caricaturing* (PMC), we here pursue this idea for the domain of socio-emotional communication skills. Considering recent evidence that these skills are systematically related to self-perceived quality of life, we first introduce PMC methods as tools for diagnostic and training purposes, and show how they permit selective manipulations of different visual (e.g., shape, texture) or auditory (e.g. fundamental frequency, timbre) parameters in faces or voices, respectively. We then present current data that illustrate how these methods provide novel perspectives for enhancing socio-emotional communication and its cortical correlates for various target groups, including people with low abilities to recognize faces (Limbach et al., 2022), deaf cochlear implant users (von Eiff et al., 2022), or older people (Dawel et al., 2019; Limbach et al., 2018). We critically discuss chances and challenges for such perceptual training interventions, including a pathway to develop these into culture-fair, adaptive and versatile training tools to enhance socio-emotional skills.

8:30 a.m.-10:00 a.m. PDT
Symposium 5.2
PRECISION MODULATION OF ANXIETY AND MOOD DISORDER-RELEVANT BEHAVIORS USING NEUROSTIMULATION: WHAT CAN NEUROPHYSIOLOGY TELL US

Session Chair: Christopher Sege
Medical University of South Carolina
Discussant: Lisa McTeague
Medical University of South Carolina

Descriptors: Anxiety / Depression, Neurostimulation, Psychophysiology

Increasing precision of psychiatric intervention tools will be critical to address ongoing limitations of anxiety/ mood disorder treatments. Neurostimulation using technologies like transcranial magnetic stimulation (TMS) shows promise as a precision tool, and much work is being done to test how neurostimulation effects might be maximized by pairing it with specific disorder-relevant processes. In line with such work, this symposium presents research that uses neurostimulation to modulate neurophysiological markers of anxiety/ mood disorder-relevant cognitive, affective, and behavioral processes. To begin, Christopher Sege presents research

that uses TMS to modulate EEG/ ERP indicators of cognitive control under stress – a critical area since cognitive control deficits are a transdiagnostic psychiatric risk factor. Next, Jon Ryan presents a study using TMS to reliably modulate reward positivity – an electrocortical reward processing index that predicts depression risk. Following Dr. Ryan, Mathias Weymar presents multiple tests of how transcutaneous vagal stimulation-based modulation of working memory – another key process in many anxiety/ mood presentations – can be optimized. Finally, Adam Cobb presents data in which transcranial direct current stimulation enhances cardiac response change across exposure sessions – and thus might enhance a treatment-critical fear habituation process. Following research presentations, Lisa McTeague then integrates the data to discuss implications and necessary next steps for translation into applications that improve treatment effects.

ACCELERATED RTMS AS A TOOL FOR ENHANCING COGNITIVE CONTROL: EVIDENCE FROM NEUROPSYCHOLOGY AND NEUROPHYSIOLOGY

Christopher Sege[1], Claire Cox[1], Kevin Caulfield[1], Holly Fleischmann[1,2], Bridgette Holland[1], James Lopez[1], Mark George[1], Donna Roberts[1], Lisa McTeague[1]
[1]Medical University of South Carolina, [2]University of Georgia

The left dorsolateral prefrontal cortical site typically targeted with therapeutic repetitive transcranial magnetic stimulation (rTMS) for depression is seated in a network integral to higher order cognition. Accordingly, cognitive improvements have been reported as ancillary benefits to rTMS for patients. However, among healthy individuals, findings have been mixed. We proposed that a near continuous assessment of the dose response curve was warranted. We implemented a wide range of doses, including far exceeding those typically applied within healthy samples. Forty healthy participants were randomized to ten doses of accelerated rTMS to left dlPFC. Participants received from one to 10 active intermittent theta burst rTMS sessions/day for five days (600 pulses, 120% resting motor threshold). Each of the ten doses increased by one active session per day resulting in 5–50 active sessions. Pre- and post-rTMS participants completed neuropsychological/ neuropsychiatric assessment, structural MRI, and electrocortical and startle measures during cognitive and stress

tasks. The current talk presents results across various domains. Of particular relevance, rTMS modulated electrocortical indices of attention control in a working memory task such that rTMS increased P300 amplitudes to targets as well as to auditory stimuli under threat—particularly at the highest doses. This is the first examination of the dose–response relationship for accelerated rTMS among healthy participants, or any condition. Implications for advancing rTMS for intact and disordered cognition are discussed.

INTERMITTENT THETA-BURST STIMULATION TO THE ROSTROMEDIAL PREFRONTAL CORTEX MODULATES REWARD-RELATED NEURAL ACTIVITY

Jon Ryan[1], Jourdan Pouliot[2], Greg Hajcak[1], Derek Nee[1]
[1]Florida State University, [2]Unversity of Florida

Anhedonic depressed patients show increased treatment resistance and suicidal ideation compared to non-anhedonic patients. These deficits have largely been tied to the mesolimbic pathway; a dopaminergic reward circuit that includes the ventral striatum (VS). VS activation is largely mediated via inputs from the medial prefrontal cortex (mPFC) and limbic areas. Depressed anhedonic patients show reduced VS activation to reward-related stimuli, perceived behaviorally as a lack of reward motivation. Interventions to enhance VS activation may therefore improve reward processing and anhedonic symptoms. Thus, we attempted to modulate VS reward activation in healthy individuals through intermittent theta-burst stimulation (iTBS), a form of transcranial magnetic stimulation (TMS). Following studies which have shown iTBS can propagate to downstream structures within a targeted pathway, we stimulated the rostromedial PFC (rmPFC), an area showing high co-activation with the VS, in an attempt to alter reward response. To capture this change, we utilized the reward positivity (RewP), an event-related potential that indexes activity of the reward circuit and has been shown to be abnormal in depression. Within-subject comparisons determined that rmPFC stimulation potentiated the RewP when compared to control stimulation. Additionally, these changes were dependent on rmPFC-VS connectivity and the ability of TMS to reach an ideal target. These findings provide novel methodology for enhancing reward response, which could lead to future interventions for treating anhedonic depression.

INFLUENCE OF NON-INVASIVE TRANSCUTANEOUS AURICULAR VAGUS NERVE STIMULATION (TAVNS) ON EMOTIONAL EPISODIC MEMORY: THE ROLE OF TONIC AND TRANSIENT STIMULATION

Mathias Weymar, Manon Giraudier, Carlos Ventura-Bort
University of Potsdam

Non-invasive transcutaneous auricular vagus nerve stimulation (taVNS) has received tremendous attention in the field as promising neuromodulator of cognitive and affective functions in clinical and non-clinical populations, which likely exerts its effect via the brain's arousal (LC-NA) system. Despite its potential, however, optimal stimulation parameters (e.g., duty cycle, intensity) are still under debate. In a series of studies, we aimed to test the influence of continuous and transient taVNS on emotional episodic memory (mediated by the LC-NA system). In one study (N = 37), we found that continuous vagal (vs. sham) stimulation during emotional and neutral picture viewing increased long-term recollection memory for emotional pictures, as reflected by behavioral and electrophysiological memory indices (parietal ERP Old/New effect). When applying taVNS using a standard duty cycle of 30s on/off stimulation during encoding (N = 30), however, no such enhancement in emotional recollection was found. Data from a third study (currently ongoing) will also be presented, in which we closely synchronize on/off taVNS and sham stimulation with the presentation of emotional and neutral pictures. Results of these studies will be compiled and discussed. taVNS can have a modulatory influence on learning and episodic memory, which could be relevant for clinical application (e.g., adjunct treatment option for disorders with altered memory functions). Our data, however, also point to critical stimulation parameters that need to be considered when applying taVNS.

TRANSCRANIAL DIRECT CURRENT STIMULATION MODULATES HEART RATE AND HEART RATE VARIABILITY DURING IN VIVO EXPOSURE THERAPY

Adam Cobb, Patrick O'Conner, Eric Zaizar, Franscisco Gonzalez-Lima, Michael Telch
University of Texas, Austin

Transcranial direct current stimulation (tDCS) is one of several forms of non-invasive brain stimulation in development for enhancing interventions for anxiety and stress-related disorders. This study evaluated whether tDCS-augmented in vivo exposure results in changes in heart rate (BPM) and heart-rate variability (HRV). In a double-blind, placebo-controlled trial, contamination- and animal-phobic participants (N = 49) were randomized to active tDCS (1.7 mA, 20 min.; n = 27), or sham tDCS (1.7 mA, 30 sec.; n = 22), followed by 30 min. of in-vivo exposure. Active tDCS targeted excitation of the left mPFC and inhibition of the right dlPFC; polarity was counterbalanced for controls. BPM and HRV were derived from continuous Polar HR monitor recordings during behavioral approach tasks (BATs) involving brief (30 sec.) exposure to feared targets at pre-treatment, post-treatment, and a 1-month follow-up, as well as during six 5-min. Trials of in vivo exposure. The active tDCS group exhibited significantly greater reductions in BPM, and marginally greater increases in HRV from pre-treatment to 1-month in an extinction context, compared to the sham tDCS group. Similarly, the active tDCS group exhibited significantly greater reductions in BPM, and increases in HRV across exposure trials, relative to the sham tDCS group. Findings for the generalization context were non-significant. In line with the main outcome findings, tDCS targeting prefrontal regions appears to offer an effective means of enhancing exposure therapy, perhaps through top-down modulation of autonomic arousal.

8:30 a.m.-10:00 a.m. PDT
Symposium 5.3
TRANSDIAGNOSTIC NEUROCOGNITIVE MECHANISMS RELATED TO THREAT UNCERTAINTY UND EXTINCTION

Session Chairs: Matthias Wieser[1], Martin Herrmann[2]
[1]Erasmus University, [2]University of Würzburg

Descriptors: anxiety, uncertainty, extinction
The neurocognitive mechanisms related to uncertainty of threat and fear extinction play an important role in understanding anxiety disorders. New insights on these processes and their interaction will be featured in this symposium from research paradigms with different methods (EEG, Startle, SCR, fMRI). Marta Andreatta shows that stress can enhance fear memories, impairing fear extinction and facilitating spontaneous recovery of conditioned fear. The next two papers examine the importance of the personality variable intolerance of uncertainty (IU). First, Annmarie MacNamara shows how

PSYCHOPHYSIOLOGY SPR

backward cues presented immediately after an unconditioned stimulus can be used to elicit contextual threat memories and how participants with higher IU showed increased SCR and late positive potentials (LPP) to these stimuli. Matthias Wieser presents data from 182 healthy participants who were examined with an Eriksen-Flanker task and a classical fear conditioning and extinction paradigm. Here, the EEG parameters of ERN and ssVEP were investigated in their relation to IU, and interestingly showed minimal effects. Finally, in the presentation by Martin Herrmann, the significance of neural correlates (fMRI) of unpredictable threat processing on the prediction of the therapeutic outcome of exposure therapy is examined. ROI analyses revealed significant group differences in the anterior cingulate cortex (ACC), with higher ACC activity in non-responders. Altogether, the presented studies point to nuanced view of how transdiagnostic mechanisms may underlie pathological anxiety.

DISTAL STRESS AND THE PERSISTENCE OF CONDITIONED FEAR MEMORIES

Marta Andreatta[1,2], Christopher Klinke[1], Matthias Wieser[2], Maren Lange[3]
[1]University of Würzburg, [2]Erasmus University, [3]University of Münster

Stress influences both memory consolidation and retrieval processes. Impaired extinction of conditioned fear (i.e., persistent fear responses) has been demonstrated in individuals, who were stressed day(s) prior the learning. It remains to clarify whether such stress-induced impairment of fear extinction has long-lasting effects. We tested fear and extinction memories in 74 participants, who underwent either the socially evaluated cold pressure test (SECPT) or a sham protocol on Day1. Subsequently, all participants underwent a fear acquisition (Day2), fear extinction (Day3), and memory recall test (Day17). The unconditioned stimulus (US) was an electric stimulation, which was delivered during fear acquisition only at the offset on one shape (CS+) but not at the offset of the other shape (CS−). Successful fear acquisition was indicated by higher fear and US-expectancy ratings as well as startle potentiation to CS+ vs. CS−. Conditioned fear responses successfully decreased during fear extinction with exception of persistent stronger subjective fear in the stress group for CS+ as compared to CS−. Two weeks later during the memory recall test, explicit extinction memories weakened in all participants as indicated by the higher fear and US-expectancy ratings for CS+ compared to CS−. While implicit extinction memory weakened only in stressed participants as showed by their startle potentiation to CS+ as compared to CS−. In sum, stress may strengthen fear memories, thereby impairing fear extinction and facilitating the spontaneous recovery of conditioned fear.

MODELING ANXIETY AND ITS TREATMENT IN THE LAB: A NOVEL MEANS OF ELICITING CONTEXT AND MODULATION OF THREAT EXTINCTION BY WORKING MEMORY LOAD

Annmarie MacNamara, Yuhan Cheng, Yixin Zhang, Kayla Wilson, Elizabeth Bauer, Bryan Jackson, Stephen Maren, Shannon MacDonald
Texas A&M University

Threat learning paradigms can be used to model anxiety mechanisms, as well as factors that may affect the treatment of anxiety disorders. Nonetheless, progress in understanding ineffective contextual modulation of threat in trauma-related psychopathology is impeded by difficulty modeling context in human experimental designs. Drawing on the rodent literature, we tested backward (BW) cues, which are presented immediately *after* delivery of an unconditioned stimulus, as a novel means of eliciting contextual threat. BW cues elicited increased SCR and late positive potentials (LPPs) compared to no-threat cues, ts > 1.77, ps < .012 during early acquisition, with participants higher in intolerance of uncertainty showing heightened SCR to BW cues, $r = .341$, $p = .017$, $N = 49$. Therefore, BW cues may provide a cross-species means of retrieving contextual threat memories. In another line of work, we used the LPP to evaluate empirical support for the practice of maximizing attention to threatening stimuli during extinction learning/exposure therapy. Participants performed a threat acquisition task, followed by threat extinction under high- versus low-working memory load. Results showed that working memory load slowed extinction learning, $F(1,33) = 4.42$, $p = .04$, $N = 38$, providing evidence in favor of limiting distraction/cognitive load during exposure therapy. In sum, our results may lead to a more flexible and effective means of eliciting contextual threat, and provide the first experimental evidence that working memory load compromises electrocortical measures of threat extinction.

NOT AS CERTAIN AS WE THOUGHT - THE (NON-)EFFECTS OF INTOLERANCE OF UNCERTAINTY ON FEAR EXTINCTION AND PERFORMANCE MONITORING

Matthias Wieser, Marcelo Malbec, Asimina Aslanidou, Marta Andreatta
Erasmus University

Intolerance of uncertainty (IU) is supposed to be a risk factor for internalizing disorders and has been found to be associated with dysfunctions in fear extinction learning and performance monitoring. In the present study, 182 healthy participants performed an Eriksen flanker task designed to elicit the ERN and a classical fear conditioning and immediate extinction paradigm with flickering faces designed to elicit steady-state visual evoked potentials (ssVEPs). Affective ratings, skin conductance, and electrophysiological brain activity (EEG) were recorded. Participants completed the Intolerance of Uncertainty Scale and other measures of anxiety and depression. IU was not associated with the ERN, corroborating previous findings. The same was observed for subjective measures of fear conditioning and ssVEPs. Exploratory latent profile analyses will be presented which aim to disentangle specific neurocognitive profiles of error monitoring and fear extinction and their relationship to IU and other measures of psychopathology. The current findings suggest that small samples may have previously exaggerated the links between self-reported IU and error monitoring (ERN) and fear extinction. As such, further high-powered replications are required to confirm if, and how, these are related. Overall, results indicate that the influence of intolerance of uncertainty on different domains is less clear than previously thought. Possible subgroups of IU may be found with latent profile analyses of large datasets including data from several different paradigms, as presented here.

FUNCTIONAL NEUROANATOMY OF UNPREDICTABLE THREAT PROCESSING IN THE PREDICTION OF TREATMENT RESPONSE IN ANXIETY DISORDERS

Martin Herrmann[1], Niklas Siminski[1], Agate Logina[1], Hanna Schwarzmeier[1], Fabian Seeger[1,2], Kati Roesmann[3], Elisabeth Leehr[4], Böhnlein Joscha Böhnlein[4], Bettina Gathmann[4], Markus Junghöfer[4], Udo Dannlowski[4], Ulrike Lueken[1,5], Thomas Straube[4]
[1]*University of Würzburg,* [2]*University of Heidelberg,* [3]*University of Siegen,* [4]*University of Münster,* [5]*Humboldt-Universität zu Berlin*

Although exposure therapy is highly effective in anxiety disorders, there is a large number of patients, who do not respond sufficiently (about 50 percent). In the last decades, a considerable number of studies investigated the potential of fMRI for the prediction of therapy response. However, no study investigated the prediction of therapy outcome of exposure therapy based on neuronal activity during predictable and unpredictable threat processing. Here, the Wuerzburg data of a bi-centric clinical study investigating the effects of virtual reality exposure therapy (VRET) in spider phobic patients are analyzed. Before VRET, we measured the neural activity during a predictable/unpredictable threat task using fMRI. A sample of N = 67 patients could be included in the fMRI analyses. We defined therapy response as a reduction in spider phobia questionnaire (SPQ) score of 30% and a reduction of 50% in a behavioral approach task (BAT) from baseline to follow-up. ROI analyses revealed significant group differences in the anterior cingulate cortex (ACC) in the contrast of disorder-specific vs. control condition for the cue as well as anticipation period, with higher ACC activity in non-responders. In contrast, hyperactivity in the bed nucleus of the stria terminalis (BNST) during the confrontation with spider vs. neutral stimuli correlated with better therapy response. This study confirms that ACC and BNST play a crucial role in threat processing, and can be a neural marker for exposure therapy response. This should be confirmed in a future prospective clinical trial.

ABSTRACT

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Big Idea Abstracts

Thursday, September 29, 2022

8:30 a.m.-10:00 a.m. PDT
Big Idea Session: New Methods in Psychophysiology
8:30 a.m.-8:45 a.m. PDT | LOW-INTENSITY TRANSCRANIAL FOCUSED ULTRASOUND TARGETING THE RIGHT PREFRONTAL CORTEX: A NEW METHOD TO INCREASE APPROACH AND DECREASE WITHDRAWAL BEHAVIOR VIA SPECIFIC INHIBITION OF MIDFRONTAL THETA

Philipp Ziebell[1], Johannes Rodrigues[1], André Forster[1], Isabelle Landwehr[1], Tanja Seibert[1], Jay Sanguinetti[2], John Allen[2], Johannes Hewig[1]
[1]*University of Würzburg,* [2]*University of Arizona, Tucson*

Descriptors: Low-Intensity Transcranial Focused Ultrasound, Midfrontal Theta, Approach vs. Withdrawal
Low-intensity transcranial focused ultrasound (LITFUS) as a newly emerging non-invasive neuromodulation offers various benefits (e.g., ease of use, targeting precision, side effect avoidance). Its potential has been highlighted for scientific and practical applications (Beisteiner & Lozano, 2020; Darmani et al., 2022). In this double-blind within-subjects study ($N = 152$), we applied right prefrontal cortex (RPFC) LITFUS, which was found to enhance mood, while decreasing anxiety and worrying (Reznik et al., 2020; Sanguinetti et al., 2020). To expand evidence on a physiological and behavioral level, a virtual T-maze was used for simultaneously recording approach vs. withdrawal and electroencephalographic midfrontal theta (MFT). Heightened MFT has been linked to heightened conflict experiences as well as withdrawal-like negative feelings and behavior (Cavanagh & Shackman, 2015; Gratton et al., 2018), for instance, increased anxious anticipation of social threat or less risky gambling decisions (Osinsky et al., 2017; Schmidt et al., 2018). We hypothesized RPFC LITFUS would induce MFT inhibition that should predict increased approach and decreased withdrawal. RPFC LITFUS led to significant MFT inhibition, distinctly evident in scalp topography. As expected, this could significantly predict increased approach and decreased withdrawal, with prediction patterns once more revealing distinct scalp topographies. These findings suggest the promise of further basic and applied research, such as for supporting psychotherapeutic interventions regarding emotional and motivational disorders.

8:45 a.m.-9:00 a.m. PDT | HOW YOUR SPEECH RESPONDS TO STRESS: THE VALIDATION OF ACOUSTIC, PROSODIC, AND SEMANTIC SPEECH FEATURES IN A MULTI-PARADIGM STRESS-INDUCTION TASK

Mitchel Kappen[1,2], Jonas Van Der Donckt[3], Gert Vanhollebeke[1,2,4], Sofie Van Hoecke[3], Marie-Anne Vanderhasselt[1,2]
[1]*Department of Head and Skin, Ghent University, University Hospital Ghent (UZ Ghent), Department of Psychiatry and Medical Psychology,* [2]*Ghent Experimental Psychiatry (GHEP) Lab,* [3]*IDLab, Ghent University - imec,* [4]*Department of Electronics and Information Systems, Ghent University*

Descriptors: Psychosocial Stress, Speech, Ambulatory Psychophysiology
The use of speech as an ambulatory psychophysiological measure to detect stress levels is increasingly gaining attention since it is cheap, scalable, and non-intrusive. In the current study, we collected semi-spontaneous speech (i.e., via picture-describe task) from subjects who participated in two distinct stress paradigms including control conditions (i.e., Cyberball & MIST) on two separate days. We conclude a successful stress induction using multiple psychophysiological measures (cardiac and electrodermal responses), enabling us to directly study the effects of stress and physiological reactivity on acoustic, prosodic, and semantic speech features. We consistently found, corresponding to earlier findings, increases in pitch (Fundamental Frequency; F0) after the stress condition. Moreover, we found increases in jitter (frequency variation), shimmer (amplitude variation), and speaking rate after the stress condition, which was not detectable in earlier read-out-loud paradigms. In addition, we found that these effects return to baseline levels after a 10-minute recovery period, correlating to our physiological measures. Our results show that speech 1) is a promising biomarker for stress measurements, 2) has a high temporal

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resolution as a stress measurement tool, and 3) would be an important addition to ambulatory psychophysiological research. By inducing stress using two distinct paradigms on two different days, we ensure that our results are related to the experience of (psychosocial) stress in general, rather than the induction method specifically.

9:00 a.m.-9:15 a.m. PDT | **DAILY WEARABLE SENSORS FOR PSYCHOPHYSIOLOGICAL RESEARCH: WHEN AND HOW**

Veronica Dudarev[1], Oswald Barral[2], Guy Davis[2], James Enns[1]
[1]*University of British Columbia,* [2]*HealthQB Technologies, Inc*

Descriptors: cardiac biometrics, wearable sensors, pain
Wearable sensors (WS) are *the* technological breakthrough of this decade. The promise is that devices like smart watches will soon monitor our bodily states, providing data to predict illnesses and optimize performance. Yet the psychological health community is cautious to adopt WS for research purposes, resisting the temptation of near-continuous physiological measurement because it is less controlled when compared to laboratory conditions. Here we offer a protocol of *how* a daily wearable device *can* be used for research purposes. Validity of several WS of cardiac biometrics has been established against ECG in laboratory. But what about reliability of the WS in the uncontrolled settings of daily life? A traditional approach is to measure and statistically control the interfering factors, but doing so interferes with the aim of having wearers naturally go about their daily lives. We suggest focusing measurements on times of the day when most of these factors are not at play – and that is during sleep. Study 1 confirmed that the number of cardiac biometrics samples obtained during wakefulness is very low and so is their reliability. However, during sleep both the quantity and reliability of data were remarkably high, thus promising to predict subjective states of pain and emotion. And indeed, in Study 2 we showed that sleep-time heart rate predicts next-day pain intensity in people experiencing primary chronic pain. We propose that daily unobtrusive physiological measurement can be achieved with WS, provided that biodata is collected at times when interfering factors are not at play.

9:15 a.m.-9:30 a.m. PDT | **HOW LOW CAN YOU GO? MEASUREMENT OF EVENT-RELATED BRAIN POTENTIALS FROM A TWO-CHANNEL EEG SYSTEM**

Katherine Boere[1], Elle Parsons[1], Gordon Binsted[2], Olave Krigolson[1]
[1]*The University of Victoria,* [2]*York University*

Descriptors: EEG, ERP, P300
Mobile electroencephalography (mEEG) has rapidly moved from a toy used at Science Centres to a mainstream research and clinical assessment tool. With that said, the adoption of mEEG systems has not been without its issues. For instance, the classic problems mEEG systems have to address are non-traditional electrode placements, timing issues associated with Bluetooth data transmission and reduced electrode counts. Previously, we have demonstrated that the first two of these challenges can be mitigated (see Krigolson et al., 2017; 2021). The outstanding question that remains is how many electrodes do you actually need? Here, we examined this question using the Patch EEG system by Cognionics, a three-channel EEG system with all electrodes placed on the forehead. Participants completed a standard visual oddball task to measure the event-related potential components of interest – the N200 and P300. We demonstrate that the data collected with the Patch three electrode system undoubtedly revealed N200 and P300 ERP components. Importantly, this research validates low electrode count mEEG for "real world" data collection within a minute of set-up time. Most promisingly, this finding explodes the capability of EEG-based clinical assessment in the field in just a few minutes.

9:30 a.m.-9:45 a.m. PDT | **MEASURING STARTLE BLINK USING CMOS CAMERA (PHYSIOCAM)**

Shyama Shah, Gregory Lewis
Indiana University

Descriptors: EMG, Startle, Non-Contact Sensor
The human startle reflex provides a sensitive, noninvasive measure of central nervous system activity. Startle reflex is measured by electromyography (EMG) and response strength can be measured by the EMG activity of the Orbicularis Oculi muscle. We aim to design a non-contact AI-enabled sensor that can quantify startle blink magnitude comparable to EMG precision. To measure corneal reflex, we are using Biopac BP-160, 3 electrodes system, two electrodes placed over the Orbicularis Oculi muscle and one ground over the forehead. In parallel, we use a CMOS Camera setup to capture video frames at 25 and 60 Hz, from which 68 facial landmarks are

extracted using an AI-enabled pre-trained model. We extract distance vectors between pairs of landmarks around the eye region of interest and derive time series data which on further analysis provides startle blink measurement. For clarity, it is also plotted against the EMG from Biopac. Startle reflexes were elicited with a 50 ms, 96 dB burst of white noise with a near-instantaneous rise/fall time, delivered via headphones, which is generated in Adobe Audition. The blinks are aligned in both the EMG and the video plot, results are comparable. The results show that the startle blink measurement can be designed using non-contact sensors. The results are promising and would provide an alternative to the conventional EMG-based measurement, which is lengthy, time-consuming, requires expertise, and is often uncomfortable for subjects.

9:45 a.m.-10:00 a.m. PDY | **REAL-TIME STIMULATION OF PARAHIPPOCAMPAL PHASE-RESETTING DURING SPATIAL NAVIGATION USING CLOSED-LOOP EEG-TMS**

Malte Güth, Drew Headley, Travis Baker
Rutgers University

Descriptors: closed-loop, EEG-TMS, spatial navigation
Phase-resetting of the theta rhythm (4–12 Hz) created by grid cells in the parahippocampal cortex (PHC) has been shown to facilitate encoding of navigationally imperative information in rodents by aligning them with a precise phase angle of the theta local field potential. We aimed to investigate this phase coding mechanism in humans by identifying a scalp-level marker in the EEG using simultaneous EEG-fMRI and by developing a novel real-time closed-loop (RT-CL) EEG-TMS system. The RT-CL provides the necessary processing speed for instantaneous analysis of oscillatory features within microseconds and the subsequent delivery of phase-locked TMS pulses. To test the RT-CL's performance, we compared its triggering sensitivity and phase precision to a state-of-the-art phase prediction system. When targeting theta cycles in simulated, frequency-modulated sweeps (1–50 Hz), analyses revealed a near perfect triggering performance within 7–10° of the targeted phase for the RT-CL. Preliminary analyses indicated that this level of performance was maintained when targeting occipital alpha oscillations and PHC phase-resetting in response to encoding reward locations in 22 undergraduate students. Hence, this study provides a strong foundation for future experiments aiming to establish a causal relationship between the phase of PHC oscillations and spatial memory encoding in humans. In addition, the unprecedented temporal resolution of the RT-CL promises to refine and expand our capabilities in stimulating neuronal oscillations from theta to faster rhythms such as beta and gamma.

Friday, September 30, 2022

1:00 p.m.-2:30 p.m. PDT
Big Idea Session: Psychophysiology of Cognitive Control and Executive Functions
1:00 p.m.-1:15 p.m. PDT | CEREBELLAR EEG SOURCE LOCALIZATION REVEALS AGE-RELATED COMPENSATORY ACTIVITY MODERATED BY GENETIC RISK FOR ALZHEIMER'S DISEASE

Elizabeth Paitel[1], Kristy Nielson[1,2]
[1]*Marquette University,* [2]*Medical College of Wisconsin*

Descriptors: Cerebellum, Electroencephalography (EEG), Alzheimer's risk
Cerebellar (CB) electroencephalography (EEG) was not deemed feasible until recent advances demonstrated excellent localization of source activity despite its anatomical configuration and distance from sensors. Importantly, the posterior CB is now appreciated as contributing substantively to cognitive processes, including executive functioning (EF). Yet, its precise role in EF is not yet understood. EEG and its exceptional temporal resolution are ideal for disentangling posterior CB contributions across the cognitive time course. Moreover, aging and Alzheimer's disease (AD) are an ideal context for studying CB contributions to EF as each is associated with CB deficits and subtle, early EF decline. Further, the CB role in AD risk at asymptomatic stages is unknown. Thus, we investigated the contributions of age and genetic AD risk (via Apolipoprotein-E ε4) on CB source activation during conflict processing (N200 window) and performance monitoring (P300 window) sub-processes of successful inhibitory control in healthy, cognitively intact elders (24 ε4-, 20 ε4+; age 72–89). Older age predicted greater CB activation during the P300 time window (performance evaluation, adaptation), but not during the N200 window (conflict processing). In left crus I (and trend in bilateral crus II), this was moderated by ε4, with greater CB activation in older age only in ε4-, consistent with compensatory theories. In contrast, lower CB activation was evident in ε4+ regardless of age, suggesting reduced compensatory capacity in ε4+ and sensitivity of CB EEG to subtle AD-related neural deficits.

1:15 p.m.-1:30 p.m. PDT | AMPHETAMINE USE DISORDER IS LINKED TO HEIGHTENED EMOTIONAL URGENCY AND INSULAR CORTEX RECRUITMENT DURING BEHAVIORAL INHIBITION

Jennifer Stewart[1,2], Kaiping Burrows[1], Chrysantha Davis[1], Mary Kate Dykes[1], Ricardo Wilhelm[1], Breanna McNaughton[1], Rayus Kuplicki[1], Robin Aupperle[1,2], Jonathan Savitz[1,2], Martin Paulus[1,2], Evan White[1]
[1]*Laureate Institute for Brain Research,* [2]*University of Tulsa*

Descriptors: substance use disorder, fMRI, stop signal task
Although substance use disorders are linked to blunted frontocingulate processing during inhibitory control, it is unclear whether this pattern persists during abstinence. Abstinent individuals with amphetamine use disorder (AMP; $n = 49$, 59% female) and healthy controls (CTL, $n = 45$, 51% female) from the Tulsa 1000 study completed questionnaires and a stop signal task (SST) during functional magnetic resonance imaging (fMRI). Groups were compared on: (1) Demographics and verbal IQ; (2) UPPS-P Impulsive Behavior Scale ratings; (3) SST brain responses during correct (go, easy stop, difficult stop) and error (easy stop, difficult stop) trials; and (4) SST behavioral responses. Results focus on large effect sizes ($p < .01$) indicated by Hedge's g. AMP had lower verbal IQ ($g = 1.40$) and reported higher UPPS-P Positive Urgency ($g = 1.57$) and Negative Urgency ($g = 2.08$) scores than CTL. fMRI results for correct trials demonstrated: (1) a group main effect, wherein AMP showed higher insula, amygdala and putamen signal than CTL ($g = 0.70–1.00$); and (2) a group*condition interaction, wherein AMP exhibited higher insula, amygdala, and nucleus accumbens signal than CTL during successful inhibition of difficult stop trials ($g = 0.58–0.79$). Moreover, within AMP, lower verbal IQ scores were linked to greater insula signal during successful inhibition of difficult trials ($r[41] = −.40$, $p < .01$, $R^2 = .16$). No group differences emerged for SST error trials or behavior. Findings suggest that action suppression may be cognitively and emotionally taxing on individuals attempting to maintain sobriety.

1:30 p.m.-1:45 p.m. PDT | THE IMPACT OF EXERCISE ON PSYCHOPHYSIOLOGICAL INDICES OF ERROR MONITORING: DOES INTENSITY MATTER?

Kaylie Carbine[1], Alexandra Muir[2], Harrison Marsh[2], Bruce Bailey[2], Michael Larson[2]
[1]*California State University Dominguez Hills,* [2]*Brigham Young University*

Descriptors: error monitoring, exercise, ERN/Pe
Error monitoring is a key aspect of cognitive control and critical for behavior adjustment and goal achievement. Although exercise may improve error monitoring, the role of exercise intensity on error monitoring is unclear. We tested if moderate- or vigorous-intensity exercise compared to rest differentially impacted error monitoring via the error-related negativity (ERN) and error positivity (Pe) event-related potentials (ERPs). In a within-subject design, 212 participants (49% female, $M_{age} = 22.46$) completed a flanker task on three occasions in randomized order- after seated rest, moderate exercise (40 minutes of jogging at 35% VO_{2max}), and vigorous exercise (40 minutes of jogging at 70% VO_{2max}). 3-condition (rest, 35%, 70%) by 2-accuracy (correct, error) mixed models for ERPs and post-error slowing revealed ERN amplitude was larger after vigorous exercise compared to rest ($p = .02$). Pe amplitude was larger after vigorous exercise compared to rest, regardless of accuracy ($p = .04$). There was also greater post-error slowing after rest and moderate exercise compared to vigorous exercise ($ps < .02$). 3-condition (rest, 35%, 70%) by 2-trial (congruent, incongruent) mixed models for accuracy and reaction times revealed that although accuracy did not differ by condition, reaction times were faster after vigorous exercise compared to rest and moderate exercise, specifically for incongruent trials ($ps < .01$). Vigorous compared to moderate exercise or rest may result in increased recruitment of error monitoring resources and improved behavioral performance and goal achievement.

1:45 p.m.-2:00 p.m. PDT | EFFECTS OF STATE WORRY AND WORKING MEMORY LOAD MANIPULATIONS ON PSYCHOPHYSIOLOGICAL INDICES OF ERROR-PROCESSING

Sara LoTemplio, Jack Silcox, Ryan Murdock, David Strayer, Brennan Payne
University of Utah

Descriptors: Error-related Negativity, Error processing, EEG
The compensatory error monitoring hypothesis (Moser et al., 2013; 2014) suggests that high anxiety individuals

have larger ERN amplitudes because they must employ extra, compensatory efforts to override the working memory demands of their anxiety. Yet, to our knowledge, no ERN study has employed direct manipulation of working memory demands in conjunction with direct manipulations of induced anxiety. Furthermore, little is known about how these manipulations affect other measures of error processing, such as the error-related pupil dilation response and post-error behavioral adjustments. Therefore, we manipulate working memory load and anxiety, using a worry task, in a 2x2 within-subjects design to examine the interactive effects of working memory load and anxiety on ERN amplitude, error-related pupil dilation response amplitude, and post-error behavior. There were no effects of our manipulations on ERN amplitude, suggesting against a strong interpretation of compensatory error-processing theory. However, the worry manipulation affected post-error behavior, such that worry caused a reduction in post-error accuracy. Additionally, the working memory manipulation affected error-related PDR magnitude and the amplitude of the error-related positivity (Pe), such that increased working memory load *decreased* the amplitude of these responses. Results are discussed in relation to compensatory error-processing theory.

2:00 p.m.-2:15 p.m. PDT | **UNRAVELING THE COGNITIVE CORRELATES OF HEART RATE VARIABILITY WITH THE EX-GAUSSIAN AND DRIFT DIFFUSION MODELS**

Derek Spangler[1], Jared McGinely[2], Bruce Friedman[3], Julian Thayer[4,5]
[1]The Pennsylvania State University, [2]Towson University, [3]Virginia Tech, [4]University of California Irvine, [5]The Ohio State University

Descriptors: heart rate variability, cognitive control, computational modeling
Vagally mediated heart rate variability (vmHRV) is theorized to index cognitive control and hence relate to health and performance. However, evidence for associations between vmHRV and cognitive control has been mixed. These inconsistencies may stem from usage of standard performance metrics that conflate psychological processes. In this talk, we will present three studies that examine vmHRV alongside more precise metrics of higher-order cognition in healthy participants. We specifically used the: (1) *ex-Gaussian model* of response times (RT), which separates the skewed RT distribution into different moments with unique cognitive interpretations, and (2) *drift diffusion model*, a computational model of information processing in two-choice tasks. Using the

ex-Gaussian model, we showed that vmHRV specifically relates to attentional functions proxied by very long response times. We then expanded on this effect with the drift diffusion model and showed that vmHRV is related to the rate of information accumulation. Across studies, vmHRV-cognition relationships would have been missed if solely relying on traditional performance. Findings will be discussed in reference to theorized links between vmHRV and inhibitory control. We will also discuss how model-based approaches can enhance the joint study of cognitive control and the autonomic nervous system.

2:15 p.m.-2:30 p.m. PDT | **THE INTEROCEPTIVE NEURAL MECHANISM UNDERLYING ADAPTIVE COGNITIVE CONTROL**

Seung Suk Kang, Seung-Lark Lim, Joseph Bodenheimer
University of Missouri, Kansas City

Descriptors: Interoception, Adaptive cognitive control, Heartbeat-evoked brain response
The neurovisceral integration theory suggests that visceral afferents to the brain influence cognitive functions, highlighting the role of interoception in supporting adaptive behaviors that are responsive to environmental demands. However, it is unknown if and how interoceptive neural responses contribute to cognitive controls directing goal-relevant behaviors. Using 31 healthy subjects' EEG recordings collected with a cognitive control task and brain source-level analysis of the time-frequency inter-trial phase coherence measure of heartbeat-evoked brain response (HEBR), we found that theta-frequency HEBR of the right insula was modulated by response conflicts across trials. The conflict-related HEBR modulation predicted behavioral indices of adaptive cognitive control and the task-related prefrontal early theta response in the subsequent trials. We also found significant associations between the insula theta HEBR and the interregional phase coherence between the insula and the dorsal anterior cingulate cortex, the two core nodes of the salience network. These results suggest that the theta HEBR reflects the conflict-related functions of the salience network. Furthermore, the insula theta HEBR showed enduring conflict-related modulations even during the inter-stimulus-intervals and sensitivity to not only the current but also the previous trials' conflicts. These distinct properties suggest that the insula theta HEBR provides a unique and essential neural mechanism signaling accumulative conflicts that modulates the prefrontal responses for adaptive cognitive controls.

ABSTRACT

Poster Session 1
Wednesday, September 28, 2022

1–001 | DIMENSIONALITY ESTIMATION AND REDUCTION OF EEG BEFORE INDEPENDENT COMPONENT ANALYSIS: THE IMPACTS ON THE RELIABILITY OF THE EEG MEASURES

Seung Suk Kang, Joseph Bodenheimer
University of Missouri, Kansas City

Descriptors: ICA, Reliability, Dimensionality reduction
To accurately quantify brain activities from EEG, it is essential to conduct rigorous preprocessing of EEG to remove prominent physiological and environmental noises. Independent component analysis (ICA) has been widely used as a standard method to remove noises that are pervasive or systematically associated with EEG tasks (e.g., eye blinks, facial muscle artifacts, noisy electrodes). However, one of the assumptions of ICA (the number of components equals the number of EEG channels) is always violated in the application to EEG. Therefore, the practice of ICA-based EEG denoising suffers from the issues in dealing with many mixed ICs (i.e., ICs reflecting multiple source signals), which make it difficult to classify them into brain versus noise components.
FUNDING: Brain and Behavior Research Foundation, Young Investigator Award (25158).

1–003 | PERFORMANCE MONITORING AND ITS DEVELOPMENT – A COGNITIVE SYSTEMS APPROACH

Ty Lees, Zachary Fisher, Lisa Gatzke-Kopp
The Pennsylvania State University

Descriptors: Cognitive Development, Event-related Potentials, Dynamical Systems
Performance monitoring is comprised of several related but discrete processes that form a dynamic system that integrates externally provided and internally derived information to adjust behavior and facilitate learning. Historically, developmental performance monitoring research is limited and has examined individual components of the system in isolation. The little work investigating multiple components suggests that as children age performance monitoring capabilities transition from relying on external feedback to internal error models, and this change is mirrored in relevant ERP indices. However, this work does not consider how the development of these components may be interrelated. Recently, we observed that the associations among performance monitoring ERPs change across middle childhood and may indicate how these processes interact to support cognitive development. With these results in mind, we postulate that a systems perspective characterizing the within-person dynamics that underlie performance monitoring may be useful in imaging how these dynamics relate to development. Dynamical system models are one such approach, and can be used to not only describe and predict the interactions between multiple components of a phenomenon viewed as a system, but also examine how said components and the system evolve across time. Here, I will discuss the development of performance monitoring and the proposed cognitive systems approach, the implications of treating the system itself as a unit of development, and how this approach can be leveraged in developmental research.

1–004 | PERSONAL CHOICE SHIELDS AGAINST NOISE EFFECTS ON EFFORT-RELATED CARDIOVASCULAR RESPONSE

Johanna Falk[1], Guido Gendolla[1], Peter Gollwitzer[2,3,4], Gabriele Oettingen[2,5]
[1]*University of Geneva, [2]New York University, [3]University of Konstanz, [4]Leuphana University of Lueneburg, [5]University of Hamburg*

Descriptors: Cardiovascular Response, Effort, Action Shielding
Two experiments tested whether personal choice vs. external assignment of task characteristics moderates the effect of aversive noise stimulation effects on effort-related cardiovascular response. We expected strong action shielding and low receptivity for the noise stimulation when participants could choose themselves the stimulus color of (1) an easy memory task ($N = 124$)

and (2) an easy mental concentration task ($N = 112$). By contrast, when the stimulus color was assigned, we expected weak action shielding and high receptivity. Here, the noise stimulation should increase the subjective difficulty of the task, and consequently lead to more effort. We assessed effort-related cardiovascular reactivity during performance, and the response-pattern of cardiac pre-ejection period supported our hypothesis in both studies. Participants in the assigned condition showed stronger cardiac pre-ejection period reactivity when exposed to aversive noise stimulation than when executing the task in silence. These noise effects did not appear among participants who could choose the stimulus color. Thus, our results show that the simple act of choosing task characteristics leads to shielding against unpleasant noise effects on effort-relate cardiovascular response, whereas individuals remain receptive for noise stimulation during action execution when task characteristics are externally assigned.

1–005 | HYPERREACTIVITY AND IMPAIRED HABITUATION OF STARTLE AMPLITUDE DURING UNPLEASANT PICTURES IN BORDERLINE BUT NOT SCHIZOTYPAL PERSONALITY DISORDER: DEFICIENT INHIBITORY CONTROL?

Erin Hazlett[1,2], Kim Goldstein[1], M. Mehmet Haznedar[1,2], Marianne Goodman[1,2], Kalpana Kapil-Pair[1], Elen-Sarrah Dolgopolskaia[1]
[1]Icahn School of Medicine at Mount Sinai, [2]James J. Peters VA Medical Center

Descriptors: Emotion, Affect-Modulated Startle, Psychopathology
Borderline personality disorder (BPD) is characterized by deficient emotion regulation and inhibitory control: greater intensity of reactions to unpleasant emotional cues, and slower-than-normal return of these responses back to baseline once they are triggered. Habituation is defined as decreased response to repeated stimulation. This study examined habituation of affect-modulated startle (AMS) in BPD during emotional- and neutral-picture processing. The sample included BPD patients ($N = 35$), schizotypal personality disorder patients (SPD; $N = 26$; psychopathological-comparison group), and healthy controls (HC; $N = 29$). All participants received rigorous clinical assessments and patients were unmedicated. AMS was examined during a series of intermixed unpleasant, neutral, and pleasant pictures. Compared with the other groups, BPD patients showed greater overall AMS during unpleasant pictures and deficient habituation of startle-amplitude during unpleasant

pictures from early-to-later trials. The groups did not differ in AMS during neutral or pleasant pictures, or self-reported picture valence. In the BPD group, *poorer* habituation to unpleasant pictures was associated with *greater* symptom severity and suicidal/self-harming behavior. The results: indicate that abnormal processing of and habituation to unpleasant pictures is specific to BPD and not observed in SPD; are consistent with studies showing anomalous amygdala habituation to unpleasant pictures in BPD patients with a history of self-harming behavior; have important implications for clinical assessment and treatment of BPD.

1–006 | EXTERNALLY IMPOSED BALANCE ERRORS EVOKE AN ERN

Aiden Payne[1,2], Lena Ting[2], Greg Hajcak[1]
[1]Florida State University, [2]Emory University

Descriptors: ERN, balance
The error-related negativity (ERN) is a neural correlate of error monitoring, but lack of experimental control over errors can confound its measurement. Experimentally-controlled balance errors evoke a balance N1 potential resembling the ERN in scalp topography and moderating factors. We hypothesize that the balance N1 and ERN share underlying neural mechanisms. To test this hypothesis, we examined whether the balance N1 and ERN are associated across individuals. In 21 young adults (age 25 ± 5) and 20 older adults (age 70 ± 7), the balance N1 was evoked by sudden and unpredictable sliding movement of the floor while standing, and the ERN was evoked by errors committed by the hand (ERN-hand) or feet (ERN-foot) in two arrow flanker tasks. Data were band-pass filtered (1-25 Hz) and averaged within subjects across perturbations or error trials. The balance N1 was then measured 100-250 ms after perturbation, and the ERN was measured -50 to 100 ms around response entry, excluding individuals with <6 artifact-free error trials. Associations between ERPs were tested with Pearson's correlation coefficient at frontocentral sites. The balance N1 was positively correlated with both the ERN-hand and ERN-foot within each group; ERN-hand and ERN-foot were also positively correlated in both groups. The results suggest the balance N1 and ERN share mechanisms underlying individual differences. Balance perturbations may thus

1–008 | REDUCED ELECTROCORTICAL RESPONSES TO PLEASANT PICTURES IN DEPRESSION: A TIME-DOMAIN AND TIME-FREQUENCY DELTA ANALYSES

Carola Dell'Acqua[1,2], C.J. Brush[1], Kreshnik Burani[1], Nicholas Santopetro[1], Julia Klawohn[1,3], Simone Messerotti Benvenuti[2], Greg Hajcak[1]
[1]*Florida State University,* [2]*University of Padua,* [3]*MSB Medical School Berlin*

Descriptors: depression, time-frequency, approach motivation
The late positive potential (LPP) to pleasant content is an electrocortical indicator of blunted emotional reactivity in depression. Additional insight into emotional reactivity can be provided using time-frequency decomposition. The present study examined time-frequency delta in depression and investigated whether the combination of time-domain and time-frequency data would explain additional variance in the depression status. The study was a secondary analysis of data collected during a passive viewing task of pleasant and neutral pictures in a community-based sample of 75 participants with a current depressive disorder and 42 controls. A time-frequency analysis on event-related changes within delta frequency band was conducted. Cluster-based statistics revealed a centro-parietal increase in delta power to pleasant relative to neutral pictures in the control group but not within the depression group. Moreover, a fronto-centro-parietal reduction in delta power to pleasant pictures emerged in depression relative to controls. Both a smaller LPP and delta power to pleasant pictures were related to depression status. The combination of LPP and delta power explained a greater amount of variance compared to the model where LPP was entered as the only predictor of depression status. These data suggest that delta power might be a promising correlate of the hypo-activation of the approach motivational system in depression. A combination of these measures can be leveraged together to enhance clinical utility and to shed light on the underlying mechanisms associated with depression.

1–009 | ERROR-RELATED NEURAL ACTIVITY IN CHILDREN WITH OBSESSIVE–COMPULSIVE DISORDER: A TIME-FREQUENCY INVESTIGATION

Carola Dell'Acqua[1,2], Greg Hajcak[1], C.J. Brush[1], Nicholas Santopetro[1], Alexandria Meyer[1]
[1]*Florida State University,* [2]*University of Padua*

Descriptors: obsessive–compulsive disorder, time-frequency, error-related brain activity
Greater performance monitoring, widely examined with the error-related negativity (ERN), has been suggested as a biomarker of obsessive–compulsive disorder (OCD) in children. Greater theta power to errors is believed to reflect greater error processing. Additionally, recent investigations showed that decreased beta power following an error reflects motor preparation, while greater beta power following an error reflects motor inhibition. The present study examines time-frequency theta and beta power in pediatric OCD with a data-driven, cluster-based approach. The aim was to clarify the electrocortical mechanisms of performance monitoring in children with OCD ($n = 23$, 13 females, mean age $= 12.6 \pm 1.03$) and without OCD ($n = 26$, 14 females, mean age $= 12.3 \pm 1.10$) during an arrowhead version of the flanker task while electroencephalographic activity was recorded. Consistent with previous work, the OCD group showed greater theta power on error trials relative to controls. Additionally, the OCD group exhibited a reduced early fronto-central beta power decrease (i.e., greater power) following error trials relative to the control group. Overall, by examining separate time-frequency measures, the present study provided novel insight into the dynamics of performance monitoring in OCD -suggesting that OCD may be characterized by increased theta power to errors, as well as increased beta power following error trials.

1–012 | ATYPICAL APERIODIC AND PERIODIC NEURAL ACTIVITY IN PARKINSON'S DISEASE

Douglas Angus[1], Anna Finley[2], Nicholas Kelley[3], Ahmed Moustafa[1], James Cavanagh[4]

[1]Bond University, [2]University of Wisconsin, Madison, [3]University of Southampton, [4]University of New Mexico

Descriptors: Parkinson's Disease, Oscillations, Aperiodic
Parkinson's Disease (PD) has been associated with greater total power in canonical frequency bands (i.e., alpha, beta) of the resting electroencephalogram (EEG). However, PD has also been associated with a reduction in the proportion of total power across all frequency bands. This discrepancy may be caused by limited attention to aperiodic activity (1/f) present across all frequency bands. Aperiodic slope has been linked to the ratio of inhibitory to excitatory neural activity, and the aperiodic offset has been linked to the rate of neuronal spiking, both of which are relevant to PD. We examined differences in the resting EEG of PD participants ($N = 26$) and age-matched controls (CTL; $N = 26$). We extracted power from canonical frequency bands using traditional methods and also extracted separate parameters for periodic and aperiodic activity. Cluster-based permutation tests over spatial and frequency dimensions indicated that total alpha and beta power during eyes-open and eyes-closed recordings were greater in PD (vs. CTL) participants. Both the slope and the offset of aperiodic activity were greater for PD (vs. CTL) participants. After removing the aperiodic slope and offset, greater alpha power in PD (vs. CTL) was only present in eyes-open recordings and no reliable differences in beta power were observed. Differences between PD and CTLs in the resting EEG are likely driven by aperiodic activity, suggestive of greater relative inhibitory neural activity and greater neuronal spiking. These findings challenge models of PD that emphasise power in canonical frequency bands.

1–013 | RELATIONSHIP BETWEEN WITHIN-PERSON DIFFERENCES IN ERROR-RELATED NEGATIVITY AND ERROR POSITIVITY AND CORRECT-TRIAL RESPONSE-TIME MEANS AND VARIATIONS IN HEALTHY PARTICIPANTS

Miranda Lutz[1], Scott Baldwin[2], Ingmar Franken[1], Michael Larson[2], Peter Clayson[3]

[1]Erasmus University Rotterdam, [2]Brigham Young University, [3]University of South Florida

Descriptors: performance monitoring, event-related potentials, individual variability
The relationship between performance-monitoring ERPs and behaviors, including response times (RTs), is not straightforward and at times contradictory. This may be due to an overreliance on subject-average scores, obscuring within-person trial-by-trial changes in RTs. We used location-scale multilevel models to test whether the error-related negativity (ERN) and error positivity (Pe) components of the event-related potential (ERP) predict within-person means and variances in correct-trial RTs over and above current-trial congruency in 263 healthy participants who completed a modified Eriksen Flanker task. Predictors included current-trial congruency, previous-trial accuracy x previous-trial Pe, and previous-trial accuracy x previous-trial ERN with constituent main effects on the location (means) and scale (variances) portions of the model. The best-fitting model included congruency, previous-trial accuracy, previous-trial Pe, and the previous-trial accuracy x previous-trial Pe interaction for the location portion and congruency, previous-trial accuracy, previous-trial Pe, previous-trial ERN, and the previous-trial accuracy and previous-trial ERN interaction for the scale portion. Smaller previous-trial Pe was related to faster RTs, mainly for post-error trials. Smaller within-person variability in RTs was related to larger previous-trial Pe and ERN, primarily for error trials. Findings show that within-person changes in correct-trial RTs are related to within-person differences in ERN and Pe. Additionally, ERPs predicted changes in the mean and variability of RTs.

1–014 | A SYSTEMATIC REVIEW AND META-ANALYSIS ON THE ACUTE EFFECTS OF EXERCISE ON P3 AMPLITUDE AND LATENCY

Shih-Chun Kao[1], Feng-Tzu Chen[2], David Moreau[3], Eric Drollette[4], Steve Amireault[1], Chien-Heng Chu[5], Yu-Kai Chang[5]

[1]Purdue University, [2]China Medical University, [3]University of Auckland, [4]University of North Carolina, Greensboro, [5]National Taiwan Normal University

Descriptors: acute exercise, P3 amplitude, P3 latency
Although the acute exercise effect on behavioral cognitive performance is well-documented, a comprehensive evaluation on neural activities that support cognitive functioning following acute exercise is lacking. This systematic review meta-analytically examined the changes in P3 of even-related potential, a neuroelectric marker of neural inhibition underlying attention and executive function processes following a single bout of exercise. The analysis included 39 studies and examined acute exercise effects on P3 through its amplitude and latency, which are theorized to reflect attention allocation to and the processing speed for categorizing a stimulus. Findings from the analysis showed that exercise has small effects on increasing amplitude (Hedges' $g = 0.315$) and decreasing latency (Hedges' $g = 0.146$). The

amplitude effect was moderated by the type, intensity, and duration of exercise, with a smaller effect being observed for high-intensity than moderate-intensity exercise, for interval exercise than aerobic, resistance, and combined exercise, as well as for exercise lasting ≤10 min and 11–20 min than exercise lasting 21–30 min. The latency effect was moderated by the duration of exercise, with exercise lasting 11–20 min showing a smaller effect than exercise lasting ≤10 min. These results demonstrated that acute exercise enhances the allocation of attentional resources and processing speed needed to implement cognitive processes underlying goal-directed behavior. Further, these beneficial effects may be manipulated through prescribing exercise using specific parameters.

1–015 | THE IMPACT OF THREATENING CONTEXTS ON DEFENSIVE RESPONSES TO CONDITIONED FEAR STIMULI

Yannik Stegmann[1], Marta Andreatta[1,2], Matthias Wieser[2]
[1]University of Würzburg, [2]Erasmus University Rotterdam

Descriptors: threat, conditioning, context
Fear and anxiety are crucial for adaptive responding in life-threatening situations. Whereas fear is a phasic response to an acute threat accompanied by selective attention, anxiety is characterized by a sustained feeling of apprehension and hypervigilance during potential threat situations. Fear and anxiety are usually considered mutually exclusive, with distinct neural underpinnings. However, recent evidence challenges this distinction between fear and anxiety, and simultaneous activation of fear- and anxiety networks has been reported. Therefore, the current studies experimentally tested potential interactions between fear and anxiety. 104 healthy participants completed a fear conditioning paradigm followed by a test phase in which the conditioned stimuli were presented in front of either conditioned or inherently threatening or neutral contextual images. To capture defensive responses, we recorded subjective, physiological, and visuocortical activity to the conditioned stimuli as a function of contextual threat. Results demonstrated successful fear conditioning in all measures. In addition, threat and US-expectancy ratings, cardiac deceleration, and visuocortical activity were enhanced for fear cues presented in inherently threatening contexts, while conditioned threat contexts potentiated only subjective fear responses. These results are in line with an additive or interactive rather than an exclusive model of fear and anxiety, indicating facilitated defensive behavior to imminent danger in potential threat situations.

1–018 | FLOW EXPERIENCE MAY PARTLY ARISE DUE TO THE LOCUS COERULEUS NOREPINEPHRINE (LC-NE) SYSTEM BEING IN A MODE THAT SUPPORTS A STRONG TASK ENGAGEMENT

Hairong Lu[1], Dimitri Van der Linden[1], Arnold Bakker[1,2]
[1]Erasmus University Rotterdam, [2]University of Johannesburg

Descriptors: Flow experience, Locus coeruleus norepinephrine system, Task engagement
Flow is a state of full task immersion that has received considerable attention in the literature. During flow, people feel they are 'in the zone' or 'in the flow of things', which usually results in better task performance. Despite the large amount of research conducted on flow, relatively little is known about its neurocognitive underpinnings. Accordingly, the present study builds on the notion that the flow experience relates to the activity of the locus coeruleus- norepinephrine (LC-NE) system which provides feedback to extend the engagement in the current activity. In the experiment, we induced levels of subjective flow experience using n-back tasks with different levels of difficulty. During the tasks, continuous pupil diameter and EEG were recorded. We found that pupil dilation indexing phasic LC-NE activity showed a positive relationship with flow experience and showed an inverted U-shape with task difficulty. As a presumed alternative indicator of phasic LC-NE activity, EEG P3b showed an inverted U-shape relationship with task difficulty but showed no significant relationship with flow experience. We also found a positive relationship between task performance and flow experience. In conclusion, this study suggests that the flow experience may partly arise due to the LC-NE system being in a mode that supports a strong task engagement. FUNDING: China Scholarship Council.

1–019 | ALTERED BEHAVIOR AND ELECTROPHYSIOLOGY IN THE ULTIMATUM GAME IN INDIVIDUALS WITH ELEVATED DEPRESSIVE SYMPTOMS

Korbinian Riepl[1], John Allen[2], Johannes Rodrigues[1], Johannes Hewig[1]
[1]University of Würzburg, [2]The University of Arizona

Descriptors: Depression, Ultimatum Game, P3b
The ultimatum game is an important paradigm to study social bargaining behavior. In this paradigm, a proposer divides an amount of money (e.g., 10 Cents) between oneself and a responder. If the responder accepts the distribution,

both players get the money as proposed. If the responder rejects, neither of the players gets anything. While rational choice theory suggests that responders should accept all offers above 0, responders typically reject half of all unfair offers. After 8 trials as proposers in the ultimatum game, including a short mood assessment using happy, neutral, and sad smileys before each offer, the participants played 144 trials as responders. There, they saw a happy, neutral, or sad emotional face of the proposer before the offer in each trial. We recruited 100 participants (51 with low and 49 with high depressive symptoms). As proposers, participants with high depressiveness indicated less current happy mood and more current neutral and sad mood than healthy controls. Moreover, they offered less money (less 5 Cent and more 1 Cent offers out of a 10 Cent pot) than control participants. As responders, participants accepted more offers from happy, compared to neutral or sad proposers. Moreover, participants with high depressiveness showed a reduced P3b amplitude to the offers. This may be a neural marker of a reduced motivation to engage in the task. We will discuss our results in the light of other research that found behavioral and electrophysiological alterations depending on depressiveness, as well as state and trait affect in the ultimatum game.

1–020 | GENERALIZATION OF SAVORING TO NOVEL POSITIVE STIMULI: AN ERP INVESTIGATION

Kayla Wilson, Annmarie MacNamara
Texas A&M University

Descriptors: Savoring, Emotion Regulation, ERP
While initial work indicates that savoring is an effective means of upregulating positive emotion, its boundary conditions and the utility of savoring in everyday life are less clear. For example, if savoring generalized to similar, but previously unseen stimuli, this would suggest some level of automatization that might conserve resources and help to ensure higher levels of positive emotion irrespective of direct attempts to upregulate. Here, participants ($N = 84$; 54 female; $M = 18.93$, $SD = 1.87$) were presented with positive pictures (i.e., happy people or cute animals) and neutral pictures (i.e., plants). Participants were randomly assigned to savor people and view animals or vice versa, and to passively view plants. Subsequently, participants viewed previously unseen pictures from the same categories, without instructions to savor them. EEG and subjective ratings of picture valence and arousal were recorded during both tasks. During the first task, savoring increased the late positive potential (LPP) to positive pictures, $t(83) = 2.07$, $p = .041$, as well as subjective ratings

of picture pleasantness, $F(1, 164) = 211.69$, $p < .001$, and arousal, $F(1, 164) = 161.76$, $p < .001$. In the second task, savoring generalized to previously unseen pictures, resulting in larger LPPs, $t(42) = 3.81$, $p < .001$ and more pleasant, $t(42) = 5.00$, $p < .001$ and arousing, $t(42) = 4.20$, $p < .001$, picture ratings, but only for depictions of animals and not people. Therefore, savoring appears to generalize to previously unseen pictures, though effects may vary by picture category/content.

1–021 | MUSICAL TEMPO INFLUENCES LISTENERS' CARDIAC DYNAMICS

Shannon Wright[1], Caroline Palmer[1], Nick Greene[2], Steven Livingstone[2]
[1]McGill University, [2]University of Otago

Descriptors: Cardiac dynamics, Auditory perception, Tempo
Coupling of physiological activity with external rhythms often occurs in perception and action. We test whether the rate (tempo) of music influences physiological coupling during perception. Previous findings of musical tempo effects on cardiac rhythms were inconsistent, possibly due to individual differences in physiology as well as reliance on linear measures of cardiac activity. This study investigated effects of musical tempo on cardiac dynamics during perception with a focus on individual differences. Listeners' ($n = 13$) cardiac activity was recorded during a silent baseline and while they listened to slow tempo (70 bpm) and fast tempo (150 bpm) classical music excerpts. Listeners reported lower levels of felt arousal ratings following the slow tempo compared to the fast tempo condition. Heart rate variability was highest during the slow tempo condition. Tempo did not influence mean heart rate, but individual differences were observed during the slow tempo music: Listeners with slow baseline heart rates got slower and those with fast baseline heart rates got faster. Recurrence quantification analyses showed that cardiac activity became more predictable and changed more slowly during slow tempo music. In sum, individual differences in baseline cardiac behaviour are important to understand physiological coupling with musical tempo. Nonlinear analyses revealed additional influences of musical tempo on cardiac activity, demonstrating the importance of considering changes in physiological activity over time.

1–022 | BUDDHIST PHILOSOPHY

Shankar Biswas
Dhamma Sima Vihar, Andhra Pradesh

Descriptors: Nibbana, Buddhism, Four noble truths, Sense bases

The sense bases are eye (seeing), ear (hearing), nose (smelling), tongue (tasting), body (touching) and mind (thinking/feeling). The experience is felt as one of three tones are Pleasant, Unpleasant and Neutral. Buddhism describes what these sense bases are and how they work. These sense bases can be related to many of the philosophical and psychological teachings of the Buddha. One of the most important teachings of the Buddha is the Four Noble Truths. Buddhism explains that one who needs to attain Nirvana must understand and realize these Four Noble Truths. These noble truths have a direct connection with the sense bases. The ultimate goal of Buddhism is Nirvana. But there is no place or a special world called The Nirvana. This paper describes that the noble truths can be identified within one's own sense bases. The noble truth of suffering occurs within the functioning of the sense bases and the cause of suffering, "craving" operates inside the senses bases and the cessation of suffering. Relevant material will be drawn for this paper directly from the Pāli (language) canonical sources. The major finding is that the first three noble truths can be experienced through the six sense bases. The conclusion derived from the study is that the sense bases have direct relevance to Nirvana, which is not to be conceived as another place or another dimension, but phenomena that can be experienced through one's own sense bases, and that the other noble truths are also to be experienced in relation to one's own sense bases.

1–023 | A LONGITUDINAL STUDY OF THE EFFECTS OF SUBCONCUSSIVE IMPACTS ON ELECTROPHYSIOLOGICAL MEASURES OF AUDITORY WORKING MEMORY IN CONTACT AND COLLISON SPORTS ATHLETES

Matthew Wilson, Christopher Hill
Northern Illinois University

Descriptors: P300 response, Auditory, Concussion

Objective: The auditory P3b response, measured using an auditory n-back task of varying difficulty (0-, 1-, and 2-back), was investigated as an index of change in cognitive function resulting from exposure to subconcussive impacts (SCI) in contact/collision sports over a single season. Methods: Auditory P3b responses were examined in ten contact/collision sport athletes, e.g., football and soccer, and ten non-contact sport athletes at three different time points (pre-, mid-, and post-season) across two electrode regions of interest (central, parietal). Results: P3b amplitude in the central region under the 2-back condition was lower in SCI athletes compared to control during mid-season ($MD = -2.336$ microvolts, $p = 0.045$). However, pre- and post-season amplitude, did not differ between groups. Similarly, SCI athlete P3b amplitude in the parietal region decreased from pre- to post-season ($MD = 4.024$ microvolts, $p = 0.001$) and compared to control during the 2-back task. P3b latency was not significant different across groups or time in either region. Conclusions: Preliminary results suggest subtle alterations in cognitive abilities may progressively develop over a single season of SCI exposure, as measured by P3b response amplitude. Interpreted under the context of the concussions group going longer between mid- and post-season measurements the lack of a difference at post-season measurement suggests neurologic recovery may be present at the conclusion of the season. Future research should longitudinally investigate cognitive function with SCIs over the course of several years.

1–024 | RELATIONAL VICTIMIZATION PREDICTS DEVELOPMENTAL INCREASES IN ERROR-RELATED BRAIN ACTIVITY AND THEREBY INCREASES IN SOCIAL ANXIETY IN ADOLESCENT GIRLS ACROSS TWO YEARS

Sally Cole[1], Lushna Mehra[1], Enrique Cibrian[1], Elise Cummings[2], Brady Nelson[2], Greg Hajcak[1], Alexandria Meyer[1]
[1]Florida State University, [2]Stony Brook University

Descriptors: Error-related negativity, adolescents, social anxiety

The error-related negativity (ERN) is an event-related potential that is elicited following mistakes on lab-based reaction-time tasks. An elevated ERN amplitude has been observed in anxious individuals across the lifespan and has been shown to predict risk for future increases in anxiety. The ERN is sensitive to environmental influences early in development, including punitive parenting style and interpersonal stressors. We tested whether relational victimization (i.e., the extent to which peers purposefully attempt to harm adolescents' relationships with others) predicts increases

in the ERN and social anxiety symptoms across two years in a sample of 151 adolescent females (ages 8–15). Participants displayed a larger ERN at Time 2 than at baseline, $t(151) = 4.99$, $p < .001$, and the baseline ERN was positively related to the ERN two years later, $r(150) = .40$, $p < .001$. Increased relational victimization at baseline predicted increases in the ERN two years later, controlling for baseline ERN, $t = -2.16$, $\beta = -.16$, standard error $= .12$, $p = .03$. Furthermore, relational victimization at baseline predicted increases in social anxiety, $t = -3.02$, unstandardized $\beta = -.04$, standard error $= .01$, $p < .01$, and this relationship was mediated by increases in the ERN, unstandardized $\beta = -.01$, standard error $= .003$, 95% confidence interval: $-.01$ to $-.0003$. These results suggest that relational victimization impacts the developmental trajectory of the neural response to errors and thereby impacts increases in social anxiety among adolescents.

1–025 | PARENT REPORT OF CHILD CONCERN OVER MAKING MISTAKES RELATES TO CHILD ERROR-RELATED NEGATIVITY

Isaac Mirzadegan, Lyndsey Chong, Karl Wissemann, Lushna Mehra, Alexandria Meyer
Florida State University

Descriptors: error-related negativity, error sensitivity, children
The error-related negativity (ERN) has been theorized to reflect a general error-detection system. In addition, the ERN has been associated with disorders of *anxious apprehension*, or disorders characterized by increased performance concerns (e.g., generalized anxiety disorder, social anxiety disorder, obsessive–compulsive disorder). Individual differences in the ERN have also been related to the degree to which a person finds making mistakes to be aversive or threatening (i.e., "error sensitivity"). One previous study demonstrated that both child- and parent-reported child error sensitivity were associated with a larger child ERN in 5-7-year-old children. In the present study, we sought to replicate this finding in older children. In a group of 6-to-9-year-old children ($n = 50$), we measured child ERN using a Go/No-Go task and collected parent and child report of children's error sensitivity, using the validated Child Error Sensitivity Index (Chong & Meyer, 2019). In contrast to previous findings, child-reported error sensitivity did not relate to the ERN, $r(48) = -.03$, $p = .43$. However, consistent with previous findings, parent-reported child error sensitivity was negatively associated with child ERN, $r(48) = -.27$, $p < .05$, such that children higher in error sensitivity had a larger ERN. Findings support the relation between error sensitivity and neural activity in response to errors. Future work should examine how other indices of error sensitivity (e.g., observational lab-based measures, behavioral measures, naturalistic observations) relate to the ERN.

1–026 | HEBB CAUGHT MY EYE: PUPIL DILATION AS AN INDEX OF SEQUENCE LEARNING

Alessandro Pozzi, Sacha-Michelle Dubois-Sénéchal, Marlène Bolduc, Hélèna St-Cyr, François Vachon
Université Laval

Descriptors: Hebb effect, Sequence learning, Pupillometry
Speech, navigation, and other everyday activities require the learning and execution of sequence of information. Sequence learning can be studied through the Hebb repetition effect: the improved serial recall for a repeated sequence of items relative to random sequences. Hitherto, the examination of the Hebb effect has been restricted to the behavioural domain. The present study seeks to determine whether this phenomenon can also be captured at the physiological level. Hence, we explored pupillometry—a valid index of cognitive load—as a potential proxy of "Hebbian" learning. Since learning is associated with a reduction in the cognitive resources needed to process the learned material, we hypothesized that the learning induced by the repetition of a sequence could be indexed by a gradual decrease in pupil size. To do so, subjects completed an auditory serial recall task of 8-digit lists, one of which was repeated every 3 trials (for a total of 16 repetitions). Variations in pupil diameter were recorded during both the encoding phase (Experiment 1) and the retention phase (Experiment 2). Results of both experiments show a significant decrease in pupil size during the first seconds of the retention phase for the repeated sequence compared to random sequences. These results suggest that pupil dilation can reflect the learning of a sequence, paving the way to novel means to enhance our understanding of the Hebb effect and other sequence learning phenomena.

1–027 | VAGALLY-MEDIATED HEART RATE VARIABILITY IS ASSOCIATED WITH STRESSFUL LIFE EVENTS BUT NOT SELF-PERCEIVED STRESS IN A PREDOMINANTLY HISPANIC SAMPLE OF FEMALE COLLEGE STUDENTS

Grant Benham, Jordan Kenemore, Juliana Chavez, Samantha Garcia, Marco Fuentes, Natali Tamez
The University of Texas Rio Grande Valley

Descriptors: Chronic stress, Heart rate variability
Low heart rate variability (HRV) is associated with increased risk for diabetes, cardiovascular disease, and early death. Although the impact of chronic stress on physical health is well established, findings on the association between stress and HRV are mixed, potentially due to the variety of measures used. We examined the relationship of vagally-mediated HRV with two self-report stress measures: self-perceived stress and past-month stressful life events. Forty female undergraduates (18-24 yrs, 95% Hispanic) completed a survey and 3-minute ECG recording while seated quietly, breathing spontaneously. ECG was recorded on a Biopac system and analyzed using Kubios HRV software. To assess vagal activity indexed by heart function, RMSSD (square root of the mean squared differences of successive R-R intervals) and HfHRV (high frequency .15–.4 Hz, based on spectral analysis) values were calculated. Data from two participants were excluded due to poor/missing ECG. HRV values were log-transformed. Partial correlations, controlling for age, revealed a significant negative correlation between HRV and life-events stress (RMSSD, $r(35) = -.35$, p = .016; HfHRV $r(35) = -.33$, p = .025), but not self-perceived stress (RMSSD, $r(35) = -.14$, p > .05; HfHRV $r(35) = -.09$, p > .05). Our findings suggest that the association between vagally-mediated HRV and self-reported measures of chronic stress may depend on the manner in which stress is assessed. Such knowledge may be important in the development of future research, either as a variable to be controlled for or a variable of interest.

1–028 | BIOPHYSICAL DYNAMICS OF THE STOP-SIGNAL P3 DURING ACTION-STOPPING

Darcy Diesburg[1,2], Jan Wessel[1], Stephanie Jones[2,3]
[1]*University of Iowa,* [2]*Brown University,* [3]*Providence VA Medical Center*

Descriptors: Motor inhibition, P3, Biophysical computational modeling
The horse race model of motor inhibition is a theoretical account of inhibitory control in the stop-signal task (SST). It suggests that action-stopping results from a race between a go- and stop-process, with successful stops resulting from a faster stop-process or slower go-process. Although the EEG-measured frontocentral-P3 (FC-P3) has been linked to motor inhibition in the SST, investigating whether its mechanisms align with the race model is challenging due to complex dynamics that underlie evoked cortical activity. Human Neocortical Neurosolver (HNN), a biophysical model of canonical neocortical columns, can be used to probe circuit mechanisms of the FC-P3 event-related potential (ERP). We postulate that neural mechanisms of a stop process should onset *earlier* in successful vs. failed stops but otherwise not differ in canonical network dynamics underlying ERP generation. We generated FC-P3 ERPs from 234 SST EEG datasets and fit HNN models during successful and failed stops. The models predict the P3 is generated by excitatory thalamic/cortical drives to proximal pyramidal dendrites at ~305 ms. Consistent with our hypothesis, the differences in observed P3 onset in successful vs. failed stop conditions can be reproduced by drive arriving ~20 ms *earlier* in successful stops, with the strength of the drive unchanged across conditions. These results suggest a race model account of the FC-P3 aligns with cortical dynamics during action-stopping. Moreover, biophysical models of cortex can help interrogate theoretical accounts of ERPs as they relate to underlying neural mechanisms.

1–029 | INDIVIDUAL DIFFERENCES IN LPP AMPLITUDE AND THETA POWER PREDICT CUE-INDUCED EATING BEHAVIOR

Kyla Gibney[1,2], George Kypriotakis[2], Francesco Versace[1,2]
[1]*MD Anderson Cancer Center UTHealth Graduate School of Biomedical Sciences,* [2]*The University of Texas MD Anderson Cancer Center*

Descriptors: cue-induced behavior, individual differences, incentive salience
Individual differences in the tendency to attribute incentive salience to cues—as measured by the late positive potential (LPP)—predict cue-induced eating. Although cognitive control mechanisms are also known to regulate eating, we have yet to monitor the engagement of cognitive control systems in tandem with the LPP. We recorded electroencephalogram (EEG) from 59 adults while they

viewed emotional & food-related images that preceded the delivery of food rewards (candies) or nonfood objects (beads). We measured the amplitude of the LPP in response to the images as a measure of incentive salience, and we monitored theta power after the candy or bead was dispensed to the participant as a metric of the engagement of cognitive control. We found that individuals with larger LPP responses to food cues than to pleasant images (C > P group) ate significantly more during the experiment than did those with the opposite response pattern (P > C group, p < 0.001). We also found that individuals with higher theta power after dispensation of the candy than of the bead (CA > BE) ate significantly more than did those with the opposite response pattern (BE > CA, p < 0.001). These findings suggest that individual differences in both affective and cognitive processing may underlie vulnerability to excessive eating behavior, thereby underscoring the importance of individualized treatments for maladaptive behaviors.

1–030 | HOW YOUR SPEECH RESPONDS TO STRESS: THE VALIDATION OF ACOUSTIC, PROSODIC, AND SEMANTIC SPEECH FEATURES IN A MULTI-PARADIGM STRESS-INDUCTION TASK

Mitchel Kappen[1,2], Jonas Van Der Donckt[2], Gert Vanhollebeke[1,2], Sofie Van Hoecke[2], Marie-Anne Vanderhasselt[1,2]
[1]Ghent University, University Hospital Ghent (UZ Ghent), [2]Ghent University

Descriptors: Psychosocial Stress, Speech, Ambulatory Psychophysiology
The use of speech as an ambulatory psychophysiological measure to detect stress levels is increasingly gaining attention since it is cheap, scalable, and non-intrusive. In the current study, we collected semi-spontaneous speech (i.e., via picture-describe task) from subjects who participated in two distinct stress paradigms including control conditions (i.e., Cyberball & MIST) on two separate days. We conclude a successful stress induction using multiple psychophysiological measures (cardiac and electrodermal responses), enabling us to directly study the effects of stress and physiological reactivity on acoustic, prosodic, and semantic speech features. We consistently found, corresponding to earlier findings, increases in pitch (Fundamental Frequency; F0) after the stress condition. Moreover, we found increases in jitter (frequency variation), shimmer (amplitude variation), and speaking rate after the stress condition, which was not detectable in earlier read-out-loud paradigms. In addition, we found that these effects return to baseline levels after a 10-minute recovery period, correlating to our physiological measures. Our results show that speech 1) is a promising biomarker for stress measurements, 2) has a high temporal resolution as a stress measurement tool, and 3) would be an important addition to ambulatory psychophysiological research. By inducing stress using two distinct paradigms on two different days, we ensure that our results are related to the experience of (psychosocial) stress in general, rather than the induction method specifically.

1–031 | PROSPECTIVE AND SPECIFIC PREDICTION OF SYMPTOMS OF DEPRESSION AND ANXIETY: UNDERSTANDING THE UTILITY OF THE ERROR-RELATED NEGATIVITY AND REWARD POSITIVITY AS MARKERS OF RISK

Lidia Panier, Juhyun Park, Anna Weinberg
McGill University

Descriptors: Internalizing symptoms, RewP, ERN
A blunted Reward Positivity (RewP) and heightened Error-Related Negativity (ERN) have been associated with depression and anxiety, respectively. These associations have been observed both cross-sectionally and prospectively; however, anxiety and depression are strongly associated with one another, and the specificity with which the RewP and the ERN can prospectively predict symptoms is not clear. In this study, we collected EEG data from 49 undergraduate students at a baseline visit (T1), using the Doors and Flanker Tasks to elicit the RewP and the ERN respectively. Participants also completed the IDAS-II at T1, and again one academic year later (T2). Symptoms of anxiety and depression were strongly correlated with one another at both T1 and T2. We found that the RewP predicted symptoms of depression at T2 over and above the ERN, even adjusting for symptoms of depression at T1, such that a blunted RewP at baseline predicted higher depressive symptoms a year later. Neither ERP was significantly associated with anxiety at T2 after adjusting for anxiety at T1. These findings replicate previous work showing the RewP prospectively predicted increases in depression, and further suggest the specificity of this association. Results support the utility of the RewP as a neurophysiological marker that can help to understand the etiology

of depression and inform treatment planning. Future studies should also consider examining the associations of the RewP with specific facets of depression to identify which facets drive this association.

1–032 | AUTONOMIC SYSTEM FUNCTION AND MALTREATMENT HISTORY AMONG MEN IN THERAPY FOR ERECTILE DYSFUNCTION

Olivia Roath[1], Karoline Bischof[2], Adrian Stumm[2], Ben Kneubühler[2], Annette Bischof-Campbell[2], Luisa Guscetti[2], Gregory Lewis[1], Jacek Kolacz[1,3]
[1]Indiana University, [2]Zurich Institute for Clinical Sexology and Sexual Therapy, [3]The Ohio State University Wexner Medical Center

Descriptors: Autonomic Nervous System, Sexual Psychophysiology, Traumatic Stress
Trauma history is linked with both sexual dysfunction and altered autonomic nervous system (ANS) function. Because sexual response relies on coordination of the ANS, a system compromised by traumatic stress may lead to impaired response, providing a mechanism for the connection between trauma and sexual dysfunction. This study uses heart rate variability and self-report to compare ANS function, maltreatment history, and erectile function in a clinical sample seeking help for erectile dysfunction (ED). Male clients at a sex therapy clinic ($n = 24$, 28–64 yrs) completed the Childhood Trauma Questionnaire and International Index of Erectile Function. The Polar H10 heart rate monitor was used to collect cardiac interbeat intervals during a sit/stand posture shift task. ECG derived variables used in analysis were heart period, respiratory sinus arrhythmia (RSA), and vagal efficiency (VE). Maltreatment history was associated with smaller shifts in RSA during posture changes ($p = 0.04$, $d = 0.94$) and lower erectile function was associated with lower VE ($p = 0.02$, $d = -0.99$). Sensitivity analyses did not suggest that client age or medication use could explain these results. Findings illustrate how clients with maltreatment history and more severe erectile dysfunction may demonstrate compromised autonomic systems with dampened ability to adapt to state shifts. This support for a physiological connection between traumatic stress and erectile dysfunction provides a potential physiological target during treatment for erectile dysfunction.

1–033 | POSITIVE EMOTION UPREGULATION IS RESISTANT TO CONCURRENT WORKING MEMORY LOAD: AN EVENT-RELATED POTENTIAL STUDY OF REAPPRAISAL AND SAVORING

Yuhan Cheng[1], Blaine Peters[1], Annmarie MacNamara[1,2]
[1]Texas A&M University, [2]Texas A&M Institute for Neuroscience

Descriptors: ERP, Emotion Regulation, Working Memory Load
Positive emotion upregulation has been understudied, particularly when it comes to investigation of the factors that may modulate its success. In the lab, reappraisal and savoring have been shown to increase the late positive potential (LPP) and subjective ratings of pictures. Nonetheless, in the real world, ongoing cognitive demands are higher and might serve as a source of distraction, diverting processing resources away from and compromising upregulation success. Here, 76 participants (44 females; M age = 18.86 years, SD = 1.21) used savoring or reappraisal to upregulate their response to positive pictures that were interspersed with high- (6 letter) or low- (2 letter) working memory (WM) load trials. Results showed that high levels of WM load reduced the LPP, $F(1,74) = 4.01$, $p = .05$, $\eta_p^2 = .05$, while both reappraisal and savoring increased the LPP, $F(1,74) = 7.72$, $p = .007$, $\eta_p^2 = .09$. Critically, WM load did not impede the effect of positive emotion upregulation on the LPP (BF$_{10}$ = .18). In addition, WM performance on high-load trials was worse when participants were engaged in reappraisal versus passive picture viewing, $F(1,74) = 6.133$, $p = .02$, $\eta_p^2 = .08$. Therefore, reappraisal and savoring are resistant to the effect of concurrent WM load, though reappraisal may compete for shared resources – and interfere – with WM performance. Results suggest that upregulation of positive emotion via reappraisal and savoring may translate well to the real-world, where cognitive demands and distraction are likely higher than in the lab.

1–034 | CHOOSING TASK CHARACTERISTICS SHIELDS AGAINST INCIDENTAL AFFECTIVE INFLUENCES: EVIDENCE FROM EFFORT-RELATED CARDIOVASCULAR RESPONSE

Johanna Falk[1], Guido Gendolla[1], Peter Gollwitzer[2,3,4], Gabriele Oettingen[2,5]
[1]University of Geneva, [2]New York University, [3]University of Konstanz, [4]Leuphana University of Lueneburg, [5]University of Hamburg

Descriptors: Cardiovascular Response, Effort, Action Shielding
We investigated whether engaging in action by personal choice vs. external assignment of task characteristics

moderates the effect of incidental affective stimulation on effort ($N = 117$). Choice has been found to lead to an implemental mindset and should thereby shield action execution against affective influences, whereas external assignment should lead to integrating affect-related information into demand-related judgements. Thus, we expected low effort when exposed to happy music, and higher effort when exposed to sad music when the stimulus color was assigned. By contrast, when participants could choose the color themselves, we expected low effort independent of the happy or sad music presentation. We assessed effort-related cardiovascular reactivity during performance, and the response-pattern of cardiac pre-ejection period supported our hypothesis. Effort was higher in the Assigned Color/Sad Music condition than in the other three conditions. Thus, choice of task characteristics indeed shielded action execution, whereas participants remained receptive for affective influences when task characteristics were assigned.

1–035 | ELECTROPHYSIOLOGICAL MECHANISMS UNDERLYING GENERALIZATION LEARNING IN MISOPHONIA

Richard Ward, Faith Gilbert, Payton Chiasson, Jourdan Pouliot, Skylar McIlvanie, Caitlin Traiser, Kierstin Riels, Ryan Mears, Andreas Keil
University of Florida

Descriptors: Generalization Learning, Misophonia, Attention
Individuals with Misophonia experience adverse emotional reactions to "triggering" auditory stimuli produced by another individual. Although theories propose an etiological role of Pavlovian conditioning in Misophonia, no research has formally addressed this question. Using an aversive generalization task, we investigated the electrophysiological mechanisms underlying generalization learning in Misophonia. Participants ($n = 39$) completed an auditory aversive generalization task consisting of an auditory tone presented at three different pitches (i.e., CS+, GS1, GS2) over habituation and acquisition phases. During the acquisition phase, one pitch was associated with an aversive white noise blast, serving as a CS+. We measured auditory-steady state responses (ASSRs) and behavioral ratings of valence and arousal to each pitch, and examined the response distribution across the generalization gradient. Behaviorally, participants rated the CS+ as more unpleasant and arousing compared to the other pitches. ASSR's demonstrated an inverted "V" distribution across the generalization gradient, with the CS+ having significantly reduced power compared to the

GS1, and the GS cues having similar power. This shifted response pattern was observed across participants, and was not associated with self-reported Misophonia symptomology. These preliminary outcomes imply individuals may focus on cues representing boundaries between safety and threat. Furthermore, these findings suggest generalization learning may not be a critical etiological mechanism of Misophonia.

1–036 | UNEXPECTED RELIEF: LIKELIHOOD MODULATES THE REWP ELICITED BY THE ABSENCE OF AVERSIVE OUTCOMES

Elizabeth Bauer, Annmarie MacNamara
Texas A&M University

Descriptors: reward positivity (RewP), expectancy, event-related potential (ERP)
The reward positivity (RewP) is an ERP component thought to reflect reward prediction errors. In support of this theory, prior work has manipulated the expectancy of appetitive outcomes (e.g., winning money) to show that the RewP is larger for rewards compared to losses and for unexpected compared to expected outcomes. In addition, the RewP can be elicited by the absence of aversive outcomes (e.g., shock), in line with the notion that it is a reward rather than a salience signal. Nonetheless, in the limited work to-date that has conceptualized reward as the absence of an aversive outcome, results have been inconclusive regarding whether the RewP is further enhanced when an aversive outcome is expected, but is not delivered. Here, we examined the RewP to feedback indicating unexpected and expected outcomes in a threat-of-shock doors task. Participants ($N = 80$; 49 female; age $M = 18.95$ years, $SD = 1.90$) viewed a pair of doors surrounded by a red or green border. Shock delivery was expected (80%) following selection of doors on red-bordered trials and unexpected (20%) on green-bordered trials. We used temporospatial principal components analysis to isolate the RewP, finding that it was increased for no shock versus shock feedback, $F(1, 79) = 39.72$, $p < .001$, and for unexpected versus expected feedback, $F(1, 79) = 22.19$, $p < .001$. Results are consistent with a reward prediction error account of the RewP, indicating that it is larger for better than expected outcomes, even when reward is operationalized as the absence of an aversive event.

1–037 | THE ERROR-RELATED NEGATIVITY AND STARTLE REFLEX TO PREDICTABLE AND UNPREDICTABLE THREAT

Rachel Ferry, Brady Nelson
Stony Brook University

Descriptors: Unpredictability, Threat, Error
The error-related negativity (ERN) and startle reflex are two psychophysiological measures that are enhanced in the context of punishment and threat. The predictability of threat is an important characteristic that has been shown to impact the magnitude of threat responding, but this has largely been examined using exogenous (e.g., electric shock) and not endogenous (e.g., errors) threat. Moreover, it is unclear whether these two psychophysiological responses reflect domain-general or domain-specific threat system activation. In a sample of 18- to 35-year-old adults, the present study examined the startle reflex during the no, predictable, and unpredictable threat (NPU-threat) task using electric shocks and the ERN during three flanker tasks in which errors were not punished, predictably punished, or unpredictability punished with an aversive scream. Both the startle reflex and the ERN were enhanced due to predictable and unpredictable threat relative to no threat. The startle reflex and ERN were not correlated in the absence of threat. However, startle potentiation and ERN enhancement to threat were positively correlated within each predictability condition. The present study suggests that both exogenous and endogenous threat elicit domain-general threat system activation, even amongst psychophysiological measures that do not demonstrate an association in the absence of threat.

1–038 | PATERNAL SOCIAL ANXIETY MODERATES THE ASSOCIATION BETWEEN PARASYMPATHETIC REGULATION AT AGES 3 AND 5 AMONG MALE PRESCHOOLERS

Sarah Peoples, Rebecca Brooker
Texas A&M University

Descriptors: paternal anxiety, child regulation, RSA suppression
It is well known that the emotional context created by maternal characteristics dynamically influences children's regulatory capacities across development; however, less is known with regards to fathers. Modulation of parasympathetic activity represents an early regulatory capacity which children employ regularly and may be indexed by Respiratory Sinus Arrhythmia (RSA), or the relative decrease in RSA between baseline and threat-eliciting tasks (i.e., suppression). Increased RSA suppression has been most consistently implicated in more effective emotion regulation, while decreased RSA suppression may predict later development of anxiety-related disorders. The current study explored the moderating role of paternal social anxiety (Social Interaction Anxiety Scale) when predicting the development of RSA suppression (baseline minus Go-no-Go) from ages 3 to 5 in both male ($n = 46$) and female ($n = 64$) pre-schoolers. Among male children only, RSA suppression at age 3 positively predicted RSA suppression at age 5 when paternal social anxiety *decreased* across these ages, $B = .711$, $SE(B) = .163$, 95% CI [.325, 1.10], $p = .003$, and negatively predicted RSA suppression at age 5 when paternal social anxiety *increased* across these ages, $B = -1.102$, $SE(B) = .329$, 95% CI [-1.88, $-.323$], $p = .012$. These results suggest that *increasing* levels of paternal social anxiety across early childhood may uniquely moderate the development of vagal flexibility among male offspring from ages 3 to 5, such that male children exhibit *decreasing* parasympathetic regulation in the context of internal threat.

1–039 | MODELING TRAIT EFFECTS ON THE RELATIONSHIP BETWEEN NEURAL PROCESSING AND RESPONSE TIMES ON A FLANKER TASK IN NEUROTYPICAL ADULTS

Susan Mingils[1], Patricia Davies[1], Mei-Heng Lin[2], William Gavin[1]
[1]Colorado State University, [2]Rutgers University

Descriptors: path analysis, flanker task, individual differences
Previous studies support the feasibility of path analysis to examine brain-behavior relationships. This study investigated the relationship between stimulus-related neural processing and behavioral response times (RT) and whether the relationships differed between correct and incorrect responses in adults. This study also examined the effects of trait variables on successive ERP components and RT. Participants included 60 neurotypical 18–22-year-old adults who performed a speeded flanker task on two separate visits 6–21 days apart. The baseline-to-peak amplitude of N1, P2, N2, and P3 and RTs for correct and incorrect responses were calculated. Four manifest path models (N1-> P2-> N2-> P3-> RTs) were conducted separately for correct and incorrect trials for each of the two visits while controlling for traits

(age and sex). Model fit indices showed excellent to acceptable model fit, but the model for incorrect responses at session 1 had the best model fit (RMSEA = 0.00, SRMR = 0.01, CFI = 1.00, TLI = 1.16). However, only the model for correct trials at session 1 showed P3 significantly predicting RT ($\beta = -0.57$, $p < 0.001$). Age effects were mixed across the models. Sex significantly predicted P2 for both correct and incorrect trials at session 1, but only correct trials at session 2. Sex significantly predicted RT for all four models, with females having slower RTs overall. This study shows path analysis successfully reveals interrelationships within a neural processing stream and demonstrates the importance of controlling for trait variables when examining brain-behavior relationships.

1–040 | UNFOLDING THE NEGATIVE EXPECTANCY BIAS IN SOCIAL ANXIETY: A NEUROCOMPUTATIONAL ASSESSMENT OF SOCIAL FEEDBACK-BASED LEARNING

Elise Kortink, Ili Ma, Selin Topel, Melle van der Molen
Leiden University

Descriptors: Social Anxiety, Neurocomputational modelling, Frontal midline theta
Learning from social feedback and using this information to adapt one's expectations about future appraisals from others is crucial for well-being and healthy relationships. Given the negative expectancy bias in social anxiety (SA), such learning processes could affect the development and maintenance of SA symptoms. However, the neurocomputational processes underlying biased social learning remain unclear. Increased knowledge of these processes could aid advancement of prevention and treatment of SA. Therefore, we developed the Social Evaluative Learning through Feedback (SELF)–Profile paradigm. In this task, 175 healthy young adults (aged 18–25) created their own social-media profile, consisting of 60 personal statements and a profile picture. Participants were told that four self-selected peers had allegedly evaluated their profile and had indicated for each of the participant's statements whether they liked/disliked them. Participants predicted on a trial-to-trial basis whether each peer had indicated to like/dislike them for every statement. Unbeknownst to the participants, the peers differed in their probability of giving positive feedback (i.e., 85%, 70%, 30%, 15%). Simultaneously, we recorded EEG to examine frontal-midline (FM) theta responsivity to social-evaluative prediction-errors. Here,

we present results of computational modeling analyses of the trial-to-trial changes in social feedback predictions. Furthermore, we tested whether FM-theta power constitutes a neurocomputational index of biased social learning in SA.

1–042 | NEURAL MECHANISMS OF FEAR LEARNING PROCESSES IN PATIENTS WITH DIFFERENT ANXIETY DISORDERS

Franziska Kausche, Hannes Carsten, Kai Haerpfer, Anja Riesel
University of Hamburg

Descriptors: Fear conditioning, Anxiety disorders, EEG
Learning to fear certain situations and generalizing this fear to similar situations is highly adaptive and helps to avoid future harm. However, fear overgeneralization can lead to excessive anxiety and avoidance as seen in anxiety patients. In the present study, we investigated the underlying mechanisms in 160 participants and whether they differ between different anxiety disorders (each n = 40: healthy controls (HC), obsessive–compulsive disorder (OCD), social phobia (SocP), and specific phobia (SP)). Participants underwent a fear conditioning paradigm with three phases: fear learning, generalization and extinction, while we measured electroencephalography. The main outcome was the late positive potential (LPP) to the conditioned stimuli. Results support successful fear learning in all participants (differential LPP to CS+ vs CS-). In addition, anxiety patients showed increased LPPs of the CS+. During fear generalization, there were differences in LPP amplitudes to generalization stimuli between patients. Compared to HC, OCD showed decreased fear generalization, whereas SocP and SP showed increased fear generalization. During fear extinction learning, OCD and SocP seem to be limited in inhibiting their fear response (increased LPP). In addition, we will explore associations to specific symptom dimensions. Overall, results suggest that LPP is a useful marker for tracking fear learning processes. Moreover, fear learning appears to be enhanced in anxiety patients, although different anxiety disorders appear to differ in the observed changes in generalization and extinction.

1–043 | THE DIFFERENTIAL INFLUENCE OF POSITIVE AND NEGATIVE HEALTH FACTORS ON THE PREADOLESCENT BRAIN

Nicole Logan[1,2], Nicole Occidental[1], Jennifer Watrous[1], Lauren Raine[1], Arthur Kramer[1,3], Charles Hillman[1]
[1]Northeastern University, [2]University of Rhode Island, [3]University of Illinois, Urbana-Champaign

Descriptors: mental wellbeing, exercise, childhood obesity
This study examined the influence of adiposity and mental wellbeing on the preadolescent brain's response to acute exercise. In a sample of 58 children (ages 8–10; 19 females), demographic measures of age, sex, IQ, and socioeconomic status were considered. Children participated in a randomized crossover trial completing two different interventions: seated rest and moderate-intensity treadmill walking. Associations between adiposity, cardiorespiratory fitness, and self-reported mental wellbeing were assessed on neurocognitive performance of a Go/NoGo task. Regardless of intervention, higher adiposity was associated with higher trait-anxiety ($p \leq 0.001$) and disordered eating ($p \leq 0.05$), however, higher fitness was associated with lower depression scores ($p = 0.02$). Following rest, children with higher adiposity showed associations with neurocognitive performance (increased accuracy, lower SD-RT, increased P3 amplitude, decreased P3 latency; p's ≤ 0.05); an effect not found after the exercise intervention (p's > 0.05). In contrast, following exercise, children with higher fitness showed associations with behavioral performance on the Go/NoGo task (increased accuracy, lower SD-RT; p's ≤ 0.05); an effect not found after rest (p's > 0.05). Lastly, trait-anxiety increased with higher adiposity, and mediated poorer neuroelectric performance (decreased P3 amplitude) on the NoGo task after exercise (95%CI = -0.43, -0.11). As rates of childhood obesity, anxiety, and physical inactivity continue to increase worldwide, these results have implications for the mental health and wellness of children.

1–044 | SOME DON'T LIKE IT HOT: GENITAL AND SUBJECTIVE SEXUAL AROUSAL IN RESPONSE TO COPULATORY MOVEMENTS OF VARIOUS ANIMAL SPECIES

Ondřej Novák, Lucie Krejčová, Martin Hůla, Kateřina Potyszová, Klára Bártová
Charles University

Descriptors: Sexual Arousal, Vaginal Photopletysmograph, Penile Plethysmograph
Research have repeatedly showed sex differences in genital and subjective arousal in response to erotic video. Men's genital reactions are category-specific while women's are category non-specific. For man, the most important features eliciting arousal may be cues relating to the preferred sex of actors, whereas for women the crucial cue may be activities and movements connected with a sexual context, i.e. copulatory movements (CM). If so, women should react to stimuli depicting not only non-preferred sex but also other animal species. The aim of the study is to test level of the sexual arousal in response to the copulatory movements in nonhuman animals of various phylogenetic distance from humans. Genital responses were assessed using vaginal and penile plethysmography. A group of 42 heterosexual participants (21 women, mean age = 27.59) was presented with eleven 1-minute mute videos showing penetrative sexual intercourse in animal pairs of the same species (humans, bonobos, lions, rabbits, lizards etc.). Analysis revealed the main effect of stimulus type ($p < .001$, $\omega^2 = 0.35$). The largest responses were for human stimuli (both heterosexual and lesbian) differing from the animal ones. Animal stimuli were indistinguishable from each other ($p = 1$) eliciting almost no genital response. There was no difference in genital responses between men and women ($p = 1$). For subjective arousal, similar results were obtained. So far, the results suggest that CM displayed in non-human species is not a sufficient sexual cue for eliciting genital as well as subjective sexual arousal.

1–047 | THE EFFECT OF CEREBELLAR TMS ON ERROR PROCESSING: A COMBINED SINGLE-PULS TMS AND ERP STUDY

Adam Berlijn[1,2,3], Dana Huvermann[1,2,4], Stefan Groiss[1,2], Manfred Mittelstaedt[1], Alfons Schnitzler[1,2], Christian Bellebaum[1], Dagmar Timmann[4], Martina Minnerop[1,2,3], Jutta Peterburs[1,5]
[1]Heinrich-Heine-University Düsseldorf, [2]University Hospital Düsseldorf, [3]Research Center Jülich, [4]University Hospital Essen, [5]Medical School Hamburg

Descriptors: error processing, cerebellum, TMS
The goal of this study was to investigate temporal aspects of cerebellar contributions to the processing of performance errors. Error processing is at the heart of performance monitoring, and the cerebellum is assumed to generate an internal model for action predictions that ultimately contribute to the neuronally coded response-locked error-related negativity (ERN). We co-registered EEG and applied single-pulse transcranial magnetic stimulation (TMS) to the left posterolateral cerebellum and

an extra-cerebellar control region (vertex) while healthy adult volunteers completed a Go/NoGo Flanker Task. The individual peak latency of the ERN was estimated based on a similar task without TMS pulses and used to define four time points for stimulation (temporal shift −100, −50, 0, +50 ms relative to ERN latency). Cerebellar stimulation did not affect the hit rates, but significantly fewer errors were committed after the pulse. With respect to error processing, a significant main effect of stimulation condition was found, with decreased ERN amplitudes for cerebellar stimulation, irrespective of stimulation time. These results indicate that cerebellar TMS modulated error processing, resulting in decreased error rates and a blunted ERN. Similar to TMS application to probe cerebellar-brain inhibition in the motor domain, the inhibitory tone of the cerebellar cortex may have been disrupted. Reduced excitatory output may have facilitated the processing of error information, which is reflected in better performance and decreased ERN magnitude.

1–048 | NEURAL RESPONSE TO MONETARY AND SOCIAL REWARDS AND FAMILIAL RISK FOR PSYCHOPATHOLOGY IN ADOLESCENTS

Clare Beatty[1], Greg Hajcak[2], Brady Nelson[1]
[1]Stony Brook University, [2]Florida State University

Descriptors: risk, psychopathology, reward

The reward positivity (RewP) is an event-related potential (ERP) component that indexes reinforcement learning and reward system activation. A parental history of major depressive disorder has been associated with a blunted RewP in offspring, suggesting that the RewP might index risk for psychopathology. However, it is unclear whether other forms of parental psychopathology are also associated with the adolescent offspring RewP, and whether this relationship is related to domain-general or domain-specific (e.g., monetary vs. social) neural response to rewards. In a sample of 175 adolescent females, the present study examined the association between adolescent and parental psychopathology and adolescent RewP to monetary and social reward. Results indicated that greater adolescent distress and positive mood dimensions were associated with a more blunted adolescent domain-general (i.e., across both monetary and social) RewP. Conversely, a greater adolescent fear/obsessions dimension was associated with a more enhanced adolescent domain-general RewP. A greater parental distress dimension was associated with a more blunted adolescent domain-general RewP. Finally, the associations between parental and adolescent psychopathology dimensions and the adolescent RewP were independent of each other. The present study suggests that the domain-general RewP in adolescent females is associated with both familial risk and concurrent psychopathology dimensions. These findings have important implications for identifying and understanding mechanisms of risk for internalizing psychopathology.

1–050 | REMOTE PHYSIOLOGICAL MEASUREMENTS UNDER CONTROLLED LIGHTING CONDITIONS

Britain Taylor[1,2], Gregory Lewis[1,2], Aidan Whelan[2], Nicole Miller[1,2]
[1]*Indiana University Bloomington, Luddy School of Informatics, Computing, and Engineering,* [2]*The Kinsey Institute at Indiana University*

Descriptors: Physiological Measurement, Heart Rate, Facial Affect

Heart rate variability (HRV) is an essential metric for psychophysiologists due to its power in tracking autonomic activity. Remote PPG (rPPG) is a technique for extracting a pulse wave from video data and can be used to estimate HRV if the signal quality is sufficient. We seek to determine if environmental lighting impacts rPPG signal strength and whether HRV could be detected [LG1] in specific locations on the face. Human subjects were outfitted with a fingertip PPG (Biopac, Inc.) and instructed to sit with little to no movement in a controlled lighting environment. A single lightbulb was positioned within the environment and 60-second synchronized recordings of the camera and PPG signal were collected. The lightbulb was moved to three vertical positions; high (above face), medium (in line with the nose), and low (below face), and 5 horizontal angles of incidence: directly in front of the subject (0 degrees), +/− 60 degrees, +/− 30 degrees to the side. We present empirical results on rPPG strength across the face by detecting changes in signal quality within regions defined by computer vision landmarks (DLIB). The signal-noise ratio (SNR) data are presented in the form of a heatmap for visualization and target regions of interest are contrasted across illumination settings. Future applications of the method will involve movement in natural environments and should extend HRV data collection to many currently inaccessible environments. The goal of this study is to look at the signal strength of the pulse wave.

1–051 | INTERGENERATIONAL TRANSMISSION OF THE ERROR-RELATED NEGATIVITY IN MOTHER-DAUGHTER DYADS: DEVELOPMENTAL EFFECTS

Simon Morand-Beaulieu, Iulia Banica, Anna Weinberg
McGill University

Descriptors: Error-related negativity, Intergenerational transmission, Parent–child dyads

Anxiety symptoms are known to be transmitted within families, but the mechanisms of this transmission are not clear. One possibility is through familial transmission of neural responses to errors, which have been shown to predict future anxiety, and are partially heritable. However, familial transmission is not static. Instead, it interacts with other factors across the lifespan to predict phenotypes—in other words, the influence of intergenerational transmission may increase across development. Adolescence, in particular, is a period of explosive neural development, as well as a time when risk for anxiety increases—especially for girls. In this study, 48 mothers and their adolescent daughters (ages 10 to 19) completed a Flanker task to elicit the error-related negativity (ERN), which is an ERP marker linked to error monitoring and a proposed endophenotype of anxiety. Consistent with previous reports, we found a positive correlation between mothers' and daughters' ERN, such that mothers with a larger ERN had daughters with a larger ERN. Furthermore, daughters' developmental stage significantly moderated the association between mothers' and daughters' ERN, whereby mothers' ERN magnitudes were associated with daughters' ERN magnitudes in older (mid- and late adolescence) but not younger girls. These results suggest that the familial association of the ERN increases across the period of adolescence. Intergenerational transmission of the ERN getting stronger by mid-adolescence in girls may contribute to the onset of anxiety disorders occurring around this developmental period.

1–052 | WHERE RDOC AND HITOP MEET: PERSON-CENTERED AND VARIABLE-CENTERED APPROACHES TO UNDERSTANDING NEURAL RESPONSES TO REWARD AND THREAT AND ASSOCIATIONS WITH PSYCHOPATHOLOGY

Juhyun Park[1], Lidia Panier[1], Greg Hajcak[2], Roman Kotov[3], Anna Weinberg[1]
[1]McGill University, [2]Florida State University, [3]Stony Brook University

Descriptors: reward positivity, error-related negativity, psychopathology

The RDoC constructs of reward and threat sensitivity are implicated in multiple forms of psychopathology. However, studies often focus on a single diagnosis, failing to account for co-occurring disorders. Given high rates of comorbidity, this approach may not adequately describe links between reward, threat, and psychopathology. HiTOP, a classification system addressing comorbidity, may be helpful. We used person-centered and variable-centered approaches (i.e., latent class analysis [LCA] and regression) to clarify the links between neural measures of reward and threat sensitivity (i.e., RewP and ERN respectively) and psychopathology in light of the HiTOP framework. LCA identified three classes in a diagnostically heterogeneous adult sample ($n = 417$; Mage = 44.0, 70.3% Female, 79.4% Caucasian), using lifetime diagnoses re-assigned to the HiTOP subfactors as indicators (i.e., Distress, Fear, OCD, Mania, Substance Abuse): Limited Psychopathology (27.3%), Distress-Fear (58.5%), and Fear-Mania (14.1%). The classes were differentially associated with internalizing symptoms, supporting their validity. The classes did not differ in reward sensitivity, but Fear-Mania showed greater threat sensitivity than Limited Psychopathology. Regression analyses showed that Substance Abuse predicted greater reward sensitivity, and interacted with Fear to predict threat sensitivity. These findings suggest the links between neural measures of RDoC constructs and psychopathology are more nuanced when comorbidity is captured using the HiTOP framework.

1–053 | THE DIVING RESPONSE AND CARDIAC VAGAL ACTIVITY: A SYSTEMATIC REVIEW AND META-ANALYSIS

Stefan Ackermann[1], Markus Raab[1,2], Serena Backschat[1], David Smith[1], Florian Javelle[1], Sylvain Laborde[1,3]
[1]German Sport University, [2]London South Bank University, [3]Normandie Université

Descriptors: heart rate variability, diving reflex, psychophysiology

This work aimed to synthesise the various triggers of the diving response and to perform a meta-analysis assessing their effects on cardiac vagal activity. The protocol was preregistered on PROSPERO (CRD42021231419; 01.07.2021). A systematic and meta-analytic review of cardiac vagal activity was conducted, indexed with the root mean square of successive differences in the context of the diving response. The search was finalised on November 6th, 2021. Studies with human participants were utilized, measuring cardiac vagal activity pre- and during and/or pre- and post-exposure to at least one trigger of the diving response. 18 papers ($n = 321$) met inclusion criteria. Triggers examined include face immersion or cooling, diving, and total body immersion into water. Compared to resting conditions, a significant moderate to large positive effect was found for cardiac vagal activity during exposure (Hedges′ g = 0.69, 95% confidence interval 0.40 to 0.98), but not post-exposure (Hedges′ g = 0.17, 95% confidence interval − 0.20 to 0.54). Amongst the considered moderators, total body immersion ($p < 0.001$) and face immersion ($p = 0.018$) had a significantly larger effect than forehead cooling, but did not differ significantly from each other. The results show that the diving response enhances cardiac vagal activity during exposure. The main limitations were the small number of studies included, with very heterogenous triggers, few participants and low quality of evidence. Further research is needed to investigate the role of cardiac sympathetic activity and the moderators discussed here.

1–054 | EFFECTS OF VOLUNTARY SLOW BREATHING ON HEART RATE VARIABILITY: A SYSTEMATIC REVIEW AND META-ANALYSIS

Sylvain Laborde[1,2], Mark Allen[3], Uirassu Borges[1], Fabrice Dosseville[2], Thomas Hosang[4], Maša Iskra[1], Emma Mosley[5], Caterina Salvotti[1], Laura Spolverato[1], Nina Zammit[1], Florian Javelle[1]
[1]German Sport University, [2]Normandie Université, [3]University of Wollongong, [4]Helmut Schmidt University, [5]Solent University

Descriptors: Slow breathing, Heart rate variability, Vagus nerve

Voluntary slow breathing (VSB) is used as a prevention technique to support physical and mental health, given it is suggested to influence the parasympathetic nervous system. However, to date, no comprehensive quantitative review exists to support or refute this claim. We address this through a systematic review and meta-analysis of the effects of VSB on heart rate variability (HRV). Specifically, we focus on HRV parameters indexing PNS activity regulating cardiac functioning, referred to as vagally-mediated (vm)HRV: 1) during the breathing session (i.e., DURING), 2) immediately after one training session (i.e., IM-AFTER1), as well as 3) after a multi-session intervention (i.e., AFTER-INT). From the 1842 selected abstracts, 223 studies were suitable for inclusion (172 DURING, 16 IM-AFTER1, and 49 AFTER-INT). Results indicate increases in vmHRV with VSB, DURING, IM-AFTER1, and AFTER-INT. Given the involvement of the PNS in a large range of health-related outcomes and conditions, VSB exercises could be advised as a low-tech and low-cost technique to use in prevention and adjunct treatment purposes, with few adverse effects expected.

1–055 | WHITE MATTER INTEGRITY, BODY MASS INDEX, AND MILD COGNITIVE IMPAIRMENT

Emma Tinney[1], Psyche Loui[1], Arthur Kramer[1,2], Charles Hillman[1], Curtis Johnson[3]
[1]*Northeastern University, *[2]*University of Illinois, Urbana-Champaign, *[3]*University of Delaware*

Descriptors: Diffusion tensor Imaging, Mild Cognitive Impairrment, Body Mass Index

Mild cognitive impairment (MCI), a prodromal stage of Alzheimer's disease, has negative effects on memory and cognition, which are linked to degenerative changes in the brain. To assess whether white matter (WM) integrity is compromised in MCI, we collected diffusion-weighted images from 60 healthy older adults (OA) (69 ± 6 yrs) and 20 with amnestic MCI (72 ± 9 yrs). WM integrity differences were examined using Tract-Based Spatial Statistics (TBSS). We hypothesized that those with MCI would have diminished WM integrity relative to OA. In a whole-brain comparison, those with MCI showed higher axial diffusivity in the splenium (SCC) and body of the corpus callosum (BCC), superior corona radiata (SCR), and the retro-lenticular part of the internal capsule (RLIC) (p's < 0.05 TFCE-corrected). Additionally, significant between-group connectivity differences were observed using probabilistic tractography between the SCR, chosen from the TBSS results, and primary somatosensory area and primary motor cortex (p's < 0.05). To examine how modifiable health factors relate to WM alterations, linear regression showed significant interactions between groups and body mass index (BMI) on diffusivity outcome measures from probabilistic tractography (p's < 0.05). The findings suggest that these regions may be more sensitive to neurodegenerative disease and health behaviors eluding that modifiable lifestyle factors may affect white matter integrity.

1–057 | MNEMONIC MECHANISMS IN VIRTUAL REALITY - COMPARISON OF EVENT-RELATED POTENTIAL CORRELATES OF REPETITION SUPPRESSION BETWEEN VR AND THE CONVENTIONAL LABORATORY

Marike Johnsdorf, Joanna Kisker, Merle Sagehorn, Thomas Gruber, Benjamin Schöne
University of Osnabrück

Descriptors: Repetition-Suppression, ERPs, VR

Virtual reality (VR) allows to investigate cognitive processes under realistic conditions maintaining the strict experimental control of a conventional laboratory. Previous research regarding mnemonic processes shows that, unlike in the laboratory, experiences in VR become part of autobiographical memory. To differentiate whether the processes underlying autobiographical memory formation already differ during early encoding stages, we investigated the Repetition Suppression (RS) effect. RS is manifested by a reduction in neural response with repeated stimulus presentation and represents the earliest instance of mnemonic processes. We presented pictures of 180 objects, either under conventional laboratory conditions or in a realistic virtual environment. Analysis of event-related potentials (ERPs) shows that the amplitudes of ERPs at posterior electrodes were lower in VR compared to the PC condition. This indicates an optimized distribution of cognitive resources in realistic contexts. The RS effect could be replicated in both conditions at posterior and anterior electrodes for a late time window (220–690 ms). A specific VR-RS effect was found in VR at anterior electrodes for a later time window (800–1200 ms). Here, the amplitude was significantly more negative for the first object presentation, suggesting more differentiated encoding processes in VR compared to the laboratory.

Specifically, electrotomographic results (VARETA) imply the involvement of somatosensory areas in VR and thus the formation of a more intertwined autobiographical memory trace.

1–058 | TAKE A BREAK FOR MEMORY SAKE! EXAMINING EFFECTS OF SHORT BOUTS OF ACUTE EXERCISE ON ERPS, INHIBITORY CONTROL, AND EPISODIC MEMORY IN CHILDREN

Eric Drollette, Alexis Slutsky-Ganesh, Megan Johnson, Christopher Wahlheim, Jennifer Etnier
University of North Carolina, Greensboro

Descriptors: Physical activity, preadolescence, executive function

The purpose of this study was to examine the effects of short bouts (9-minutes) of cycling and high-intensity interval exercise (HIIE) on cognition (i.e., inhibitory control, episodic memory) and ERPs (i.e., P3, FN400, LPC) in children. METHODS: While fitted with an EEG cap (64 Ag/AgCl electrodes), participants ($n = 33$; 9–12 years old) completed three counterbalanced sessions including seated rest while watching an educational video, pedaling a stationary cycle, and HIIE (alternating 30-seconds of in-place calisthenics and rest). Next, EEG data were recorded while participants completed a flanker task (P3 ERP component) and word recognition memory task (FN400 and LPC ERP component). RESULTS: Results revealed no differences between conditions for flanker performance (accuracy and RT) and P3. Memory results revealed overall faster RT (hits and correct rejects) for HIIE compared to cycling and seated rest, and greater accuracy (only hits) for HIIE and cycling compared to seated rest. FN400 amplitude remained stable while LPC revealed greater mean amplitude for HIIE compared to seated rest. CONCLUSION: These data suggest that short exercise bouts improve cognitive and neurocognitive measures of memory but not inhibitory control. The selective ERP findings further suggest that memory improvements may be facilitated by recollection (greater LPC amplitude) but not familiarity (FN400). Future research may benefit by further exploring changes in underlying neurocognitive mechanisms associated with the dual-process model of episodic memory following short active breaks in children.

1–059 | EFFECTS OF PERCEIVED AGENCY AND CONTEXTUAL VALENCE IN A DELAYED FEEDBACK TASK

Alliya Padiak[1], Fernando Valle-Inclan[2], Takahiro Hirao[3], Hiroaki Masaki[4], Steven Hackley[1]
[1]University of Missouri, Columbia, [2]University of La Coruña, [3]National Institute for Quantum and Radiological Science and Technology, [4]Waseda University

Descriptors: sense of agency, contextual valence, time-frequency analysis

It is often the case that an individual must reflect on which, if any, of their actions led to a favorable or unfavorable outcome, especially if that outcome was delayed. If they attribute an outcome to themselves, they are said to have a "sense of agency." We examined oscillatory EEG activity during the 2.5-s delay prior to feedback in a 2-door gambling task in which participants ($N = 26$) either had a chance to win or a chance to lose 50 yen on each trial. On Choice trials, participants were led to believe that their keypress determined the outcome; on No-Choice trials, they correctly understood that the outcome was selected randomly by the computer. The pre-feedback delay had previously been studied with fMRI and ERP methods, but not with time-frequency analysis. We found that pre-feedback alpha suppression in sites overlying right frontal and occipital areas was stronger on Choice than No-Choice trials. Pre-feedback beta suppression in sites overlying left prefrontal cortex was also greater on Choice trials. Both of these effects appeared to be modulated by contextual valence: they were significantly larger in conditions with potential gain than those involving potential loss. These findings highlight the importance of selective attention and reward anticipation when the outcome of one's own action is awaited.

1–060 | THE AUTONOMIC NERVOUS SYSTEM IN IT'S NATURAL ENVIRONMENT: IMMERSION IN NATURE IS ASSOCIATED WITH CHANGES IN HEART RATE AND HEART RATE VARIABILITY

Emily Scott[1], Sara LoTemplio[2], Amy McDonnell[2], Glen McNay[2], Kevin Greenberg[2], Ty McKinney[2], Bert Uchino[2], David Strayer[2]
[1]Northern Vermont University, [2]University of Utah

Descriptors: Electrocardiography, Stress Recovery, Environmental Restoration

Stress Recovery Theory (SRT) suggests that time spent in nature reduces stress. While many studies have examined

changes in stress physiology after exposure to nature imagery, nature virtual reality, or nature walks, this study is the first to examine changes in heart rate (HR) and vagally mediated HR variability, as assessed by Respiratory Sinus Arrhythmia (RSA), after a longer duration of nature exposure. Consistent with SRT, we hypothesized that immersion in nature would promote stress recovery, as indexed by an increase in RSA and a decrease in HR. We also predicted that exposure to nature would improve self-reported mood. We used a within- subjects design ($N = 67$) to assess changes in peripheral physiology before, during, and after a 5-day nature trip. Results demonstrated a significant decrease in RSA and a significant increase in HR during the trip compared to before or after the trip, suggesting that immersion in nature is associated with a shift toward parasympathetic withdrawal and possible sympathetic activation. These results were contrary to our hypotheses and may suggest increased attentional intake or presence of emotions associated with an increase in sympathetic activation. We also found an improvement in self-reported measures of mood during the trip compared to before or after the trip, confirming our hypotheses and replicating previous research. Implications of this study are discussed in the context of SRT.

1–061 | COMPARISON OF GROUP AND INDIVIDUAL LEVEL RELIABILITY AND CROSS-PHASE RESPONSE PREDICTION OF CONDITIONED FEAR

Mana Ehlers[1], Maren Klingelhoefer-Jens[1], Manuel Kuhn[1,2], Tina Lonsdorf[1]
[1]University Hospital Hamburg-Eppendorf, [2]Harvard Medical School

Descriptors: fear conditioning, reliability, individual differences
While the need for adequate statistical power in neuroscience has been established years ago, measurement reliability, as a crucial determinant of the maximally observable effect size, has only recently attracted attention. In the current project I investigated measurement reliability in fear conditioning as a key prerequisite for individual-level predictions in translational neuroscience. I will present longitudinal reliability at the individual and group level in addition to cross-sectional reliability and response predictability across experimental phases. For this study, 120 individuals performed a fear conditioning paradigm twice six months apart. Skin conductance responses, fear ratings and BOLD-fMRI data were analysed with different data transformations and included numbers of trials. The analyses revealed that while longitudinal reliability was generally poor to moderate at the individual level, it

was good for fear acquisition but not extinction training at the group-level. Cross-sectional reliability was satisfactory. Moreover, higher responding in preceding phases predicted higher responding in subsequent experimental phases at a weak to moderate level depending on data specifications. In sum, the results suggest the feasibility of individual-level predictions for (very) short time intervals (e.g., cross-phases) while predictions for longer time intervals may be problematic.

1–063 | EEG REVEALS SIMULTANEOUS, DISSOCIATED PROCESSES IN THE EXERTION OF COGNITIVE CONTROL

Mark Lavelle, James Cavanagh
University of New Mexico

Descriptors: Cognitive Control, EEG, Drift Diffusion Modeling
Our ability to discern multiple, simultaneous latent processes during the exertion of control is limited by rudimentary combinations of manifest behavior. We hypothesized that EEG could provide unique evidence that control can simultaneously alter behavioral output (i.e., decision threshold) as well as sensory gain (i.e., drift rate). This study includes EEG data from 16 young adults who completed a Flankers task where the luminance of the stimuli varied trial-wise against a black background. Conflict was associated with lower drift and lower threshold, as well as increased frontal midline theta power. However, these fixed effects are not likely representative of the trial-wise variance in latent parameters: it is unlikely that a more difficult situation led to a truly reduced threshold in all trials. The conflict*theta interaction specifically loaded on higher threshold, revealing a mechanism underlying trial-wise variance in response caution. Increased luminance was associated with higher drift and threshold, as well as increased alpha-beta power [KLC1] in visual cortex. While there was no interaction between alpha-beta power and luminance on drift-diffusion parameters, reduced alpha-beta power corresponded with higher drift-rate during conflict. In sum, the occluded view of purely behavioral metrics suggests that individuals respond less cautiously faced with conflict. However, EEG revealed trial-level variance of latent parameters that explain how frontal control systems can influence momentary response caution, while visual cortex separately influences evidence quality.

1–064 | INFLUENCE OF A PHOBIC STIMULUS ON EMOTIONAL FACIAL RECOGNITION: AN ERP STUDY

Roberto Huerta-Chávez, Julieta Ramos-Loyo
University of Guadalajara

Descriptors: Specific phobia, Emotion, ERPs
In specific phobia, there is an amplification of attention and hypersensitization towards the feared stimulus. It has been observed that the images of the feared stimulus subliminally presented generate an anxiety response. Subliminal stimuli can enhance the recognition of a second stimulus when both are emotionally congruent, such as an emotional face. We aimed to assess the effect of subliminal phobic stimuli on emotional face recognition in ERPs using an oddball task. Two groups of women ($n = 30$) participated: a control group (COG) and; a group with a diagnosis of cockroach phobia according to the DSM-IV-TR (PHG). We first presented a masked image with a dish or a cockroach for 50 ms, then an emotional (happy or fearful) or neutral face for 300 ms, and finally, a black screen for 700 ms. In the fear and happiness conditions, the participants had to respond to the target emotion, and in the sex condition, to the sex of the face. The PHG showed shorter reaction times in response to fearful faces after looking at cockroaches than dishes. In addition, the PHG had shorter P3 latency than COG to fearful faces after both types of stimuli. Likewise, PHG obtained lower P3 amplitude to fearful faces after looking at cockroaches than dishes. We conclude that the PHG was sensitive to the phobic subliminal images, reducing the time processing and cognitive resources required for encoding and recognition of fearful faces.

1–065 | THE ROLE OF UNCERTAINTY AND COGNITIVE LOAD ON ANXIETY AND FEAR RESPONSES

Deachul Seo[1], Nicholas Balderston[2], Juyoen Hur[1]
[1]*Yonsei University,* [2]*University of Pennsylvania*

Descriptors: Uncertainty, Cognitive control, Anxiety/Fear
Fear and anxiety are differentiated in that they are responses to certain and uncertain threat, respectively. Cognitive control may be differentially engaged in response to certain vs. uncertain threat, and result in different patterns of change in fear vs. anxiety responses. In the present study, we seek to understand the interactive effect of uncertainty and cognitive load on fear and anxiety responses. 35 participants performed n-back tasks with varying cognitive load (i.e., 1-back, 3-back) while undergoing a modified threat of shock paradigm in which both occurrence and temporal uncertainty of threat were manipulated. Fear and anxiety responses were assessed using the acoustic startle reflex. Anxiety-and fear-potentiated startle were computed to probe anxiety and fear responses, respectively. A repeated measures ANOVA revealed a significant three-way interaction effect (temporal certainty X occurrence certainty X cognitive load, $p = .018$) on startle response. Startle amplitude was significantly reduced when timing of shock was uncertain under high cognitive load, and this effect was only evident when probability of shock was also uncertain. When anxiety vs. fear responses were examined separately, anxiety was significantly lower when cognitive load and threat uncertainty were combined ($p = .049$), but no such effect was evident in fear response. These findings suggest that uncertainty may function as an additional load in mind when cognitive resources are already diminished and that anxiety and fear may involve different mechanisms of emotion-cognition interaction.

1–066 | MEASURING ENGAGEMENT DURING TEXT READING: EVIDENCE FROM ELECTRODERMAL ACTIVITY (EDA)

Yilun Jheng[1], Leen Catrysse[2], Sander Van de Cruys[1], David Gijbels[1], Karolien Poels[1]
[1]*University of Antwerp,* [2]*Open University, Heerlen*

Descriptors: Electrodermal activity, Emotion, Reading
Reading and learning from texts is a crucial skill as health messages are often communicated via text. Therefore, it is important to gain more insights into how texts can engage readers to facilitate comprehension. Researchers have already compared narrative versus didactic text formats on memory, comprehension and belief formation. However, previous studies mainly used self-report measures. Moreover, there is a lack of understanding on how narratives incorporated into didactic texts can engage readers and influence comprehension. The current study aimed to unravel readers' emotional engagement while reading narrative, didactic, and mixed texts by applying physiological measurements. Specifically, we investigated emotional arousal by electrodermal activity (EDA). Fifty-four undergraduate students were recruited to participate in a laboratory experiment in which they had to read three texts about environmental hazards. A trough-to-peak (TTP) analysis was conducted with Ledalab. The EDA peaks were analyzed with generalized linear mixed-effects models in R, with participant as a random effect, and text type as a fixed effect. Results show that EDA

peaks of mixed texts were significantly higher than those of didactic texts. Additionally, the confidence ratings on knowledge questions were significantly higher when participants read mixed texts compared to didactic texts. Narratives embedded in mixed texts seem more emotionally engaging at a physiological level, which makes the content more attention-grabbing than dry information and in turn affects subjects' confidence judgments.

1–067 | LOCATION OF THE CORTICAL SOURCE OF THE "ERROR-RELATED NEGATIVITY" IN ADOLECENTS AND ADULTS; A MULTIMODAL ERP/FMRI STUDY

John Richards[1], Stefania Conte[1], Nathan Fox[2], Emilio Valadez[2], Marco McSweeney[2], Enda Tan[2], Daniel Pine[3], Anderson Winkler[3], Lucrezia Liuzzi[3], George Buzzell[4]

[1]University of South Carolina, [2]University of Maryland, [3]National Institute of Mental Health, [4]Florida International University

Descriptors: attention, Infants/children/adolescents, Decision making

The error-related negativity (ERN) is a negative deflection in the event-related potential (ERP) in frontocentral electrodes (e.g., Fz-Cz), within ~100 ms of error commission. The cortical source of the ERN has been located in the cingulate gyrus, but it is unclear if it is in the dorsal anterior cingulate (dACC) or the posterior cingulate (PCC). The fMRI BOLD error response in the dACC could have the same origin as the ERN. However, recent work has located the source of the ERN in posterior regions, PCC. We tested 12-yr-olds ($n = 44$), 15-yr-olds ($n = 59$), and adults ($n = 23$) on a flanker task, during separate EEG and fMRI sessions. Individualized head models from structural MRIs were used for ERP source localization. The ERN occurred 40–60 ms post error. It was largest at FCz for the 12-yr olds, over FCz and Cz for the 15-yr-olds and extended from FCz through Pz for the adults. The cortical source of the ERN was in the dACC area for the 12 yr olds, the dACC and central cingulate for the 15 yr olds, and in the PCC for the adults. The error-linked activity in the BOLD fMRI was predominantly in the dACC for all three age groups. The cortical source of the stimulus-locked N2 ERP component was over the dACC in all three ages, in approximately the same location as the error-linked fMRI. There was a change over age in the cortical source of the ERN, and the ERN and error-linked fMRI response were generated in different areas. The overlap of the N2 and fMRI sources suggests that the cognitive processes represented by the N2 are driving the BOLD fMRI activity.

1–068 | EVENT-RELATED POTENTIALS IN CHILDREN WITH FRAGILE X SYNDROME AND AUTISM SPECTRUM DISORDER

John Richards[1], Margaret Guy[2], Abigail Hogan[1], Jane Roberts[1]

[1]University of South Carolina, [2]Loyola University

Descriptors: attention, face processing, EEG/ERP

The N170 ERP component amplitude in response to faces is similar in typically developing (TD) children, children with autism spectrum disorder ASD, and non-ASD siblings of a child with ASD (ASIB). Children with fragile X syndrome (FXS) have a high incidence of ASD diagnoses, but there have been no studies in FXS children of the ERP response to faces. The current study examined ERP responses to faces and houses in TD, ASD, ASIB, and FXS children. The participants were children: TD ($N = 28$, $M = 5.2$ yrs); ASIB ($N = 23$, $M = 5.5$ yrs); FXS ($N = 19$, $M = 6.2$ yrs); or ASD ($N = 36$, $M = 5.6$ yrs). Pictures of upright and inverted faces and houses were presented while recording EEG with a EGI HGSN 128 channel system. The N170 occurred at about 200 ms post stimulus onset and was largest on the posterior-lateral electrodes, and larger for faces than houses. The P1 and N170 ERP components were larger for the FXS group than for the other three groups. The N170 ERP amplitude for the ASD and ASIB groups was smaller than either the TD or FXS groups, and the latter groups had the largest N170 responses on the right side. The similarity of the ASD and ASIB responses suggest a common genetic or environmental origin of the reduced response to faces. The FXS children have a high incidence of ASD outcomes but differed from ASD and ASIB children in the face processing in this study. These results suggest increased activation during face processing in the FXS participants, both in the stimulus characteristics (P1) and configuration (N170).

1–069 | HIGH INTRAINDIVIDUAL VARIABILITY OF ERN SCORES ACROSS HEALTHY CONTROL AND PSYCHOPATHOLOGY GROUPS

Harold Rocha[1], Peter Clayson[1], Scott Baldwin[2], Philippe Rast[3], Michael Larson[2]

[1]University of South Florida, [2]Brigham Young University, [3]University of California, Davis

Descriptors: ERN, Reliability, Psychopathology

Though studies of psychopathology investigate individual differences in error monitoring using the error-related negativity (ERN), psychometric internal consistency of ERN scores in psychopathology is often unreported. Low internal consistency contributes to inappropriate statistical inferences and replication difficulties. A common assumption is that ERN score internal consistency is uniform across and within participant groups. The present study tests this assumption by determining whether a healthy control group and three psychopathology groups (generalized anxiety disorder, major depressive disorder, obsessive–compulsive disorder) demonstrate between- and within-group differences in internal consistency (intraclass correlation coefficients [ICCs]). Subject-level ICCs were estimated using mixed-effects location-scale models predicting trial-level ERN scores nested within participants. Major discrepancies in ICCs were observed within each group, but between-group differences were not observed. Subject-level ICCs increased by about six-fold from smallest to largest ICC, suggesting considerable individual differences. About half of all subject-level ICCs for correct- and error-trial ERN were mischaracterized by group-level ICCs, indicating that some participants' low ICCs were masked by a group-level ICC. Findings suggest that assuming fixed within-person variability is inappropriate for analyses of ERN, and future research might consider modeling within-person variability to understand the factors that contribute to trial-by-trial differences within persons.

1–070 | THREAT-INDUCED ALTERATIONS IN COGNITION AND ASSOCIATIONS WITH DISINHIBITED BEHAVIOR

Julia McDonald, Edelyn Verona
University of South Florida

Descriptors: Disinhibition, Cognitive control, Threat

Previous literature suggests that threat disrupts cognitive control, especially for those prone to engaging in disinhibited behaviors. However, this relationship is not well understood and has yet to be directly examined. Our study extends previous literature by examining the link between individual differences in disinhibition and threat-related alterations in neurocognitive and behavioral indicators of cognitive control. Using a diverse community sample ($N = 143$), we recorded participants' brain activity during a flanker task under conditions of predictable, unpredictable, and no threat-of-shock. Findings revealed a nuanced relationship, whereby predictable threat, relative to unpredictable threat, was associated with larger N2 to flankers, perhaps at the expense of a reduced later P3. We also found a relationship between disinhibition proneness and threat-induced alterations of cognitive control, with those higher in disinhibition showing greater differences in congruence P3 and accuracy interference during the no threat vs. threat conditions. This research expands what is known about how threat can modulate cognition in everyday life and linked it to disinhibited traits and behaviors with high societal burden.

1–072 | PHYSIOLOGICAL LINKAGE BETWEEN AUTISTIC AND NON-AUTISTIC ADULT DYADS DURING COLLABORATIVE TASKS

Megan Fok, Manhua Wang, Sunwook Kim, Anabelle Theodat, Brian Baker, Myounghoon Jeon, Angela Scarpa
Virginia Tech

Descriptors: autism, synchrony, dyad

Autism is a lifelong neurodevelopmental condition with about 5.4 million autistic adults (AA) living in the US. AA have the highest unemployment rate of any disability group, underscoring the need for research that supports AA in the workplace. AA may have social reciprocity difficulties with their non-autistic (NA) peers in the workplace; however, this effect remains unexplored in the literature. Previous psychophysiological research has examined physiological linkage (PL), which is the coordinated physiological response between interacting partners, as a potential biomarker for social reciprocity. The current study examined PL between 18 AA and NA adult strangers who were age ($M = 25.33$ years) and gender (44% male) matched into 3 AA-NA and 6 NA-NA dyads. Each dyad completed 2 collaborative coding tasks (completion time, $M = 12.19$ min) with each participant wearing a photoplethysmography recording wristband (Empatica E4). Analyses examined correlations of interbeat intervals between participants in each of the 2 dyad types. For both tasks, there were significant correlations between

the NA-NA dyad participants (rs $= -0.18–0.21$, ps $< .001$), but not between the AA-NA dyad participants (rs $= -0.07–0.04$, ps $> .106$). These results demonstrate PL within the 6 NA pairs, but not within the 3 AA-NA pairs, possibly reflecting physiological differences in social reciprocity on both sides during a collaborative problem-solving task. The results need replication with a larger sample and have implications for the use of psychophysiological measurement in supporting neurodiversity in the workplace.

1–073 | RELATIONSHIP BETWEEN PRENATAL ENVIRONMENTAL FACTORS INCLUDING SMOKING, ALCOHOL DRINKING, AND CHEMICAL EXPOSURE AND EVENT-RELATED BRAIN POTENTIALS DURING GO/NOGO TASK: THE HOKKAIDO STUDY

Keiko Yamazaki, Chihiro Miyashita, Naomi Tamura, Sachiko Itoh, Atsuko Ikeda-Araki, Reiko Kishi
Hokkaido University

Descriptors: prenatal environment, event-related brain potential, Go/Nogo task

Prenatal environmental factor could be one of the causes for attention deficit hyperactivity disorder (ADHD). Previous studies indicated that event-related brain potentials (ERPs) reflect attentional or inhibition process, which is well-known problems in children with ADHD. We investigated whether prenatal exposure to environmental factor such as smoking, drinking alcohol, and perfluorinated alkyl substances (PFASs) was associate with ERPs of school aged children, or not. The information during pregnant were obtained from prospective birth cohort, the Hokkaido Study on Environment and Children's Health, which enrolled pregnant women from 2002 to 2012 in Japan. The concentration of PFASs were measured from the 3rd trimester maternal plasma. ERPs were recorded from their children at 13 years old ($n = 126$). We used visual Go/Nogo task, requiring either activation or inhibition of a button-press response to the S2 (Go or Nogo stimulus) following the S1 (warning stimulus). Go P3, Nogo P3, and N2 to S2 were analyzed by multi regression analysis. Go P3 latency tended to be prolonged with alcohol during pregnancy. For Nogo N2, amplitude was increased with one of PFASs, and latency tended to be prolonged with smoking. These imply that smoking during pregnancy might delayed children's inhibition control reflected by Nogo N2 and that drinking alcohol might delay stimulus classification process reflected by Go P3 latency. However, PFAS associated with enhancement of inhibitory process reflected by Nogo N2. These associations may be the background for variety of ADHD symptoms.

1–074 | THE EFFECT OF CEREBELLAR STIMULATION ON FEEDBACK PROCESSING: A COMBINED SINGLE-PULSE TMS AND ERP STUDY

Dana Huvermann[1,2,3], Adam Berlijn[1,3,4], Stefan Groiss[1,3], Manfred Mittelstaedt[1], Alfons Schnitzler[1,3], Christian Bellebaum[1], Martina Minnerop[1,3,4], Dagmar Timmann[2], Jutta Peterburs[1,5]
[1]*Heinrich-Heine-University Düsseldorf,* [2]*University Hospital Essen,* [3]*University Hospital Düsseldorf,* [4]*Research Center Jülich,* [5]*Medical School Hamburg*

Descriptors: Feedback processing, FRN, TMS

Recent studies suggest that the cerebellum is not only involved in processing of sensory predictions but also reward predictions. Based on internal models, the cerebellum is thought to generate predictions for action outcomes that are updated based on prediction errors. We tested the hypothesis that inhibition of the cerebellum via transcranial magnetic stimulation (TMS) impedes neural processing of reward prediction errors, which are coded in the Feedback-related Negativity (FRN). To this end, healthy adults completed a probabilistic feedback learning task in which they learnt which of two response buttons resulted in a higher chance of (immediate) positive than negative feedback, given a certain stimulus. While recording EEG data, single-pulse TMS was applied to the left cerebellum and a control site (vertex) either 100 ms post-stimulus onset, i.e., while responses were prepared, or 100 ms pre-feedback, i.e., shortly before prediction error generation. As hypothesised, the FRN reflected the trial-by-trial prediction error in the control condition (vertex stimulation), but not when cerebellar TMS was applied, irrespective of timing. However, learning performance was improved for cerebellar stimulation, especially when applied post-stimulus. Thus, cerebellar stimulation led to altered feedback processing and feedback learning, pointing to a crucial role of the cerebellum in generating reward prediction errors.

1–075 | HOW STRESS AFFECTS ATTENTION: TOP-DOWN, BOTTOM-UP OR BOTH?

Mauro Larra, Leon von Haugwitz, Edmund Wascher
Leibniz Institute - IfADo

Descriptors: stress, attention, EEG

Stress increases activity in the salience network but inhibits prefrontal structures supporting executive functions. It is therefore assumed that stress induces a qualitative change from top-down to bottom-up driven control of attention. Here, we assessed how acute stress affects the processing of target stimuli preceded by both endogenous (top-down) and exogenous (bottom-up) cues. 60 participants were exposed repeatedly to a stress or a control procedure. In between exposures, they performed a task in which to-be-discriminated targets presented at either left or right screen positions were preceded (SOA 100 vs. 250 ms) by a salient exogenous cue appearing at either the same or opposite screen position. Moreover, the target position in each trial was either predicted by a symbolic cue or was unknown. EEG was measured contra- and ipsilateral to target presentation. Stress responses were confirmed by cortisol, cardiovascular and introspective measures demonstrating pronounced stress reactions across parameters that were absent in the control group. Evoked potentials at 170 ms post-cue were enhanced by stress compared to control, irrespective of cueing condition. Moreover, stress led to increased positivity over parieto-occipital electrodes contralateral to the target peaking at 290 ms after cue onset. Importantly, this effect only arose when exogenous cues were presented at unexpected locations. These results suggest that stress increases susceptibility to the impact of salient stimuli but may still allow to control their influence if it runs against action goals.

1–076 | BEDFELLOWS IN LEARNING? THE RELATIONSHIP BETWEEN EEG ALPHA POWER AND PUPIL DIAMETER DURING PAVLOVIAN CONDITIONING

Kierstin Riels, Andreas Keil
University of Florida

Descriptors: alpha power, pupil diameter, pavlovian conditioning

Physiological indices of attention allow researchers to study what environmental factors influence behavior. Pupil size and EEG alpha power have both been proposed as indices of attention, one reason being their respective relationships to arousal. Pupil diameter increases during highly arousing experimental conditions and decreases during low arousal conditions (Bradley et al., 2008). Conversely, alpha power decreases during highly arousing conditions (Schubring & Schupp, 2021; Rajagovindan & Ding, 2010) and increases during low arousing conditions (Adrian & Matthews, 1934). The present study aimed to quantify the relationship between these measures of attention through a simple classical conditioning paradigm in which a visual Gabor patch (CS) had a 50% chance of being paired with a loud white noise burst (US, 90 dB), followed by a subjective expectancy rating of upcoming US likelihood. If decreases in alpha power and increases in pupil diameter both index increases in attention, then a negative correlation between the two during the same time periods would be expected. Anticipatory alpha power and pupil diameter were correlated across time, within each sensor, both within and across participants. Preliminary results suggest no correlation across time between pupil size and alpha power.

1–077 | PHYSIOLOGICAL THREAT REACTIVITY AND THE UTILIZATION OF SOCIAL SUPPORT IN TRAUMATIZED INDIVIDUALS

Erin Stafford, Justine Rudy, Wendy D'Andrea
New School for Social Research

Descriptors: Threat reactivity, Childhood trauma, Emotion regulation

Physiological threat reactivity is known to be mitigated by factors such as cognitive reappraisal and social support. However, effectiveness of these regulatory strategies may be mitigated or altered by groups who struggle with accessing social support or reappraisal because of negative experiences with such regulation strategies. People who have experienced childhood maltreatment are one such potential group. Autonomic physiological and subjective data were collected from 51 ($N = 102$) romantic couples. They were asked to engage in a task involving potential shock to the arm under three random conditions: sitting alone, using cognitive reappraisal, and holding their partner's hand. Results showed that those with childhood trauma showed significantly less skin conductance reactivity when alone. Subjective responses during alone conditions of these individuals were depicted as dissociation. Skin conductance reactivity increased in reappraisal and partner conditions for these participants and decreased for non-trauma participants. These findings support the notion that those with complex trauma may engage in social regulation of threat similarly to those without trauma

exposure, but that goals differ. For these individuals, upregulation of physiology is necessary. To understand the clinical utility of these findings, future research should utilize methods that look more specifically at therapist support and attachment on threat reactivity, and elaborate on whether reappraisal-focused emotion regulation works across contexts for childhood trauma survivors.

1–078 | A CARDIO-VISUAL FULL BODY ILLUSION IMPROVES BODY SIZE ESTIMATION IN HEALTHY WOMEN

Lynn Erpelding[1], Dimitri van Ryckeghem[1,2], Claus Vögele[1], Annika Lutz[1]
[1]*University of Luxembourg,* [2]*Maastricht University*

Descriptors: body image distortion, multisensory integration, virtual reality

Body image distortion (BID), i.e., the misestimation of one's own body size, is found in 80% of healthy women, and a risk factor for the development of eating disorders. BID has been linked to interoceptive deficits and can be improved by visuotactile body illusions. We investigated the effects of a cardio-visual full body illusion (cvFBI) on BID in 23 healthy women. The cvFBI was induced by presenting a 3D body scan of the participant in VR, flashing with a short (230 ms) or long (530 ms) delay after the R-peak of the participant's ECG, or not flashing at all. Short delays are typically perceived as being synchronous to one's heartbeat, long delays as asynchronous. The same conditions (short delay, long delay, no flash) combined with a 3D object (cube) served as control conditions. Before and after each illusion condition, participants indicated the width and circumference of their shoulders, waist, and hips. The results show that after the cvFBI, participants estimated their body size more accurately, especially shoulder and hip circumference. This effect was observed in all three body conditions and the short and long delay object conditions, but not in the no-flash object condition. These results demonstrate that BID can be changed with a cvFBI, but also by simply viewing one's own body in VR in a mirror perspective, or by heartbeat feedback. Cardio-visual feedback might enhance multisensory integration and trigger body image updating. This study offers new implications for interventions to target BID in healthy women and women with eating disorders.
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1–079 | DEVELOPMENTAL CHANGES IN THE REWARD POSITIVITY: THE TRAJECTORY OF NEURAL RESPONSES TO MULTIPLE TYPES OF REWARDS ACROSS ADOLESCENCE AND YOUNG ADULTHOOD

Helena Renault, Clara Freeman, Anna Weinberg
McGill University

Descriptors: Reward, Event-related potentials, Development
Neural responses to primary (e.g., candy) and secondary (e.g., money) rewards may hold different incentive values across development, especially during adolescence. However, most studies investigating reward processing across development have focused on monetary rewards, despite evidence that different incentive types shape behaviours and are processed distinctly. In this study, we sought to explore associations between age and neural responses to three types of rewards—monetary, food, and social—in a sample of adolescents and young adults (ages 9–24). Participants ($N = 81$) completed three tasks in an ongoing study to elicit the reward positivity (RewP), an event-related potential that is sensitive to reward and loss feedback. Preliminary results showed that the monetary RewP significantly decreased with age, though this effect was qualified by a significant quadratic association, such that the monetary RewP peaked in early-to-mid adolescence before decreasing again. In contrast, the social RewP increased linearly with age, though this effect was not significant, and the food RewP was not significantly associated with age. Moreover, age did not predict the strength of correlations between the different RewPs, suggesting that neural reward processing remains more category-specific throughout development. This study helps us understand key developmental changes in the reward network and furthers our understanding of the extent to which domain-general and category-specific neural reward processing are affected by developmental changes across adolescence and young adulthood.
FUNDING: Canadian Institute of Health Research Project Grant.

1–080 | THRILL SEEKERS AND IMPULSIVENESS LINKED WITH ADHD SYMPTOMS AND INDIFFERENCE TOWARD MONETARY GAIN

Keisha Novak[1,2,3], Melissa Packer West[1], Dan Foti[1]
[1]*Purdue University,* [2]*University of California, San Francisco,* [3]*San Francisco VA Health Care System*

Descriptors: ERPs, ADHD, reward processing
ADHD is a prevalent psychiatric disorder characterized by inattention, hyperactivity, and/or impulsivity. One

underlying mechanism of ADHD is abnormal sensitivity to rewards. The nature of reward processing deficiencies in ADHD remains unclear due to variables of reward magnitude, immediacy, and probability. The current study attempts to address this by examining the impact of trait impulsivity and ADHD symptom severity on anticipatory and consummatory ERPs across small and large rewards. 49 undergraduates completed a Monetary Incentive Delay (MID) task with large and small magnitude rewards. Anticipatory (Cue-P3, CNV, SPN) and consummatory ERPs (RewP, FbP3) were measured. ADHD symptoms were measured using Adult ADHD Self-Report Scale. Trait impulsivity was captured by UPPS Impulsive Behavior Scale (UPPS). Main effects of incentive magnitude were found for Cue-P3 ($p<.001$), CNV ($p=.05$), and SPN ($p<.001$). A main effect of magnitude ($p<.001$) and valence ($p<.05$) were observed for RewP. Main effect of magnitude also emerged for FbP3 ($p<.001$). Symptoms of ADHD and Sensation Seeking ($p<0.05$) and Positive Urgency ($p<0.05$) were positively correlated. RewP and FbP3 to small rewards were correlated with symptom scores ($p<0.05$ and $p<0.05$, respectively). Lack of Premeditation predicted RewP to small outcomes ($p<0.05$). ERPs are modulated by large and small cues, and across stages of reward. Larger reward cues may be required to fully capture the attention and approach motivation of more severe symptoms of ADHD. Discrete facets of impulsivity may differentially impact stages of reward.

1–081 | DOES THE HUNGER HORMONE GHRELIN INFLUENCE THE BRAIN'S RESPONSE TO SOCIAL RECOGNITION?

Uta Sailer[1], Federica Riva[1], Daniela Pfabigan[1,2]
[1]University of Oslo, [2]Vestfold Hospital Trust

Descriptors: Reward, Gut-Brain-Interaction, fMRI
Animal research has shown that social interaction is increased by administrating the stomach-derived hormone ghrelin, which stimulates appetite and food intake. These findings have inspired the idea of ghrelin's involvement in the valuation of other types of rewards, not only food. Hence, the aim of this pre-registered functional imaging (fMRI) study was to investigate how variation in ghrelin levels are related to neural processing of recognition by others as a social reward. In a within-group design consisting of two sessions inducing high (no-meal) vs. low (liquid-meal) levels of ghrelin, 48 healthy volunteers (12 women, 35 men, 1 undisclosed) performed a reward task during 3 T fMRI. Participants could receive social reward when their music choice was endorsed by an expert, or non-social reward when their music choice was rewarded

by a computer algorithm with 1 point. A regression analysis was conducted with BOLD difference values of liquid-meal minus no-meal sessions. Ghrelin levels (pg/ml) served as continuous predictor and mean activity of three ROIs previously implicated in social reward were the outcome variables: left and right ventral striatum, and ventromedial prefrontal cortex. Contrary to our hypothesis, ghrelin levels were not associated with ROI brain activation in response to social reward. Thus, either ghrelin's effects do not extend to social recognition as reward, or naturally varying ghrelin levels are not strong enough to induce a clear effect. Alternatively, the endorsements by putative experts might not have been perceived as sufficiently rewarding.

1–082 | ASSOCIATIONS AMONGST EARLY CARE, CURRENT STRESS, AND NEURAL RESPONSES TO SOCIO-AFFECTIVE INFORMATION IN A SAMPLE OF ADULT WOMEN

Corinne Sejourne, Clara Freeman, Aislinn Sandre, Iulia Banica, Paige Ethridge, Anna Weinberg
McGill University

Descriptors: Parenting, Stress, Neural responses
Stress is robustly associated with psychopathology risk, partly due to altered neural responses to socio-affective information. Multiple factors influence stress susceptibility, including early caregiving experiences. In particular, positive parenting (e.g., warm, sensitive) has been shown to buffer adverse effects of stress on mental health. This study sought to investigate whether early maternal care moderated the effect of proximal stress on neural processing in adult women. We examined two event-related potential (ERP) components elicited by positive feedback from peers: the P200 and the Reward Positivity (RewP). Eighty-nine primarily white women of high average socioeconomic status completed a semi-structured interview to assess recent stress, the Parental Bonding Instrument to assess parenting received in childhood, and a peer interaction task to elicit neural responses to social acceptance. We observed a significant interaction between early maternal care and current stress on P2 amplitude ($\beta = .237$, $t = 2.07$, $p = 0.04$), and a similar, though not statistically significant, effect on the RewP ($\beta = .207$, $t = 1.73$, $p = 0.09$). In women reporting medium or high levels of maternal warmth, proximal stress was not significantly associated with the P2 or RewP. In contrast, in women reporting low levels of early maternal warmth, high levels of

recent stress were associated with a blunted P2 and RewP. Taken together, these findings suggest that early parenting may protect against adverse effects of stress on neural functioning, even into adulthood.

1–083 | ELECTROPHYSIOLOGICAL NORMATIVE RESPONSES TO EMOTIONAL, NEUTRAL, AND CIGARETTE-RELATED IMAGES

Francesco Versace[1], Nicola Sambuco[2], Menton Deweese[3], Paul Cinciripini[1]
[1]*The University of Texas MD Anderson Cancer Center,*
[2]*Universita' di Bologna,* [3]*Vanderbilt University*

Descriptors: Pictures, Emotions, Late Positive Potential
To create reproducible emotional probes, affective scientists rely on sets of standardized pictures that are normed using subjective ratings of valence and emotional arousal. Here, we provide electrophysiological normative responses for 323 emotional pictures (215 from the IAPS) covering a wide range of categories (erotica, romantic, appetizing foods, landscapes, people engaged in mundane activities, household objects, disgusting objects, accidents, sad people, violence, mutilations, and cigarette-related contents). We collected event-related potentials and subjective ratings of pleasure and emotional arousal from 763 individuals (52% females, 41% white) aged between 18 and 65 (mean = 43). For each image, we calculated the mean amplitude of the late positive potential (LPP, an electrophysiological index of motivational relevance) and the mean subjective ratings of valence and arousal. We show that the subjective ratings of valence and arousal from this sample are highly correlated to the IAPS' published norms (Pearson $r = .97$ for pleasure and $r = .82$ for emotional arousal). LPP responses and subjective ratings of emotional arousal also are correlated (Pearson $r = .61$), but some categories that participants reported being significantly more arousing than neutral (i.e., food, landscapes, and unpleasant objects) did not evoke LPPs significantly different from those evoked by neutral pictures. Researchers interested in probing the brain's affective systems can use these electrophysiological normative responses to create emotional probes that evoke reliable neuroaffective responses.

1–084 | AFFECTIVE PROCESSING OF SEXUALLY REVELANT PICTURES IN HETERO- AND HOMOSEXUAL FEMALES AND MALES: MAGNETOENCEPHALOGRAPHIC CORRELATES

Sabine Prantner[1], Markus Junghöfer[2],
Alejandro Espino-Payá[2], Cristina Giménez-García[1],
Rafael Ballester-Arnal[1], M. Carmen Pastor[1]
[1]*Universitat Jaume I,* [2]*University of Münster*

Descriptors: Magnetoencephalography, Gender, Sexual Orientation
Viewing erotic pictures evokes a distinct pattern of brain activity as demonstrated by previous research. Neuroelectric correlates of gender differences showed rather heterogeneous results, with a tendency for faster and stronger brain activity in men. This study used high-density magnetoencephalography (MEG) to measure brain responses of hetero- and homosexual females and males to opposite- and same-sex romantic and pornographic images of couples. Underlying neural sources were estimated and statistically analyzed in early (0-300 ms) and late (300-600 ms) time windows. In the early time interval, romantic stimuli evoked stronger neural activity in the extended visual cortex compared to pornographic ones. This effect was especially demonstrated for females, regardless of their sexual orientation. Pornographic compared to romantic stimuli evoked increased neural activity from 300 ms post-stimulus onwards in visual cortex regions independent of gender and orientation. In the same late interval homosexual participants revealed increased reactions to homosexual contents at left-prefrontal cortex regions. Our findings suggest that gender and sexual orientation play an important role in affective processing of sexually relevant stimuli. Differences in early cortical processes support sensitivity to nude bodies in affective-motivational areas but do not replicate faster and stronger responses in males towards sexual content. This study adds to the existing literature to develop more accurate neurobiological models of sexual arousal that incorporate gender and sexual orientation.

1–085 | THE HEART OF SELF-REGULATION FOR MAKING THE RIGHT CHOICE? MORE THAN THE RESTING STATE, REACTIVITY AND RECOVERY OF HEART RATE VARIABILITY PREDICT ADVANTAGEOUS DECISION MAKING

Valentin Magnon[1], Frederic Dutheil[2], Guillaume Vallet[1]

[1]Université Clermont Auvergne, CNRS, LaPSCo,
[2]Université Clermont Auvergne, CNRS, LaPSCo, CHU Clermont-Ferrand, WittyFit

Descriptors: Vagal reactivity and recovery, Advantageous decision making, Self-regulation index

From simple everyday choices to life-altering decisions, decision-making is a crucial cognitive ability in our daily life. Heart-brain interactions theories state that heart rate variability at rest (HRV) should predict decision-making performance. More than general physiological adaptability capacities, the somatic makers hypothesis supposes that the best predictor of advantageous decision making is the current physiological state (i.e., during the decision itself). The present study compares the general physiological adaptability (resting HRV) to specific and contextual adaptation (HRV reactivity and recovery) to explain advantageous decision making. After a comprehensive screening of any potential variables likely to influence HRV (body mass index, medication use, alcohol intake...), 54 young adults completed a decision-making task (Iowa Gambling Task) while wearing a validated chest-belt heart rate monitor (PolarH10). Bayesian regressions showed that vagal reactivity and recovery combined are the preferred statistical model to explain advantageous decision-making with a bayes factor of 163.85 (revealing strong evidence for the alternative hypothesis). Those findings support the somatic marker hypothesis highlighting the key role of *in situ* physiological adaptability in decision-making processes and show that the popular often used index of general physiological adaptability (resting HRV) may not be the best predictor of decision-making performance. This finding questions the index use to assess the heart-brain interactions for other cognitive functions.

1–086 | GASTRIC INTEROCEPTION AND GASTRIC MYOELECTRICAL ACTIVITY IN INFLAMMATORY BOWEL DISEASES AND IRRITABLE BOWEL SYNDROME

André Schulz[1], Sina Welsch[1], Sarah Etringer[1], Greta Hansen[1], Léa Milbert[1], Jochen Schneider[1,2], Gennaro Taddei[3], Raquel Gomez Bravo[1], Charilaos Lygidakis[1], Zoé van Dyck[1], Annika Lutz[1], Paul Wilmes[1], Claus Vögele[1]

[1]University of Luxembourg, [2]Saarland University Medical Center, [3]Centre Hospitalier Emile Mayrisch

Descriptors: Interoception, Inflammatory bowel diseases, Irritable bowel syndrome

Visceral hypersensitivity is considered a key symptom in inflammatory bowel diseases (IBDs) and irritable bowel syndrome (IBS), both of which seriously affect health-related quality of life (QoL). Previous findings are mostly based on invasive procedures that may interfere with the assessment of visceral perception. The current study, therefore, investigates whether IBDs and IBS are characterized by altered perception of "natural" gastric distensions ("interoception"). Twenty IBD patients in remission (13 Crohn's disease, 7 ulcerative colitis), 12 IBS patients, and 20/12 matched healthy control (HC) individuals, respectively, underwent the water load test (WLT), in which they could drink *ad libitum* until the subjective thresholds of satiation (stage 1) and fullness (stage 2) were reached. Gastric motility was assessed using electrogastrography. IBD patients drank significantly more water until satiation than IBS patients, whereas no differences between patients and HC groups were observed. Electrogastrographic patterns were comparable between groups, suggesting no pathologies in gastric motility in IBD or IBS. The amount of water consumed until satiation negatively correlated with QoL related to bowel symptoms in IBD patients, but was positively associated with emotional well-being in IBS patients. Our findings implicate relative gastric hypersensitivity in IBS, and relative hyposensitivity in IBD patients, which are both related to specific QoL aspects.

1-087 | LATE BREAKING CARDIAC VAGAL RECOVERY FOLLOWING ACUTE PSYCHOLOGICAL STRESS IN HUMAN ADULTS: A SYSTEMATIC REVIEW

Charlotte Roddick, Yeon Soo (Christine) Seo, Shan-Li Barkovich, Luke Forrester, Frances Chen
University of British Columbia

Descriptors: stress, respiratory sinus arrhythmia, recovery

Cardiac vagal recovery following psychological stress is increasingly recognized as an important area of research with implications for health and well-being. However, vagal recovery has historically not been an explicit focus of research, and understanding of vagal recovery from acute psychological stress remains limited. A search of PsycINFO, MEDLINE, and the Cochrane Database of Systematic Reviews was conducted and no current or in-progress systematic reviews on

the topic were identified. To address this gap in the literature, the present review provides a systematic examination of the literature on vagally-mediated heart rate variability (vmHRV) recovery from acute psychological stress, defined as time-limited psychological tasks administered to elicit stress responses under controlled conditions. Systematic searches of the electronic databases PsycINFO (EBSCO), MEDLINE (Ovid) and EMBASE (Ovid) identified 4,580 published reports, of which 343 were included in the current review. In addition to summarizing methods used to operationalize and measure vagal recovery from acute psychological stress, this systematic scoping review clarifies experimental definitions and methodologies, discusses the evidence for potential moderating influences, identifies gaps in knowledge and suggests promising avenues for future research. By elucidating effective methodologies and salient factors which influence vagal recovery, this review may further provide a foundation on which to develop and standardize procedures for optimal measurement of cardiac vagal responses to laboratory stressors.

1-088 | LATE BREAKING
REVELIO: BRAIN POTENTIALS REVEAL A SIMILAR IMPACT OF KNOWLEDGE ON WORD-BY-WORD READING IN OLDER AND YOUNGER ADULTS

Melissa Troyer, Elizabeth Stine-Morrow, Kara Federmeier
University of Illinois, Urbana-Champaign

Descriptors: Language comprehension, Aging, Knowledge
Though language function is typically preserved into older adulthood, younger and older adults may comprehend language using different types of representations and/or by recruiting different mechanisms. Young adults are more likely to recruit left-hemisphere-dominated predictive mechanisms during comprehension, actively anticipating the form and meaning of upcoming words. By contrast, older adults, who have relatively more language experience and out-perform young adults on measures involving crystallized ability (e.g., vocabulary), may be less likely to predict specific upcoming words but show preserved activation of rich knowledge structures. Here, we recorded event-related brain potentials during word-by-word reading to examine how experience with specific domain knowledge, in this case, the fictional world of Harry Potter (HP), would influence language processing dynamics as older adults (age: 50-82) read sentences about HP. As in young adults (age: 18-30; Troyer & Kutas,

2020), variation in domain knowledge had a near-immediate influence on word processing as reflected in N400 brain potentials (known to reflect aspects of semantic access): domain knowledge influenced N400 amplitudes to contextually supported words and inappropriate continuations which nonetheless were related to the meaning of the sentence. We conclude that both older and younger adults can rapidly pre-activate rich knowledge structures as a function of domain knowledge. Future work will investigate the extent to which expertise influences word-level prediction in both younger and older adults.

1-089 | LATE BREAKING
AN ELECTROPHYSIOLOGICAL INVESTIGATION OF THE IMPLICATIONS OF BILINGUALISM AND AGING FOR LEXICAL AMBIGUITY PROCESSING

Shanna Kousaie[1], Naya Goguen[1], Emma Kazmierowski[1], Maxine Montpetit[1], Vanessa Taler[1,2]
[1]University of Ottawa, [2]Bruyère Research Institute

Descriptors: Bilingualism, Aging, Lexical ambiguity
Studies show that bilingualism may be associated with superior executive function (EF), while aging is associated with declines in EF. Some studies have found that bilingualism may buffer against age-related EF declines. EF processes are important for language processing, including processing homonyms, i.e., words with identical orthography but multiple meanings (e.g., "BANK" meaning "financial institution" or "river's edge"). Successful homonym processing requires selection of the contextually appropriate meaning while suppressing interference from the inappropriate meaning. If homonym processing requires EF, and bilingualism enhances EF, then bilingualism may benefit homonym processing, and this effect may interact with age. In this study, four groups (monolingual young (n=21) and older (n=22), and bilingual young (n=22) and older (n=21) adults) completed a sentence reading task while EEG was recorded. Participants read sentences and then decided whether a target word was related to the sentence-terminal word, which was a homonym. Sentences biased the reading of the homonym towards one meaning, and targets were (1) related to the contextually appropriate or (2) inappropriate meaning, or (3) unrelated to either meaning (e.g., sentence: "He made a deposit at the bank"; target word: (1) money, (2) river, or (3) shoe). The N400 ERP component was compared across conditions to examine the effect of Age Group and Language Group on lexical activation. Both Age and Language Group influenced N400 amplitude. Results will be discussed in the context of theories of homonym processing.

1-090 | LATE BREAKING
BEHAVIORALLY INHIBITED INDIVIDUALS EXPRESS ENHANCED ASSOCIATIVE LEARNING BUT REDUCED ACOUSTIC STARTLE: SUPPORT FOR A LEARNING DIATHESIS MODEL OF PTSD

Todd Allen
University of Northern Colorado

Descriptors: Eyeblink conditioning, Acoustic startle response
A learning diathesis model proposes that avoidant personality temperaments such as behavioral inhibition (BI) may increase the risk for PTSD through enhanced associative learning. Classical eyeblink conditioning was measured in humans with 3 US alone air puff trials and 60 tone-air puff acquisition trials using silver chloride EMG electrodes. BI individuals expressed faster acquisition of conditioned eyeblinks than non-inhibited controls but did not differ in reflexive reactivity to the air puff. One aspect of PTSD that may underlie this enhanced conditioning is an enhanced reactivity to the tone CS. Participants underwent acoustic startle responses (ASR) testing with eight trials at each of three sound intensities (82/92/102 dB) presented in a pseudorandom order. EMG recordings were used to quantify peak startle response amplitudes and latencies of eyeblinks. ASR responsivity increased as a function of intensity and habituated across repeated trials for each intensity level. Females exhibited enhanced ASR as compared to males. However, female BI individuals expressed reduced ASR. While BI individuals and females may be more sensitive to threatening or stressful stimuli, long term activation of the hypothalamic pituitary axis (HPA) in females expressing BI may lead to a down regulation of stress responses resulting in depressed ASR. Based on the current findings, enhanced eyeblink conditioning in BI individuals appears to come about through associative mechanisms and not simply greater reactivity to the tone and air puff which supports a learning diathesis model of PTSD.

1-091 | LATE BREAKING
THE INFLUENCE OF IMPLICIT BIASES ON THE PERCEPTION OF FACE MASKS: AN ERP STUDY

Riley Swain, Rochely Negron, Aminda O'Hare
Weber State University

Descriptors: face mask, face perception, ERP
Face masks help prevent the spread of respiratory infections. However, face masks cover important facial features that are key for the perception of emotions, and studies have shown that covering important facial features increases the likelihood of incorrectly identifying facial expressions. What remains to be explored is if face masks are perceived as negative or positive social stimuli. 64-channel EEG was recorded while participants completed a flanker implicit association test (IAT) to measure implicit biases associated with face masks. Negative or positive words appeared above or below face stimuli presented with or without a face mask. An interaction between face masks and word valence was found, such that negative words were categorized more quickly when paired with an unmasked face, and positive words were categorized more quickly when paired with a masked face. Robust N170 responses were found for all face stimuli, however, unmasked faces evoked larger P300 responses compared to masked faces. Finally, masked faces were rated as more pleasant than unmasked faces, increases in social anxiety were associated with increases in negative ratings of unmasked male faces, and increases in negative affect were associated with slower reaction times to negative words overall. These data indicate that perceiving faces with face masks does influence both our unconscious and conscious perception of others.

1-092 | LATE BREAKING
ABERRANT NEURAL OSCILLATIONS TO NATURALISTIC EVENT BOUNDARIES IN PERSONS WITH PARKINSON'S DISEASE

Michelle Wyrobnik[1,2,3], Elke van der Meer[2,3], Fabian Klostermann[1,2]
[1]Charité – Universitätsmedizin Berlin, [2]Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, [3]Humboldt-Universität zu Berlin

Descriptors: Event segmentation, theta and alpha power, Parkinson's disease
The perception of everyday events implies the segmentation into discrete sub-events (i.e., event segmentation). This process is relevant for the prediction of upcoming events and for the recall of recent activities. It is thought to involve dopaminergic networks which are strongly compromised in Parkinson's disease (PD), a prevalent neurological movement disorder. Accordingly, deficits in event segmentation have been previously shown but underlying neuronal mechanisms remain unknown. We therefore investigated 22 persons with PD and 22 age matched healthy controls who performed an event segmentation task while the electroencephalogram (EEG) was recorded. Both groups had to indicate the beginning of sub-events within three movies showing persons performing everyday activities. Results indicated PD-related deviance of behavioral segmentation. Further, the time frequency EEG analysis indicated reduced

theta (4-7 Hz) and alpha (8-12 Hz) oscillatory band power following the identification of event boundaries in the PD compared to the control group. Together, these findings point to disturbed event processing in PD. In particular, reduced theta band power could reflect deficits in matching the perceptual input with stored event representations resulting in altered event boundary identification. Reduced alpha power in the PD group may be understood as compensatory for this deficit, since alpha suppression is associated with the allocation of brain resources during task engagement. Overall, this could contribute to difficulties in everyday routines prevalent in persons with PD.

1-093 | LATE BREAKING
SURPRISE! FRONTO-CENTRAL BETA-BURSTS CONTAIN INFORMATION ABOUT UNEXPECTED EVENTS

Joshua Tatz, Alec Mather, Jan Wessel
University of Iowa

Descriptors: Shannon information and Bayesian surprise, Response inhibition, Oddball
Upon encountering unexpected events, rapid adjustments to action are often necessary. Many neurophysiological signatures that accompany unexpected events are also found during action stopping. Activity in the beta-frequency range (15-29 Hz) has recently been shown to be burst like, and these beta-bursts are present throughout the brain, implicated in neuropathology, and linked to action inhibition. Presently, we examined the dynamics of cortical beta-bursts following unexpected events using scalp-surface EEG. Dataset 1 (n=40) included unexpected events in auditory, visual, and haptic modalities. Dataset 2 (n=55) included unexpected events in auditory and visual modalities. A sliding window approach identified increased fronto-central (FC) beta-bursts following all types of unexpected events soon after their onset. In additional analyses, Dataset 1 was used exploratorily and Dataset 2 as validation. Using single-trial model-fitting, Shannon information positively predicted FC beta-burst rate, indicating a fine-grained representation of surprisal among the unexpected events. FC beta-bursts were also accompanied by bilateral sensorimotor β-bursts, particularly at low latencies thereafter. Relationships with RT were not found. Regarding multi-stage accounts of action stopping and unexpected event processing, the results suggest FC beta-bursts may relate to early processing stages such as saliency detection or interrupting ongoing motor and cognitive processes but are less likely to relate to the more specific adjustments posited in later processing stages. FUNDING: R01 NS102201 R01 NS117753.

1-094 | LATE BREAKING
ATTENTION TO CONDITIONED EMOTIONAL SOUNDS: AN ERP STUDY

Rochely Negron, Riley Swain, Collin Matthews, Aminda O'Hare
Weber State University

Descriptors: Attention, Emotional Conditioning, ERP
Emotional stimuli are more likely to capture our attention in our daily lives. People process emotional images differently than they do non-emotional images. Research regarding emotional sounds is less substantial, though there is evidence that we give more attention to emotional sounds and process them differently than non-emotional sounds. However, how do sounds that are inherently non-emotional get processed when they become associated with emotion? We recorded 64-channel EEG to click sounds, before and after an emotional conditioning task, where each click sound was paired with a different emotional sound. Participants did not display any conscious awareness of the emotional conditioning, as indicate by valence ratings of the click sounds before and after conditioning and a click sound–valence pairing task. However, preliminary analyses suggest differences in early attention ERPs to the click sounds paired with emotional sounds after the conditioning paradigm compared to before. These data suggest that non-emotional, seemingly benign sounds, such as clicks, dings, and other notification sounds can become attentionally salient and distracting if they co-occur with other emotional information.

1-095 | LATE BREAKING
PHYSIOLOGY-SUBJECTIVE EXPERIENCE COHERENCE AND INTEROCEPTION

Sasha Sommerfeldt, Richard Davidson
University of Wisconsin, Madison

Descriptors: coherence, interoception, stress
Coherence between physiological activity and subjective experience represents a step beyond simple awareness of internal body states (i.e., interoception), as individuals must not simply be aware of their physiology, but interpret what physiological signals mean for more complex emotional or stress states. It is as yet undetermined whether conscious awareness of physiological signals is necessary for strong coherence between physiology and subjective states, as this synchrony between the two systems may occur without conscious awareness of the physiology. We thus investigated the relationship between heart rate-subjective stress coherence and interoceptive accuracy (performance on a heartbeat detection task), insight (accuracy-confidence

correspondence), and sensibility (scores on the Multidimensional Assessment of Interoceptive Awareness) in a subsample of N = 21 individuals who are part of a larger ongoing study (these individuals participated prior to a pandemic-necessitated pause to data collection). We found that heart rate-subjective stress coherence was not significantly associated with interoceptive accuracy, b = 0.000, F(1, 14.53) = 0.012, p= .914, insight, b = 0.071, F(1, 10.70) = 0.049, p = .829, nor sensibility, b = 0.001, F(1, 14.76) = 0.002, p = .964. The small sample of course limits our power to detect effects, but future analyses of the entire sample will shed more light on whether conscious awareness of physiology is necessary for strong coherence between physiology and subjective mental states.

1-096 | LATE BREAKING
USING FMRI-GUIDED TMS TO ALTER THE ACTIVITY OF THE AMYGDALA: A PILOT STUDY USING THE LATE POSITIVE POTENTIAL

Austin Gallyer, Jon Ryan, Thomas Joiner, Derek Nee, Greg Hajcak
Florida State University

Descriptors: Late Positive Potential, TMS, fMRI
The salience network is a key network for detecting threat, and is involved in a variety of psychiatric disorders. One way to measure salience network activity is the late positive potential (LPP). Building off of our work on the reward positivity, in this proof-of-concept study, we sought to determine whether intermittent theta-burst stimulation (iTBS) to a region of the prefrontal cortex (PFC) that is functionally connected to the amygdala can increase the LPP to affective stimuli. Participant's (n = 3) stimulation sites were individually determined using fMRI connectivity data during an affective picture viewing task. Participants were then tested on separate days, one week apart, where either the active site or a control site (i.e., V1) was stimulated with iTBS, an up-regulatory type of transcranial magnetic stimulation (TMS). Immediately following TMS, participants completed a picture-viewing task while undergoing EEG. We used a 3 (picture type: positive, negative, & neutral) X 2 (stimulation site: V1 & PFC) within-subjects ANOVA. We found an interaction between picture type and stimulation site F(2, 4) = 8.60, p = 0.036. When we probed this interaction, we failed to find

a significant difference in the delta positive LPP between control vs. PFC stimulation t(2) = 2.79, p = 0.108, or a difference in the delta negative LPP between control vs PFC stimulation t(2) = -2.04, p = .178. Our contrasts of interest were not significant, but they were in the expected direction, showing that fMRI-guided TMS may show promise in altering amygdala activity as reflected in the LPP.

1-097 | LATE BREAKING
PREDICTING MULTI-TIMESCALE LONG SHORT-TERM MEMORY MODEL HIDDEN STATES WITH EEG INDICATES THE TIMELINE OF THE BRAIN IN PROCESSING INFORMATION OF DIFFERENT TIMESCALES IN CONTINUOUS TEXT COMPREHENSION

Sijie Ling, Alona Fyshe
University of Alberta

Descriptors: language comprehension, electroencephalogram, semantic representations
As we listen to speeches the brain performs multiple levels of computation, from the understanding of individual words to comprehending the arc of a story. Recently, computational models have been developed that also process text on multiple levels. These models, called multi-timescale long short-term memory (MTLSTM) models use information of different timescales to predict the next word in a sequence. However, the link between these new LSTMs and the brain has not been explored. Here, we use EEG recorded when subjects (n=15) passively listen to Alice in Wonderland chapter 1 (Shohini et al., 2020). We train ridge regression models that use patterns in the EEG to predict the different timescales of an MTLSTM model (Shivangi et al., 2020) processing the same text. For long timescale clusters, we find that prediction accuracy is significantly better than chance for most of the -2s to 2s window surrounding the onset of the word. For short timescale clusters, prediction is significantly better than chance both around the onset of words (-0.12s to 0.63s) and at time points distant from word onset (1.58s, 1.16s, 0.46s before the onset and 2s after the onset). This indicates that the short and long timescales of the MTLSTM model have a connection to language understanding in the brain, and that the brain handles long and short timescale information differently. Both kinds of information are largely activated near the word onset. At other time points, long timescale information is continuously processed while processing of short timescale information follows an oscillation.

1-098 | LATE BREAKING
DISTINGUISHING NEURAL CORRELATES OF FEAR AND ANXIETY SENSITIVITY: AN FMRI INVESTIGATION OF NEGATIVE PICTURE PROCESSING

Shannon MacDonald, Annmarie MacNamara
Texas A&M University

Descriptors: Anxiety sensitivity, Fear, fMRI

Fear and anxiety sensitivity (the belief that anxiety symptoms or arousal can be harmful/"fear of fear") are transdiagnostic constructs that may help parse heterogeneous diagnostic categories into more homogeneous, neurobiologically-based constituents, laying the groundwork for more targeted classification and treatment of internalizing disorders. Here, fifty-two adults (37 female; M = 23.65 years, SD = 9.69) who all shared a common "focal fear" diagnosis (i.e., specific phobia or performance-only social anxiety disorder), but varied in the extent of additional comorbid anxiety and mood disorders, passively viewed negative and neutral pictures while fMRI BOLD was recorded. Analyses focused on identifying the unique neural correlates of fear and anxiety sensitivity, above and beyond the other dimension. Results indicated that individuals with increased fear symptoms showed reduced negative > neutral BOLD in the thalamus, suggesting avoidant processing of negative stimuli. On the other hand, individuals with increased anxiety sensitivity showed heightened negative > neutral BOLD in the insula, a brain region implicated in interoception and pathological anxiety. Findings reveal distinct neural correlates of fear and anxiety sensitivity, which might serve as candidates for a more fine-grained means of conceptualizing and treating internalizing psychopathology.

1-099 | LATE BREAKING
SPOTLIGHT ON THE ERP STUDIES OF MIGRAINE: THE USE OF PORTABLE EEG HEADBANDS TO TRACL ALTERED ATTENTIONAL RESPONSES IN MIGRAINE HEADACHE DISORDERS

Faly Golshan[1], Marla Mickleborough[1], Daniel Moss[1], Gloria Sun[1], Janeen Loehr[1], Olav Krigolson[2]
[1]University of Saskatchewan, [2]University of Victoria

Descriptors: Event-related potentials and oddball paradigm, migraine headaches, visual attention

When it comes to cognitive anomalies of migraine, more information is required to elaborate on the how attention is impacted by migraine compared to other types of non-migraine headaches. We categorized 75 headache sufferers in the migraine (n=42) and non-migraine control (n=33) group. Event-related potentials (ERP) were collected during a visual oddball paradigm task in the headache-free (interictal) phase. We used a portable EEG headband (MUSE) for EEG data collection and focused on N200 and P300 amplitude and latency. By analyzing the N200 and P300 ERP components, migraineurs had a heightened oddball response showing increased amplitude in N200 and P300 difference scores for the oddball vs. standard, while the latencies of the two components remained the same in the migraine and control groups. We then looked at two classifications of migraine with and without aura compared to non-migraine controls. One-Way ANOVA analysis of the two migraine groups and the non-migraine control group showed that the difference level of N200 and P300 amplitude mean scores was greater between migraineurs without aura and the control group while these components' latency remained the same relatively in the three groups. Our results give more neurophysiological support that people with migraine headaches have altered processing of visual attention. We suggest that portable EEG headbands could be more convenient for migraine population as they could cause less discomfort especially in further studies that tend to look at electrophysiological responses during a migraine (ictal) attack.

1-100 | LATE BREAKING
ALCOHOL USE, CRAVING, AND AUTONOMIC NERVOUS SYSTEM FUNCTIONING IN YOUNG ADULTS

Sara McFarland, Katie Ison, Dexton Berger, Heather Kissel, Ty Brumback
Northern Kentucky University

Descriptors: Alcohol use, HRV, Craving

The autonomic nervous system (ANS) is integral for regulating affective and stress responses, including reactions to alcohol cues and the experience of craving, and is also known to be negatively affected by heavy alcohol consumption in alcohol dependent adults. However, specific relationships linking the ANS to alcohol craving and alcohol use during young adulthood are not well understood. Theoretically, heart rate variability

(HRV) could be a predictor of craving and alcohol use (e.g., a biological vulnerability model) or as an outcome predicted by alcohol use (e.g., a biological consequence model). We tested these models in a sample of 71 young adults (74% female; mean age 20.2) in two path models assessing the relationships among ANS activity (indexed by HRV RMSSD), alcohol craving, and alcohol use. The first assessed HRV as a predictor of craving and alcohol use. The second examined if alcohol use is related to HRV and craving. Results showed support for HRV as a predictor of craving (β=0.70, p=.04), with craving predicting alcohol use (β=2.89, p>.001). Further, multiple group analyses by sex revealed an effect of alcohol use on HRV in males only (Use→HRV: β=.64, p=.04; HRV→Craving: β=1.20, p=.04). Thus, our data provides some support for both a biological vulnerability model and a biological consequence model of ANS function related to alcohol craving and use. Future studies could assess longitudinal changes to better characterize chronological associations between ANS functioning, craving, and alcohol use.

1-102 | LATE BREAKING
HEALTHY HAND CLASSIFICATION ACCURACY DURING BCI-FES THERAPY CORRELATES WITH UPPER EXTREMITY MOTOR FUNCTION IMPROVEMENT

Sebastian Sieghartsleitner[1,2], Marc Sebastián-Romagosa[3], Woosang Cho1[1,4], Johannes Grünwald[1,2], Micah Ching[5], Christoph Guger[1]
[1]g.tec Medical Engineering GmbH, [2]Johannes Kepler[5] University, [3]g.tec Medical Engineering Spain SL, [4]International Max Planck Research School for Neural & Behavioral Sciences, [5]g.tec neurotechnology USA Inc.

Descriptors: EEG, Motor, Cognitive
Stroke is a leading cause of mortality and disability in adults 50 years and older. Brain-computer interface (BCI) systems providing functional electrical stimulation (FES) are effective in facilitating upper extremity motor recovery after stroke. However, predictors of motor recovery are still missing. The current work is based on 48 chronic patients who were treated using a BCI FES system for the upper extremity. Patients performed left and right wrist dorsiflexion motor imagery (MI) and were provided feedback, if the BCI system detected MI of the correct hand. The feedback mechanism were FES and visual feedback by a realistic avatar. Upper extremity motor function was quantified using the Fugl-Meyer Assessment for the upper extremity (FMA-UE). Patients' change in FMA-UE was independent of patients' baseline characteristics, as well

as gender t(45.9)= -0.05, P= 0.9642. However, the ability to control the BCI using MI was related with the experienced motor function improvement. Specifically, the classification accuracy for the healthy side showed a correlation with FMA-UE improvement (r= 0.3987, P= 0.0050). One possible explanation for this observation is the hyperexcitability of the contralesional hemisphere during MI of the affected side, which is associated with lesser recovery. If the contralesional hemisphere shows similar activation patterns in both cases, this would lead to less discriminative features between the two conditions. As a result, the classification accuracy for the healthy side would also be worse even-though the motor imagery was correctly performed.

1-103 | LATE BREAKING
EFFECTS OF COGNITIVE DEMANDS IN ACUTE EXERCISE ON INHIBITORY CONTROL AND ITS ELECTROPHYSIOLOGICAL INDICES: A RANDOMIZED CROSSOVER STUDY

Ting-Yu Chueh, Tsung-Min Hung
National Taiwan Normal University

Descriptors: acute exercise, ERP, inhibitory control
The present study aimed to examine the effects of cognitive demands in acute exercise on behavioral and electrophysiological correlates of inhibitory control. In a within-subjects design, thirty young male adults performed sessions of 20 min high cognitively demanding exercise (HE), low cognitively demanding exercise (LE), and active control (AC) on separate days in randomized order. A modified flanker task was administered to assess inhibitory control before and after the treatments, while electroencephalography was recorded to derive N2 and P3 components. Participants exhibited better in inhibitory control task, as indicated by significantly shorter reaction times (RT) regardless of congruency and less RT flanker effect following HE and LE compared to AC conditions with large and medium effects, respectively. The electrophysiological data revealed that acute bouts of HE and LE resulted in facilitative effects on stimuli evaluation, as indicated by significantly shorter N2 latency for congruent trials and P3 latency regardless of congruency compared to AC conditions with medium effects. Moreover, only acute HE elicited more efficient neural processes in condition requiring high inhibitory control demands, as measured by shorter N2difference latency, compared to AC condition with medium effect. Overall, the current findings suggest that acute bouts of both LE and HE improve inhibitory control and its electrophysiological substrates of targets evaluation. Acute HE may provide extra benefit

to neural processing for tasks demanding greater amounts of inhibitory control.

1-104 | LATE BREAKING
HOW DID I LOSE AGAIN? PERFECTIONISM AND THE GAMBLER'S FALLACY DURING SLEEP DEPRIVATION

Andrew Armstrong[1], Timothy Murphy[1], Danielle Molnar[1], Natalia Kubishyn[2], Lacey Sherk[1]
[1]Brock University, [2]Western University

Descriptors: Sleep Deprivation, Perfectionism, Gambler's Fallacy

Sleep deprivation has consistently been associated with cognitive impairments; however, how these impairments interact with cognitive biases and personality measures are less well studied. One cognitive bias, the Gambler's Fallacy, is a belief that a previous independent event will alter your current odds or outcome. Perfectionism has often been thought to be associated with superior performance; but also interferes with performance and is not a unitary construct. Two facets of perfectionism, self-oriented perfectionism (SOP) and socially prescribed perfectionism (SPP), were investigated during alert and sleep-deprived conditions through electrophysiological measures (P3) collected during a gambling task. The P3 is thought (in part) to represent the attention allocated to a stimulus; therefore, each successive loss in a gambling paradigm should garner increased attention, especially if one is prone to the Gambler's Fallacy. We measured the average P3 amplitude after the 2nd and 4th consecutive loss, and the difference between these was taken as a measure of the Gambler's Fallacy. Fifteen participants (12 f, Mage 22 years) completed a gambling task that was analogous to a coin flip. Multiple regression analyses found that the difference in P3 amplitudes for the sleep-deprived condition significantly predicted the SOP but not SPP. The alert condition had no significant relationship with either SOP or SPP. The results indicate that those higher in self-oriented perfectionism may be more susceptible to the Gambler's Fallacy when sleep deprived.

Poster Session 2

Thursday, September 29, 2022

2-004 | WORKING MEMORY PROCESSING OF EMOTIONAL STIMULI IN YOUNG INDIVIDUALS WITH TYPE-1 DIABETES

Geisa Gallardo-Moreno, José Gómez-Barba, Andrés González-Garrido
University of Guadalajara

Descriptors: Working Memory, Emotion, Type-1 Diabetes
Recent research has shown differential neural activation patterns in patients with Type-1 diabetes (T1D) during the performance of working memory (WM) tasks, which have been explained as an expression of a neural compensatory strategy developed to endure cognitive efficiency despite the deteriorating effects of the disease. However, the influence of emotionally salient stimuli during WM tasks has not been studied. The aim of this study was to compare neurofunctional activation patterns between T1D patients and healthy controls while performing a visuospatial WM task using facial emotional stimuli. Twenty-one right-handed, normal IQ, young participants with T1D with no significant medical history of diabetic complications nor inadequate glycemic control, and 19 healthy controls matched by age, gender and educational level, completed an fMRI visuospatial WM paradigm with neutral and happy facial expressions that were pseudorandomly presented in different screen locations. Participants had to remember the order of presentation and their corresponding location. After a short delay, a second sequence was presented and subjects had to determine if it corresponded, or not, to the inverse spatial order of the first sequence presented. Behavioral results showed significant differences in the accuracy rates between happy and neutral conditions, but no difference between groups. The fMRI analysis showed that patients had greater frontal activations suggesting that cognitive-emotional interaction processing could be affected in T1D and should be further assessed.

2–005 | SENSORY GATING SOURCE LOCALIZATION AND ITS RELATION TO COGNITIVE FUNCTIONING IN SCHIZOPHRENIA

Emily Martinez[1], Anika Guha[1], Morgan Bartholomew[2,3], Alexandra Reed[4,5], Caroline Dieh[1], Kaia Sargent[1], Logan Andrews[1], Jessica Thoma[1], Kenneth Subotnik[1], Joseph Ventura[1], Gregory Miller[1], Keith Nuechterlein[1], Cindy Yee[1]
[1]*University of California, Los Angeles,* [2]*San Francisco Veterans Affairs Health Care System,* [3]*University of California, San Francisco,* [4]*Veterans Affairs Connecticut Health Care System* [5]*Yale University*

Schizophrenia (SZ) is associated with abnormalities in sensory gating, the filtering-out of irrelevant sensory input to facilitate processing of pertinent information. Reduced sensory gating in SZ is believed to contribute to downstream impairments in attention, working memory, and processing speed. Although auditory sensory gating is widely measured using the scalp P50 ERP component, evidence is limited regarding which brain structures generate P50, how these sources behave differently during gating in SZ, and whether sources differentially influence cognitive functioning. In the present study, clinically stabilized SZ outpatients and healthy comparison participants (HC) listened to paired-click stimuli as EEG was recorded. Cognition was assessed using a standardized cognitive assessment battery. Replicating Williams et al. (2011), scalp EEG was transformed to source space and dipoles were seeded in bilateral hippocampus, thalamus, superior temporal gyrus, and dorsolateral prefrontal cortex. HC showed greater lateralization of these sources than SZ, but there was no evidence of group differences in relative contributions of sources to scalp P50. The groups showed different associations between source contributions and cognitive performance, with recruitment of hippocampus associated with better attention and working memory for HC but not SZ, and no differences for processing speed. Taken together, these findings support the role of sensory gating in cognitive functioning and demonstrate source-level differences that are associated with specific cognitive impairments in SZ.

2–006 | THE SELF-REFERENCE EFFECT: SELECTIVE MODULATION OF THE N170, P300, AND LPP

Chengli Huang[1], James Butterworth[1], Douglas Angus[2], Constantine Sedikides[1], Nicholas Kelley[1]
[1]University of Southampton, [2]Bond University, Queensland

Descriptors: Self-reference effect, Authentic self, Presented self
Information processing is enhanced when the self is salient. The literature on this *self-reference effect* has compared self-referent judgments to a variety of others – celebrities, close friends, and strangers. However, research has yet to examine how different components of the self contribute to the self-reference effect, or the cognitive processes underlying it. The current study fills this gap by examining how the authentic and presented self contribute to the self-reference effect. Participants ($N = 44$) judged whether 400 trait adjectives represented their authentic and presented selves while their brain activity was recorded with electroencephalography. Behaviorally, participants endorsed more positive (vs. negative) traits as self-descriptive. This effect was significantly stronger for the presented (vs. authentic) self. When making judgements about the presented self, participants were faster to endorse positive (vs. negative) traits. An opposite pattern emerged when making judgments about the authentic self. Event-related potential analyses revealed that the N170 was larger for negative (vs. positive) traits descriptive of the authentic self, but the opposite pattern emerged for traits descriptive of the presented self. The P300 was larger for positive (vs. negative) traits descriptive of the authentic (but not presented) self. The LPP was larger for negative (vs. positive) traits descriptive of the presented (but not authentic) self. These results suggest that self-referential information processing is contingent on the aspect of the self that are salient.

2–008 | TRANSCUTANEOUS VAGUS NERVE STIMULATION VS. SLOW-PACED BREATHING: COMPARING TWO PSYCHOPHYSIOLOGICAL METHODS TO INCREASE CARDIAC VAGAL ACTIVITY

Uirassu Borges[1], Julian Tryba[1], Sylvain Laborde[1,2]
[1]German Sport University Cologne, [2]University of Caen Normandy

Descriptors: non-invasive auricular vagus nerve stimulation, heart rate variability, neurovisceral integration model
Cardiac vagal activity (CVA) has been positively associated with cognitive, affective, and health-related outcomes. Importantly, it can also be enhanced via an array of methods. Two non-invasive methods, namely slow-paced breathing and transcutaneous auricular vagus nerve stimulation (taVNS), have especially gained interest in recent years. However, although the mechanism of action of both methods relies on a similar rationale, slow-paced breathing has been showing robust positive effects on CVA, whereas taVNS has been showing mixed evidence. This discrepancy might be due to studies testing these methods in different populations and with different study designs. In our study, we test the effects of slow-paced breathing and taVNS on CVA in the same population along with a standardized protocol for both methods. Fifty-nine participants (15 female, $M_{age} = 24$ years old, $SD = 3.3$) took part in this study with a within-subject design. CVA, measured via the root mean square of successive differences (RMSSD), was higher during slow-paced breathing compared both to baseline ($p < .001$) and during taVNS ($p < .001$), whereas no effects of taVNS on RMSSD could be found during the stimulation. Furthermore, these effects of slow-paced breathing were transient, with CVA decreasing and respiratory frequency increasing back to its resting levels after the stimulation period ($p < .001$). The results indicate that slow-paced breathing may be more suitable to increase CVA than tVNS.

2–009 | REDUCING UNCERTAINTY ABOUT THE EFFECT OF INTOLERANCE OF UNCERTAINTY ON THE ERROR-RELATED NEGATIVITY: A RANDOMIZED CONTROLLED TRIAL

Hannes Carsten, Kai Härpfer, Anja Riesel
University of Hamburg

Descriptors: error-related negativity, intolerance of uncertainty, symptom induction
The error-related negativity (ERN) has been linked to individual differences in intolerance of uncertainty (IU). Previous findings imply associations between the subconstructs of IU (prospective and inhibitory IU) and the ERN, which we ought to replicate and extend by testing for causality. To test cross-sectional and longitudinal effects of IU on the ERN, a preregistered, randomized-controlled design was employed. After measuring the baseline ERN of $N = 120$ university students, a subsample was randomly assigned to two

groups: While an intervention group ($n = 30$) performed an unsolvable probabilistic "learning" task intended to induce uncertainty, a passive control group ($n = 30$) rested. Subsequently, the ERN was assessed again (T1). Self-reported uncertainty was assessed before and after T0 and T1. Cross-sectionally no effects of IU on the ERN emerged. Longitudinally, the intervention group displayed increased self-reported uncertainty after the intervention, but no evidence emerged for ERN alterations attributable to the intervention. The link between individual differences in IU and the ERN might be much smaller and less robust than previous findings suggest, reflecting the understudied character of this association. The absence of evidence for mechanistic changes in the ERN due to a successful induction of uncertainty further questions a link between IU and the ERN. In line with previous studies linking increased ERN to anxiety independent of clinical status, the ERN seems unaffected by short-term changes such as symptom provocations for non-clinical populations.

2–010 | PATTERNS OF NORMOGASTRIC ACTIVITY DURING INDUCTIONS OF NEGATIVE EMOTIONALITY AND EMOTION DYSREGULATION

Abigail Szkutak[1], Megan Renna[2], Jean Quintero[1], Douglas Mennin[1]
[1]Teachers College, Columbia University, [2]The University of Southern Mississippi

Descriptors: emotion dysregulation, distress, health
Despite the connection between chronic emotional distress, disruptions in physiological processes, and negative health consequences (e.g., gastrointestinal symptoms), no studies have examined changes in normal gastric activity (normogastria) during state emotionality and emotion dysregulation (ED). This study examined normogastria during laboratory inductions of emotionality and ED in two diverse, undergraduate samples. In study 1, 97 participants (37.1% White) viewed emotional (fear, sadness) film clips. Results yielded significant differences between baseline, fear, and fear recovery, $F(1.72,130.61) = 4.88$, $p = .01$, partial eta squared $= .06$; normogastria was lower during the fear versus fear recovery conditions, $p = .02$. No differences in normogastria were found between baseline, sadness, and sadness recovery ($p = .31$, eta $= .02$). In study 2, 29 participants (33.3% White) completed ED (worry, rumination) inductions. Results revealed differences in normogastria between baseline, worry, and worry recovery, $F(2,38) = 3.81$, $p = .03$, eta $= .17$, and baseline, rumination, and rumination recovery, $F(2,34) = 3.45$, $p = .04$, eta $= .17$. Pairwise comparisons showed lower normogastria during worry versus worry recovery ($p = .04$) and marginally lower normogastria during rumination versus rumination recovery ($p = .07$). Taken together, findings from both studies demonstrate common disruptions in normal gastric activity during fear and ED, providing evidence for reduced normogastria as a potential biomarker of emotional distress and dysregulation.

2–011 | THE RELATIONSHIP BETWEEN BEHAVIOURAL AND NEURAL STABILITY DURING AUDITORY-MOTOR SYNCHRONIZATION

Rebecca Scheurich, Ella Sahlas, Valentin Begel, Olivia Ellis, Caroline Palmer
McGill University

Descriptors: behavioural stability, neural stability, auditory-motor synchronization
We investigated the relationship between behavioural and neural stability during auditory-motor synchronization. Previous research suggests neural oscillations that are locked to the frequency of auditory stimuli support auditory-motor synchronization (Nozaradan, Peretz, & Keller, 2016). However, the underlying oscillatory dynamics and their relationship to behaviour remain incompletely understood. In the current study, participants tapped a familiar melody at a comfortable rate. They subsequently synchronized their tapping of the same melody with a metronome set to their comfortable rate and slower (more demanding) rates while EEG was recorded. Behavioural stability of auditory-motor synchronization was measured by the standard deviation of the signed asynchronies (difference between tap and metronome onsets). Recurrence Quantification Analysis (RQA), a non-linear time series technique for quantifying system dynamics, was run on EEG activity at each performance rate. Neural stability was then measured by meanline, an outcome derived from RQA and related to mathematical stability. Results suggested that individuals with increased behavioural stability tend to also show increased neural stability, particularly at slower rates. These findings suggest that stability of oscillatory neural dynamics supports auditory-motor synchronization with increasing task demands.

2–012 | DO YOU REMEMBER YOUR TIMES TABLES? EXAMINING THE NEURAL MECHANISMS OF ANALYTICAL REASONING THROUGH MATHEMATICS

Katherine Boere, Olave Krigolson
The University of Victoria

Descriptors: EEG, decision making, fNIRS
Daily decisions range from fast, intuitive responses to slow deliberations. For example, what is the solution of two plus two? Effortlessly, most of us automatically know the answer before reading to the end of sentence four. However, what happens when the question becomes more challenging such as; 16 times 7? In this case, the answer does not come easily, and the brain must recruit engagement of high-level cognitive mechanisms to calculate the answer of 112 systemically. These two scenarios illustrate our different modes of thinking, commonly classified as intuitive (System 1) and analytical (System 2). Here, we sought to extend previous research in our lab (Williams et al., 2019), which characterized System 1 by an increase in parietal alpha power whereas System 2 by an increase in frontal theta power. Participants completed easy and hard math questions while electroencephalography (EEG) and functional near-infrared spectroscopy (fNIRS) were recorded. Interestingly, our results contradict our previous findings and suggest that both systems require increased frontal theta and parietal alpha activity. The finding alludes to the overlap between these modes of thinking and demonstrates that even when we think we are rational in our decisions, our System 1 biases may still drive many of our choices. Understanding the neural mechanisms and interplay of these two systems of thought may help us become aware of the bias in our choices daily – and how to avoid it.

2–013 | DEPRESSION SYMPTOMS AND STRESSFUL LIFE EVENTS PREDICT THE DEVELOPMENT OF THE REWARD POSITIVITY ACROSS ADOLESCENCE

Aline Szenczy[1], Elise Cummings[1], Greg Hajcak[2], Brady Nelson[1]
[1]*Stony Brook University*, [2]*Florida State University*

Descriptors: RewP, Depression, Stress
A blunted reward positivity (RewP), an event-related potential measure of reward system activation, has been associated with risk for the development of adolescent-onset depression. There is growing evidence that the RewP increases across adolescence and that it may interact with stress to predict increased depressive symptoms. However, most studies have examined the RewP at just two time points and no studies have examined within-person changes in the RewP across adolescence into young adulthood. Moreover, it is unclear whether childhood risk factors, such as early-life depression and stressful life events, might predict the developmental course of the RewP. In a sample of 315 8- to 14-year-old girls ($M_{age} = 12.45$, $SD_{age} = 1.73$), the present study examined self-report measures of depression symptoms (Children's Depression Inventory) and stressful life events (Adolescent Life Events Questionnaire) at baseline and the ΔRewP (i.e., gain-loss) during the doors guessing task at baseline, 2-year, and 4-year follow-ups. Multilevel modeling indicated that, across all participants, the ΔRewP did not change across adolescence. However, baseline depression symptoms moderated within-person changes in the ΔRewP, such that the ΔRewP demonstrated a linear increase across adolescence, but only for individuals who had low depression symptoms. Identical results were found for stressful life events. The present study suggests that childhood-onset depression and stressful life experiences impact the development of reward-related brain activity across adolescence.

2–014 | LATE BREAKING
THREAT PERCEPTION AND COGNITIVE EMOTION REGULATION: INVESTIGATING THE EFFECT OF EVOLUTIONARY RELEVANCE

Agnieszka Adamczyk[1,2], Jacobien van Peer[1], Miroslaw Wyczesany[2]
[1]*Radboud University*, [2]*Jagiellonian University*

Descriptors: reappraisal, distraction, event-related potentials
Evolutionary old threats (ET) elicit increased attention and emotional responses compared to modern threats (MT). The present study investigated whether this makes the processing of ET less susceptible to emotion-regulation (ER) via higher-order cognitive strategies. To this end, we compared: (i) the neural processing (with event-related brain potentials) of high- and low-threat images of evolutionary (snakes, lizards) and modern (guns, water-guns) origin and (ii) cognitive emotion regulation of responses via distraction and reappraisal to high-threat images (snakes and guns) in 61 female adults. We measured the parieto-occipital Early Posterior Negativity (EPN, 225-300 ms), a marker of early automatic attention, and the centro-parietal Late Positive Potential (LPP, 400-3000 ms), a marker of sustained motivated attention which is

sensitive to ER. Results showed that snakes (and lizards) elicited increased attention and emotion processing compared to guns (and water-guns) at both early (EPN) and late (LPP) processing stages. However, subjective as well as LPP responses to both types of high-threat images were successfully downregulated with the use of both ER strategies, although distraction downregulated LPP responses earlier and stronger than reappraisal. This shows that neural responses to both threat types are susceptible to voluntary cognitive ER but distraction might be more effective than reappraisal in the downregulation of immediate emotional responses to visual threats at the neural level–a finding which may have implications for the treatment of anxiety disorders.

2–015 | LEVERAGING WEARABLE SENSORS TO EVALUATE PERSON-SPECIFIC SKIN CONDUCTANCE

Cassidy Fry, Zita Oravecz, Timothy Brick, Lisa Gatzke-Kopp
Pennsylvania State University

Descriptors: skin conductance, wearable devices, ecological momentary assessment

The use of wearable devices to assess psychophysiological function in daily life opens new avenues of scientific advancement. However, many challenges remain to be addressed in applying decades of laboratory-based, between-person research into a real-world, within-person framework. We explore some of these challenges using skin conductance (SC) data collected continuously throughout a 28-day ecological momentary assessment study in 25 participants ($M_{age} = 32$; 32% male). Self-report measures were obtained 6x per day, resulting in 168 assessments per participant. This same time period resulted in approximately 448 hours (26,880 min) of SC data per participant. Raw data indicate that SC is highly skewed across participants ($M_{skew} = 7.1$) with the majority of timepoints having values near 0. Whereas all participants had minimum values near zero (range = .0003-.001μS), there was substantial range in the maximum value observed across participants (range = 13.6–224.2 μS). Strategies employed to clean data based on concurrent cardiac and temperature measures did not alter these observed ranges. We examine approaches for managing the unique cleaning and data reduction needs of such intensive data. We also examine strategies that take advantage of the unique nature of these data. Specifically, we examine whether person-specific ranges reflect psychologically meaningful between-person differences, and whether correcting for differences in range (transforming all values to reflect a proportion of the person-specific range) reveals meaningful within-person associations with self-reported data.

2–016 | GRADED AND UNGRADED EXPECTATIONS: PREDICTION DYNAMICS DURING ACTIVE COMPREHENSION

Melinh Lai[1], Brennan Payne[2], Kara Federmeier[1,3]
[1]*University of Illinois, Urbana-Champaign,* [2]*University of Utah,* [3]*Beckman Institute for Advanced Science and Technology*

Descriptors: Prediction, ERP, Late anterior positivity

To more precisely delineate the impact of prediction on semantic access and revision processes, we took advantage of the fact that the tendency to engage in prediction is not ubiquitous, but instead is subject to some degree of strategic control (Payne & Federmeier, 2017; Ness & Meltzer-Asscher, 2021). Thus, we promoted prediction in participants reading strongly and weakly constraining sentences with expected or unexpected endings by simply instructing them to actively predict the ends of each sentence. We recorded event-related potentials (ERPs) and compared them with those recorded during a prior block wherein participants simply read similar items for comprehension, much like in the paradigm introduced by Brothers et al. (2017). We found that expectancy effects on the N400 (linked to semantic access) were larger in the active prediction block than in the passive comprehension block. In addition, there were enhancements of the frontal negativity that has been described for moderately predictable words (Wlotko & Federmeier, 2012). However, the anterior positivity elicited by prediction violations was unaffected by the increased motivation to predict, consistent with other work showing that the positivity is similarity unaffected by reduced attention (Hubbard & Federmeier, 2021). Taken together, the results show that the basic engagement of prediction might be an all-or-none – as opposed to a graded – process. However other processes that are not necessarily specific to prediction can be enhanced when prediction is encouraged.

2–017 | UPLIFTING STORIES: EMBODIED PROCESSING AND RESPONSES TO ELEVATION ELICITING VIDEO CONTENT

Di Mu[1], Yen-I Lee[1], Ashley Churchill[2], Layne Russell[3], Avonte Kiper[4], Linh Nguyen[5], Paul Bolls[1]
[1]*Washington State University,* [2]*NielsenIQ,* [3]*Unaffiliated,*
[4]*Curate Insights,* [5]*MediaScience*

Descriptors: Elevation, Emotion, Prosocial Motivation
Elevation has been categorized as moral emotion (Haidt, 2000) and can be broadly conceptualized as a unique positive feeling emerging from the perception of prosocial human acts demonstrating the goodness of the human race. Building on elevation literature, this study argues to reconceptualize elevation as a cognitive and emotional process under the media psychophysiology paradigm (Potter & Bolls, 2012), and understand the mechanism of how elevation is evoked and built across time to impact people's prosocial motivation after viewing meaningful media content. This study was conducted in a 2 (Elevation high vs. low) x 3 (Videos) within-subjects repeated measures design to answer these questions. Participants ($N = 54$) were recruited from a Southwest university. Participants completed a self-reported survey after viewing 6 randomized videos. Arousal, cognitive attention, and emotion were measured by skin conductance, heart rate, and three channels of fEMG. Results showed that high elevation videos increased positive emotion (Begin $M = -77.73$; End $M = -46.00$) and cardiac deceleration (Begin $M = -4.46$; End $M = -5.38$) across time, but decreased arousal (Begin $M = -.12$; End $M = -.80$). Low elevation videos increased negative emotion (Begin $M = -7.57$; End $M = -.03$), but decreased arousal (Begin $M = -.18$; End $M = -1.18$). Additionally, high elevation videos increased elevation ($M = 5.96$) and prosocial motivation ($M = 5.76$) compared to low elevation videos. The results evidence reconceptualizing elevation and suggest that media content with high elevation encourages prosociality.

2–018 | ELUCIDATING THE COMPUTATIONAL PROCESS OF MULTI-EVIDENCE EMOTION-RELATED PERCEPTUAL DECISION-MAKING

Hilary Ngai[1], Janet Hsiao[1], Christian Luhmann[2], Aprajita Mohanty[2], Jingwen Jin[1]
[1]*The University of Hong Kong,* [2]*Stony Brook University*

Descriptors: Emotion, Decision making, Attention
Judging the emotion valence of a visual scene often requires us to combine emotion information from various sources. Previous research show that humans can extract a summary statistic to form quick categorical judgments, while downweighing extreme evidence. However, extreme emotional evidence carries salient information, making downweighing counterintuitive. Also, findings from fast decisions are not necessarily generalizable to deliberate decisions when sufficient time and repeated sampling of the evidence space is allowed. Overall, the process of how humans make categorical judgments about the overall emotion when facing multiple pieces of evidence remains to be elucidated. Using eye tracking and computational modeling in two tasks involving emotion expressions ($N = 33$), we examined the 1) subjective valuation 2) evidence sampling and 3) integration of emotion evidence. Participants viewed multiple images with expressions ranging in a fearful-to-happy spectrum before deciding whether the faces were more fearful or happy on average (Task 1), and provided subjective emotion ratings of each image presented (Task 2). Eye-movement pattern showed extreme emotions were sampled more, and computational modeling revealed extreme emotions were weighed equally or even higher. Moreover, subjective, but not objective emotion values, predicted subsequent decisions. By delineating the emotion-related multi-element deliberate decision-making process, this study revealed humans do not downweigh extreme emotion evidence. These findings are important in basic and clinical science.

2–019 | ACTIVATION OF TINNITUS ASSOCIATED NETWORK IS TINNITUS-FREQUENCY SPECIFI: AN MEG STUDY

Christian Dobel[1], Vasiliki Salvari[2], Daniela Korth[1], Christo Pantev[2], Evangelos Paraskevopoulos[3]
[1]*Jena University Hospital,* [2]*University of Muenster,*
[3]*University of Cyprus*

Descriptors: tinnitus, magnetoencephalography, connectivity
Tinnitus pathopsysiology has been associated with an atypical cortical network that involves structural changes of auditory and non-audiotry areas. Numerous resting state studies have replicated a tinnitus brain network to be signifcantly different from healthy-controls. Yet it is still unknown whether the cortical reorganization is attributed to the tinnitus frequency specifically or if it is frequency irrelevant. By means of magnetoencephalography (MEG), the current study aimed to identify frequency-specific activity patterns by using an individual tinnitus tone (TT) and a 500 Hz-control tone (CT) as auditory stimuli, across 54 tinnitus patients. The obtained MEG data were analyzed in brain source space and for functional connectivity with a whole-head in a data-driven approach. The results of event related source space analysis revealed a statistically significant cortical activation by TT that involved fronto-parietal

regions compared to the CT that mainly involved typical auditory activation-related regions. Behavioral measurements assessing tinnitus distress and psychopathological symptoms were also provided and predicted activity in tinnitus-related regions. Overall, the results suggest frequency-specify of tinnitus-tone cortical patterns. In line with previous studies, we have demonstrated thus a tinnitus frequency specific network comprising left fronto-temporal, fronto-parietal and tempo-parietal junctions. FUNDING: German Research Council / DFG.

2–020 | EFFECTS OF NONINVASIVE BRAIN STIMULATION ON HEART RATE AND HEART RATE VARIABILITY: A SYSTEMATIC REVIEW AND META-ANALYSIS

Maximilian Schmaußer[1], Sven Hoffmann[2], Markus Raab[1,3], Sylvain Laborde[1,4]
[1]German Sport University, [2]University of Hagen, [3]London South Bank University, [4]Université de Caen Normandie

Descriptors: Non-invasive brain stimulation, Heart Rate Variability, Meta analysis
Noninvasive brain stimulation (NIBS) techniques such as transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (tDCS) are widely used to test whether specific cortical regions contribute to various cognitive and affective processes. Despite the capability of NIBS to test causal directions, this approach has been rarely used to investigate the cortical control of autonomic nervous system functions such as heart rate (HR) and heart rate variability (HRV) and to test current models in this regard. In this pre-registered systematic review and meta-analysis, we aimed to examine, whether NIBS represents an effective method for altering HR and HRV, and to evaluate whether the ANS is modulated by cortical mechanisms affected by NIBS. Here we followed the PRISMA guidelines. In a series of four meta-analyses, a total of 131 effect sizes from 35 sham-controlled trials were analyzed employing random-effects meta-regressions. NIBS was found to effectively modulate HR and HRV with small to medium effect sizes. Moderator analyses yielded significant differences in effects between stimulation of distinct cortical regions. Our results suggest that NIBS is a promising tool to investigate the cortical regulation of ANS, which may add to the results of brain imaging studies and animal models. Future research is needed to identify further factors modulating the size of effects. As many of the studies reviewed were found to be at high risk of bias, we recommend that in the design and conduct of future studies methods that reduce potential risk of bias should be used.

2–021 | THE SIGNIFICANCE OF INTERNAL ERRORS AFFECTS THE PROCESSING OF EXTERNAL ACTION EFFECTS

Robert Steinhauser[1], Robert Wirth[2], Wilfried Kunde[2], Marco Steinhauser[1]
[1]Catholic University of Eichstätt-Ingolstadt, [2]Julius-Maximilians-University Würzburg

Descriptors: error monitoring, action-effect monitoring, attention
The human performance monitoring system constantly monitors internal states such as cognitive conflict and prediction errors to detect erroneous behavior and to initiate adjustments. This internal error monitoring is complemented by the inclusion of external information that may be suitable to assess the correctness of current behavior such as the direct sensory consequences of that behavior, so-called action effects. In the present EEG study, we investigated whether the inclusion of such external information depends on how important the detection of errors is for the current goal. To this end, we created speed and accuracy conditions by incentivizing fast and accurate responses, respectively, and measured EEG correlates of performance monitoring (ERN, Pe, frontomedial theta) as well as correlates of the attentional processing of task-irrelevant action effects (lateralized alpha suppression). In addition to slower responses and lower error rates, we found the accuracy condition to feature increased activity related to error monitoring. Likewise, action effects were attentionally processed to a higher degree in this condition, even for correct responses. We interpret this as evidence for an adaptive performance monitoring system that is able to gather information from many sources of evidence, particularly if the current goals necessitate such an effort.

2–022 | HEART RATE AND HEART RATE VARIABILITY AS PHYSIOLOGICAL MARKERS FOR OBSESSIVE–COMPULSIVE DISORDER: EVIDENCE FROM PATIENTS AND UNAFFECTED RELATIVES

Franziska Jüres, Julia Klawohn, Björn Elsner, Christian Kaufmann, Norbert Kathmann
Humboldt-Universität zu Berlin

Descriptors: obsessive–compulsive disorder, heart rate, healthy first-degree relatives

Several psychiatric disorders are characterized by altered activity of the autonomic nervous system (ANS), such as aberrant heart rate (HR) and heart rate variability (HRV). Further, HRV has already been identified as a predictor of therapy response. To date, only few studies with relatively small sample sizes examined HR and HRV in obsessive–compulsive disorder (OCD). This study investigated HR and HRV as potential risk factors and candidate endophenotypes for OCD. A 5-minute resting state electrocardiogram was recorded in 125 patients with OCD, 141 healthy participants, and 52 healthy first-degree relatives of patients with OCD. We examined group differences in HR and HRV in subsamples matched for age and gender. In the subsample of patients with OCD and healthy participants, patients showed higher HR and lower HRV compared to healthy participants. No group differences in HR or HRV were found between the subsamples of patients with OCD, first-degree relatives, and healthy participants. This study demonstrates aberrant ANS activity in patients with OCD, marked by high HR and low HRV. Since no deviant ANS activity in healthy first-degree relatives was found, high HR and low HRV cannot be confirmed as endophenotypes for OCD. In addition, HF and HRV were analyzed as predictors for treatment outcome in patients. First results show predictive utility of HRV, particularly in female patients with OCD. Altogether, these results support the clinical significance of HR and HRV and their potential to enhance our understanding of the pathophysiology of OCD.

2–023 | PROBLEMATIC SMARTPHONE USE IS ASSOCIATED WITH A REDUCTION IN POSITIVE, BUT NOT NEGATIVE, REWARD PREDICTION ERRORS

Emily Gost, Kate Cowger, Robert West

DePauw University

Descriptors: reward, addiction, smartphone
Smartphones have become a nearly ubiquitous component of daily life for many individuals. The widespread adoption of smartphones has been accompanied by the emergence of problematic or pathological use of these devices with meta-analytic work revealing that nearly 20% of individuals may experience problematic use. In previous research (West et al., 2021) we observed that problematic smartphone use was associated with a reduction in the amplitude of ERP components elicited by both gains and losses in the modified 2-doors task in the person select trials, and not in the computer select trials. In the current project we utilized a frequency based approach to examine the relationship between problematic

smartphone use and activity in the Delta (2-3 Hz) and Theta (4-6 Hz) EEG bands. Power in both frequency bands revealed an agent x outcome interaction consistent with the idea that Delta reflects positive prediction errors, while Theta reflects negative prediction errors. Delta activity for gains was negatively correlated with problematic smartphone use ($r = -.29$, CI[$-.09$ to $-.47$]), while the correlation between smartphone use and Theta ($r = -.04$, CI[.16 to $-.24$]) was not significant. These data are consistent with the neural imbalance theory of addiction suggesting that pathological use is associated with a disruption of positive, but not negative, reward prediction errors.

2–024 | DISTINCT PATTERNS OF ONGOING AND EVENT-RELATED ALPHA ACTIVITY RELATED TO MIND WANDERING IN THE SART TASK

Lucy Salter, Aaniyah Childs, Rudrayani Upadhyay, West Robert

DePauw University

Descriptors: mind wandering, alpha, sustained attention
Mind wandering is related to a variety of negative outcomes including reductions in memory encoding and reading comprehension, and traffic and work related accidents. The impact of mind wandering in these different domains has led researchers to examine the subjective, behavioral, physiological, and neural correlates of off target thought using different methodologies. The sustained attention to response task (SART) in combination with subjective thought probes is one commonly used measure to explore mind wandering. In the task, individuals respond to most digits while withholding a response to the digit 3. At quasi-random intervals individuals are asked to report their subjective state (i.e., whether they are thinking about the task or something else). Previous research has revealed that power in the alpha band is related to mind wandering; however, the nature of this association is inconsistent across studies. In the current study, we addressed the possibility that one reason for the inconsistency is that there may be multiple patterns of alpha in the ongoing and event-locked EEG that are differentially related to mind wandering. Consistent with this idea we found that greater ongoing occipital-parietal alpha (8-12 Hz) was related to mind wandering, while event-related alpha revealed both increases (8-10 Hz) and decreases (11-12 Hz) related to mind wandering that differed in topography. These findings indicate that it is important to consider the timing, frequency, and topography of activity within the Alpha band when studying mind wandering.

2–025 | REWARD RESPONSIVENESS (BAS) FACILITATES GAINING CONTINGENCY AWARENESS IN APPETITIVE, YET NOT AVERSIVE, CONDITIONING

Johannes Finke, Tim Klucken
University of Siegen

Descriptors: pavlovian conditioning, contingency awareness, BIS/BAS

The distinction between Behavioral Activation and Inhibition Systems (BAS/BIS) has been proposed to reflect the neurocognitive underpinnings of individual differences in approach vs. avoidance tendencies. In the present study, we investigated how BIS and BAS modulate the capacity to gain insight into stimulus-outcome contingencies during associative learning. 58 participants, left uninformed about the nature of the task, underwent a differential conditioning paradigm involving presentation of visual conditioned stimuli (CS) paired with either aversive (electric shock) or appetitive (monetary reward) unconditioned stimuli (UCS; 65% reinforcement), or no outcome. Results showed that scores on the BAS-subscale 'reward responsiveness' predicted differential UCS expectancy (CS+ vs. CS-) for the appetitive CS+ (as well as categorization as aware), whereas in aversive conditioning no such associations emerged (with BIS being unrelated to awareness). The relationship proved robust when controlling for potential influences of 'Big 5' personality traits. In contrast, there were no associations of BAS or BIS with the strength of conditioned responses at the physiological level, i.e. differential pupil as well as skin conductance responses (which, however, were modulated by contingency awareness in turn). Our findings indicate that (1) reward sensitivity is indeed dissociable from more general individual differences in associative learning, and (2) higher levels of reward sensitivity prime individuals for detecting and processing reward contingencies at a conscious level of cognition.

2–026 | CLARIFYING SEX DIFFERENCES IN ADHD-RELATED ALPHA ASYMMETRY PATTERNS ACCOUNTING FOR AEPERIODIC EEG POWER SPECTRUM FEATURES

McKenzie Figuracion, Jason Dude, Sarah Karalunas
Purdue University

Descriptors: Alpha Asymmetry, EEG, ADHD

Background: Considerable research has focused on the etiology of Attention-Deficit/Hyperactivity Disorder (ADHD) but whether mechanisms differ for females and males remains unclear. Electroencephalogram (EEG)-assessed patterns of alpha asymmetry is of particular interest however sex-specific results have been inconsistent. Here, we examine sex-specific patterns of alpha asymmetry using a novel spectral parameterization approach. Methods: 272 children (Male = 175; ADHD = 162) participated in a larger study where 64-channel resting-state EEG was recorded. Alpha power at each electrode was determined using the *specparam* (Donoghue et al., 2020) to account for both aperiodic activity and individual differences in alpha center frequency and bandwidth. Alpha asymmetry was calculated at frontal and parietal locations. Results: EEG frontal and parietal alpha asymmetry was not significantly related to sex or ADHD diagnosis and there was no sex by ADHD status interaction ($ps > .05$). However, there was a significant sex by diagnosis interaction for alpha center frequency at parietal sites, such that females with ADHD had higher peak frequency at left parietal locations than their non-ADHD female peers whereas the opposite pattern existed for males ($p = .027$). Discussion: Frontal alpha asymmetry may not be associated with ADHD using optimal parameterization approaches. Future studies considering emotional heterogeneity within the ADHD group will be important. In contrast, individual differences in lateralized posterior alpha power may reflect a sex-specific neural marker of ADHD.

2–027 | THE LATE POSITIVE POTENTIAL MEDIATES THE ASSOCIATION BETWEEN PARENTAL HISTORY OF DISTRESS DISORDERS AND FIRST-ONSET DEPRESSIVE DISORDERS IN ADOLESCENT GIRLS

Jacob Feldman, Greg Perlman, Daniel Klein, Roman Kotov, Brady Nelson
Stony Brook University

Descriptors: LPP, Depression, Mediation

A parental history of psychiatric disorders is a well-established risk factor for psychopathology in offspring. Parental distress disorders (depressive disorders, generalized anxiety disorder, and posttraumatic stress disorder) have been associated with a blunted late positive potential (LPP), a psychophysiological indicator of the motivational salience of stimuli, in adolescent girls with no lifetime history of depression. Moreover, a blunted LPP has been shown to predict the development of adolescent-onset depressive disorders. However, these results have been examined independently, and no study has tested whether the LPP mediates the association between parental risk and adolescent-onset depressive disorders. The present study examined the LPP to neutral, pleasant, and unpleasant pictures in a sample of 421 community-dwelling adolescent

girls ($M_{age} = 14.38$ years-old, $SD = 0.63$) with no lifetime history of depressive disorders. A parent completed the Structured Clinical Interview for DSM-IV to assess lifetime history of distress disorders, and the adolescent completed the Kiddie Scheduled for Affective Disorders and Schizophrenia at 9, 18, 27, and 36-month follow-ups to assess for first-onset depressive disorders. Results indicated that a blunted LPP to all stimuli mediated the relationship between parental distress disorders (i.e., risk) and first-onset depressive disorders at the 36-month follow-up. Overall, the present study supports a blunted LPP as a mechanistic biomarker for adolescent-onset depressive disorders.

2–028 | GENDER DIFFERENCES IN EMOTION PROCESSING: AFFECTIVE RATINGS AND PERIPHERAL PHYSIOLOGY DURING A MUSIC LISTENING TASK

Nieves Fuentes-Sánchez[1], Miguel A. Escrig[1], Fernando Sales[1], Marta Saez-Royela[1], Helena Gascó-Izquierdo[1], Tuomas Eerola[2], M. Carmen Pastor[1]
[1]*Universitat Jaume I,* [2]*Durham University*

Descriptors: Emotion, Music, Gender Differences
Prior research has shown controversial findings regarding gender effects on emotion processing. Additionally, most of the past literature has focused on emotional pictures but not on other affective stimuli such as music. This study aimed to explore gender differences in autonomic reactivity and affective self-reports elicited during a music listening task. A total of 110 volunteers (60 women) listened to standardized soundtracks (14 positive, 14 negative, 14 neutral) from the Film Music Stimulus Set (FMSS) presented during 8 s while electrodermal activity (EDA) and heart rate (HR) were continuously recorded. After excerpts offset, affective ratings (valence, energy arousal) were collected in a Likert 1–9 scale. Results showed that men responded with greater EDA during listening to pleasant and unpleasant music –suggesting enhanced sympathetic activation for motivationally significant and most arousing stimuli–, in comparison to women. By contrast, greater HR deceleration was found for women during listening to both neutral and emotional excerpts, suggesting overall enhanced parasympathetic activation, compared to men. Regarding affective ratings, similar patterns of evaluation were found regardless of gender, which demonstrated that music excerpts were subjectively evaluated similarly for both men and women. Taken together, our findings add empirical evidence to the field concerning the role of gender as an important source of variability to be considered when exploring physiological responses to music, both in healthy and clinical populations.

2–029 | POSITIVE AND NEGATIVE AFFECT AND TRAIT ANXIETY INFLUENCES ON EMOTION REACTIONS TO MUSIC: PHYSIOLOGICAL CORRELATES OF SYMPATHETIC AND PARASYMPATHETIC ACTIVATION

Nieves Fuentes-Sánchez[1], Miguel A. Escrig[1], Helena Gascó-Izquierdo[1], Marta Saez-Royuela[1], Tuomas Eerola[2], M. Carmen Pastor[1]
[1]*Universitat Jaume I,* [2]*Durham University*

Descriptors: Affect, Anxiety, Autonomic Reactivity
Emotional processing could be influenced by individual factors such as the variations in overall positive or negative emotionality. However, only a few studies have investigated how such individual differences could modulate subjective and physiological reactions to affective stimuli. This study addresses the influence of self-reported positive and negative affect, as well as trait anxiety, on the emotional reactions to music stimuli in a sample of 83 undergraduates (46 women). Volunteers completed the questionnaires and then listened to 42 standardized excerpts from the Film Music Stimulus Set (FMSS) presented during 8 s while autonomic measures were continuously recorded. Subjective ratings of discrete emotions (happiness, anger, fear, tenderness, sadness) were collected after music offset using a 9-point Likert scale. Pairwise correlations and linear regressions showed that scores of positive affect were significantly related to enhanced electrodermal activity and less cardiac deceleration, as well as to higher subjective ratings of happiness prompted by the music excerpts. By contrast, scores of negative affect were significantly associated with higher ratings of anger to music excerpts. In terms of trait anxiety, findings revealed that scores in this self-report questionnaire were significantly related to higher cardiac deceleration. Taken together, our findings suggest that self-reports of positive affect were associated with psychophysiological correlates of sympathetic reactivity, whereas trait anxiety seemed to be related to measures of parasympathetic activation.

2–030 | TIME-FREQUENCY POWER AND PHASE-SYNCHRONY SIGNATURES OF REACTIVITY TO VISUAL ALCOHOL CUES

Roberto Cofresi[1], Santiago Morales[2], Thomas Piasecki[3], Bruce Bartholow[1]

[1]University of Missouri, Columbia, [2]University of Southern California, [3]University of Wisconsin, Madison

Descriptors: addiction, alcohol, drug

Differences in neurophysiological reactivity to drug-related cues track risk for substance use disorders. Prior studies have used ERPs to characterize processing of drug compared to non-drug visual cues. This approach is limited because ERPs represent only phase-locked neural signals – not leveraging all the information contained in the EEG. Here, we applied time-frequency methods to utilize phase-locked and non-phase-locked signals and separately measure power and phase-synchrony in the EEG recorded during a visual cue reactivity task. The task was completed by a large sample of healthy regular drinkers ($N = 290$ [53% female, 86% White], $M_{age} = 19.55$ yr). Using permutation-based significance testing, we found that decreases in alpha band power were greater, and increases in inter-trial phase synchrony (ITPS) were weaker, for alcohol compared to non-alcohol cues over both frontal and posterior scalp sites. Given the link between alpha band activity and attention, this finding suggests more attentional resources are devoted to drug than non-drug cues. Increases in delta band power and ITPS over posterior scalp sites were greater for alcohol than non-alcohol cues. In contrast, increases in theta band power and ITPS over frontal scalp were weaker for alcohol than non-alcohol cues. Given that delta and theta band activities are linked with bottom-up and top-down attention control systems, respectively, our findings suggest that drug cues engage both bottom-up and top-down attentional control systems yet more readily engage the former than do non-drug cues.
FUNDING: This work was supported by NIH grants AA025451 (BDB, TMP), AA025451-05S1 (RUC), and AA013526 (RUC).

2–031 | LOW-FREQUENCY DEEP BRAIN STIMULATION OF THE SUBTHALAMIC NUCLEUS MAINTAINS COGNITIVE CONTROL

Rachel Cole[1], James Cavanagh[2], Arun Singh[3], Jan Wessel[1], Arturo Espinoza[1], Brooke Yeager[1], Jeremy Greenlee[1], Nandakumar Narayanan[1]

[1]University of Iowa, [2]University of New Mexico, [3]University of South Dakota

Descriptors: deep brain stimulation, conflict, frontal theta power

Cognitive control, the set of mental processes that facilitates goal-directed behavior, is impaired in many individuals with Parkinson's Disease (PD). Cognitive control is associated with an acute increase in frontal midline theta power. Notably, during tasks that require cognitive control, PD patients exhibit a smaller increase in prefrontal cortex theta power than non-PD older adults, suggesting theta-band oscillations are affected by the pathophysiology of PD. High-frequency deep brain stimulation (DBS) of subcortical nuclei is often used to treat motor symptoms in PD patients who do not respond well to medication, yet this treatment can cause further deficits in cognitive control. We tested whether stimulating the subthalamic nucleus at theta frequency (4 Hz), compared to clinical high-frequency stimulation (~130 Hz), could increase frontal theta power and improve cognitive performance on the MultiSource Interference Task (MSIT), a Stroop-like task involving conflict-related slowing. This study included 20 PD patients (4 female) with chronic subthalamic nucleus DBS. Neither conflict-related reaction time nor frontal theta was directly affected by low-frequency stimulation. We also tested whether stimulation affected the natural trial-by-trial relationship between theta power and reaction time. Surprisingly, we found no differences in the theta power-reaction time relationship between the OFF stimulation, 130 Hz stimulation, and 4 Hz stimulation conditions. These findings provide valuable insight for the alteration of DBS parameters to improve cognitive function.
FUNDING: NIA F32AG069445 to Rachel Cole NINDS R01NS100849-01A1 to Nandakumar Narayanan, Jeremy Greenlee, and James F Cavanagh.

2–034 | PERCEPTIONS OF STRESS, RESTING PARASYMPATHETIC ACTIVITY, AND INDIVIDUAL DIFFERENCES IN CHILDREN'S VALUE-BASED DECISION MAKING

Karen Smith, Seth Pollak
University of Wisconsin, Madison

Descriptors: Early Life Stress, Parasympathetic Nervous System, Value-Based Decision Making

Learning when environmental cues signal potential rewards and threats and using that information to guide behavior is critical for survival. Chronic or extreme stress in childhood has been linked to alterations in these processes, but findings are still inconsistent. Resting parasympathetic activity, which has been linked to flexible adaptation in the context of motivated responding, may

influence variability in how children respond to stress. In the current study, we examined associations between children's perceptions of stress, resting parasympathetic activity, and children's use of learned information to approach and avoid rewards and threats. Measures of resting parasympathetic activity and perceived stress were collected from twenty-two eight- and nine-year-old children. Children also underwent an instrumental conditioning paradigm to assess their approach and avoidance of rewards and threats. Higher levels of perceived stress were associated with increased avoidance of both rewards and threats, but only in children with lower levels of resting parasympathetic activity. In contrast, children with higher levels of perceived stress and higher levels of resting parasympathetic activity demonstrated increased avoidance only for threats. Overall, this research suggests resting parasympathetic activity moderates how stress influences children's effective use of learned value information. We discuss these findings in terms of the role resting parasympathetic activity may play in facilitating adaptive responses to stress.

2–035 | PUPILLARY RESPONSE TO ACOUSTIC AND CATEGORICAL DEVIANCE: WERE ALL DEVIANTS CREATED EQUAL?

François Vachon[1], Alexandre Marois[2], Katherine Labonté[3], Annie Desmarais[4], John Marsh[5]
[1]Université Laval, [2]Thales Research and Technology Canada, [3]McGill University, [4]Université de Montréal, [5]University of Central Lancashire

Descriptors: Auditory deviance, Pupillometry, Auditory distraction

The brain is deemed monitoring for unexpected irregularities: the detection of events violating model predictions tends to trigger a pattern of mismatch neural responses that signals a global state change in the environment, calling for an update of the environmental representation. Among these responses is a transient pupil dilation. In the auditory domain, there is ample demonstration that acoustic deviations evoke such pupil dilation response (PDR). However, it remains unclear whether violations at the semantic level within auditory stimulations are also endowed with the power to elicit a PDR. In the field of auditory distraction, both acoustic and categorical deviations have been shown to impair performance; yet current evidence suggests that these two forms of distraction may be underpinned by distinct mechanisms. An examination of the pupillary response to these two types of deviant event could certainly help resolving this issue. In order to contrast the PDR in the contexts of acoustic and semantic deviance, an unpredictable change of voice or of semantic category (e.g., a digit among letters) was randomly inserted in a to-be-ignored auditory sequence while monitoring the pupil diameter of participants performing visual-verbal serial recall. The results showed that both types of deviant disrupted recall, but only acoustic deviants elicited a PDR. These findings suggest that acoustic and semantic regularities are processed differently in the brain and provide further dissociation between the acoustic and the categorical deviation effects.

2–036 | THETA ACTIVITY (4–7 HZ), NOT THE ERN, PREDICTS ADAPTIVE TASK BEHAVIOR AND COPING WITH REAL-LIFE STRESS IN A PEDIATRIC SAMPLE

Gil Shner Livne[1], George Buzzell[2], Tomer Shechner[1]
[1]University of Haifa, [2]Florida International University

Descriptors: Theta, Error-related Negativity (ERN), Error Monitoring

The current study examined differences in error-related *Theta* activity (4–7 Hz) and the *Error-related negativity* (ERN), two neural processes associated with error-monitoring, and their unique associations with in-task behavioral adaptations as well as coping with real-life stress a year later in youth. Seventy-six youth (8–13 years) completed an arrow version of the flanker task while EEG was recorded (t_0). Approximately one year later, during the first COVID-19 lockdown, 40 families from the original sample completed a battery of online questionnaires to assess stress-related symptoms and coping (t_1). Response-related EEG data were analyzed using a method that allows for differentiating between induced theta and the evoked ERN, which reflect different aspects of the same EEG signal (Cohen & Donner, 2013). Results revealed that theta difference scores (error-correct), but not ERN, predicted better overall task accuracy ($p = .013$), as well as faster post-error response times ($p = .05$). Theta difference scores at t_0 also predicted better coping, as indicated by fewer worries/negative emotions ($p = .045$) and less COVID-19 specific worries ($p = .025$) one year later. Although ERN difference scores (ERN-CRN) predicted more COVID-19 worries ($p = .036$), this effect was mainly

driven by the CRN. These data highlight dissociations in the functional significance of theta and the ERN. Induced theta exhibits more robust associations with adaptive behavior, across levels of analysis, including more local prediction of task behavior and more distal prediction of coping in real-life situations.

2–038 | PARIETO-OCCIPITAL ALPHA REDUCTION TO AUDITORY CONDITIONED THREAT VARIES AS A FUNCTION OF MISOPHONIA SYMPTOM SEVERITY

Faith Gilbert, Payton Chiasson, Skylar McIlvanie, Ryan Mears, Jourdan Pouliot, Kierstin Riels, Caitlin Traiser, Richard Ward, Andreas Keil
University of Florida

Descriptors: alpha power changes, misophonia, aversive auditory conditioning

Misophonia is a largely under-examined condition characterized by strong aversive reactions to everyday trigger sounds, such as chewing, smacking, sniffling, etc. It has been hypothesized that Misophonia has shared symptomology (and potentially shared neural correlates) with other clinical diagnoses; in particular, fear and anxiety disorders. The present study sought to examine neural and behavioral responses to aversively conditioned sounds in participants high and low in Misophonia symptoms. Specifically, alpha power changes—an index of aversive conditioning—were quantified as learning progressed. Ratings of valence, arousal, and expectancy as well as continuous EEG data (used to extract alpha power reduction) were collected from 42 individuals. In an aversive generalization learning paradigm, participants listened to 3 different sine tones (320 Hz, 541 Hz, 914 Hz), where only one tone (CS+) was paired with a loud 92 dB white noise (US), but the other tones (GS) were not. Parieto-occipital alpha power changes in response to tone cues were measured through wavelet analysis. Across the whole sample, parieto-occipital alpha selectively decreased in response to the CS+. Participants scoring high in Misophonia showed greater discrimination between the CS+ and the GS, with the correlation between Misophonia symptoms and parieto-occipital alpha CS+ selectivity exceeding Pearson rs of .5. Thus, parieto-occipital alpha may represent a measure of conditioned auditory threat, which varies as a function of dysfunctional auditory hypersensitivity.

2–039 | THE IMPACT OF VALUE ON SENTENCE PROCESSING AND DOWNSTREAM MEMORY: AN ERP STUDY

Winnie Chung, Kara Federmeier
University of Illinois, Urbana-Champaign

Descriptors: Prediction, Sentence memory, Value-directed remembering

Little is understood about how people process and remember important but complex information like sentences. We investigate the relationship between selective engagement of prediction strategies and its downstream consequences for memory by recording ERPs in a value-directed remembering (VDR) paradigm adapted for sentences. Participants read sentences that differed in constraint strength (how strong a prediction a reader is likely to make) and the predictability of the sentence-final words. Each sentence was associated with a high or low number representing reward value for correctly remembering the sentence in subsequent memory tests. This value was given before each sentence, allowing participants a chance to differentially engage in processing strategies. Preliminary results suggest that processing strategies differ by item value: First, high-value items elicit more N400 facilitation (smaller amplitudes) for weakly supported predictions (WCE) compared to low-value items. Second, high-value items for prediction violations from strongly constraining sentence frames (SCU) elicit an anterior positivity, while expected completions of these items (SCE) yield a frontal negativity. A similar dissociation between the anterior positivity for prediction violations and the frontal negativity for expected words was recently observed in a study that explicitly instructed participants to predict sentence endings during reading which, with these data, further suggest that readers may selectively engage in active reading strategies like prediction for valuable information.

2–040 | MORNING VERSUS EVENING EXERCISE – WHAT'S BETTER FOR YOUR DIET? EVIDENCE FROM AN EVENT-RELATED POTENTIAL (ERP) STUDY

Tracy Bertka[1], Carly Romero[1], James LeCheminant[2], Kaylie Carbine[1], Michael Larson[2]
[1]California State University, Dominguez Hills, [2]Brigham Young University

Descriptors: P3, Inhibitory control, Food
Food-related inhibitory control, or one's ability to withhold dominant responses to desired foods, is an important factor in managing diet and health. Acute aerobic exercise may improve food-related inhibitory control, but it is unclear if morning or evening exercise may be more beneficial. We tested if food-related inhibitory control, as measured by the P3 event-related potential (ERP), differed after morning or evening moderate exercise. 138 participants ($M_{age} = 25.67$; 54% female) attended two sessions held a week apart, either both in the morning (7-10 am; $n = 71$) or evening (7-10 pm; $n = 67$). One session was a seated rest and the other was walking on a treadmill at 3.8mph, both for 45 minutes. After each, they completed two food go/no-go tasks, one where they withheld responses to high-calorie foods and one where they withheld responses to low-calorie foods, while EEG data were recorded. A 2-time (morning/evening) x 2-session (rest/exercise) x 2-task (high/low-calorie) repeated measure ANOVA for the P3 difference amplitude showed a significant main effect of task, with the high-calorie task eliciting a larger inhibitory response than the low-calorie task ($p < .001$). The effects of time, exercise, and any interactions were not significant ($ps > .063$). Regardless of the time of day or exercise, individuals require increased recruitment of inhibitory control resources to withhold from eating high-calorie compared to low-calorie foods. Future research could consider how health factors (e.g., BMI status) may interact with exercise and food-related inhibitory control.
FUNDING: Brigham Young University Office of Research and Creative Activities.

2–041 | CAPACITY FOR COGNITIVE SKILL LEARNING AS A PROTECTIVE FACTOR AGAINST COGNITIVE DYSFUNCTION IN PEOPLE WITH MULTIPLE SCLEROSIS: EVIDENCE FROM EVENT-RELATED POTENTIALS

Thomas Covey, Janet Shucard, David Shucard
University at Buffalo

Descriptors: multiple sclerosis, neuroplasticity, learning
Multiple Sclerosis (MS) is a neurodegenerative disease that can negatively impact cognitive functioning. Resiliency to cognitive decline in MS (i.e., cognitive reserve) has been associated with the engagement in cognitively enriching activities over the lifespan. We hypothesize that an individual's capacity to quickly learn and optimize cognitive skills may be an important component of the accumulation of cognitive reserve. To test this hypothesis, we examined the relationship between neural indices of cognitive skill learning and clinically validated neuropsychological tests in people with MS. People with MS completed twenty sessions of a cognitive skill learning protocol using an adaptive n-back task procedure. Before and after training, event-related potential (ERP) measures were obtained for a visual-verbal 3-back task (similar to the training task) to evaluate the change in neural activity associated with n-back practice. Neuropsychological performance was assessed with the Symbol Digit Modalities Test (SDMT), the Paced Auditory Serial Addition Test (PASAT) and the Raven's Advanced Progressive Matrices (RAPM). Correlation analyses indicated that training-induced amplitude enhancement in the P1 component latency range was significantly associated with better PASAT performance, and amplitude enhancement in the N2 component latency range was significantly associated with better SDMT, PASAT, and RAPM performance. The findings indicate that the capacity for neuroplasticity induced by cognitive skill learning is associated with protection against cognitive dysfunction in MS.
FUNDING: Pilot Grant from National Multiple Sclerosis Society Research Grant from National Multiple Sclerosis Society.

2–043 | YOUTH CARDIAC RESPONSE DURING THREAT CONDITIONING

Zohar Klein[1], Rany Abend[2], Tomer Shechner[1]
[1]University of Haifa, [2]National Institute of Mental Health

Descriptors: Anxiety, Fear learning, Cardiac response
Major theories link aberrant threat learning to the emergence of anxiety. Specifically, elevated heart rate (HR), low heart rate variability (HRV) and greater heart rate deceleration (fear bradycardia) in response to fear-evoking stimuli are suggested as potential biomarkers for anxiety among adults. Given that anxiety typically emerge during adolescence, linking pediatric anxiety to variation in cardiac response during threat learning is paramount for informing on anxiety etiology. One hundred and fifty-four youth (ages 7–17 years) completed an age-appropriate differential threat conditioning task. During conditioning, one cue (CS+; threat) was repeatedly paired with an aversive sound (US); a second cue (CS−; safety) was never paired with the US. During threat extinction, cues were presented without reinforcement. Electrocardiogram (ECG) was recorded continuously, and anxiety severity was assessed

using anxiety-related questionnaire. Results reveal that anxiety severity was positively associated with HR and negatively associated with HRV during both threat acquisition and extinction. Moreover, high-anxious youth showed greater differential fear bradycardia (threat versus safety) during extinction compared to the low-anxious youth. Finally, sex differences were observed with decreased HRV during extinction in girls compared to boys. The study provides preliminary support for the association between anxiety severity and aberrant cardiac response during threat learning that is already evident during childhood, suggesting a potential biomarkers for such psychopathology.

2–044 | RESPIRATORY SINUS ARRHYTHMIA AS A PROTECTIVE FACTOR IN RELATIONS BETWEEN NARCISSISM, PROBLEM DRINKING, AND AGGRESSION

Kyle Rawn, Peggy Keller
University of Kentucky

Descriptors: respiratory sinus arrhythmia, parasympathetic nervous system, personality and aggression

Much research finds that narcissism is related to greater aggression, regardless of the type (e.g., verbal or physical) or sample (e.g., normative or clinical). Moreover, problem drinking is associated with both narcissism and aggression and may mediate relations between narcissism and aggression. However, biological functioning has not been examined in models of these associations, despite evidence that vagal withdrawal, noted by decreases in respiratory sinus arrhythmia (RSA) during stress compared to baseline, serves as a protective factor against aggression and problem drinking. The present study addresses this gap in research. Participants are 282 college students (mean age = 19.2, 78% female) who reported about their demographics and completed the Narcissistic Personality Inventory, the Alcohol Use Disorders Identification Test, and the Buss Perry Aggression Questionnaire. RSA was recorded during baseline and during a 3-minute mirror-tracing task. Residualized RSA change scores were computed and used in models. Results found that problem drinking fully mediated the relationship between narcissism and aggression, controlling for participant sex, socioeconomic status, and race. Moderated mediation models then found that this relationship only existed for those who were not exhibiting RSA withdrawal, such that higher narcissism was associated with higher problem drinking, which was then associated with higher aggression. Results suggest that poorer biological stress responding may be a key factor in the interpersonal deficits associated with narcissism.

2–045 | RESTING STATE NETWORK DYNAMICS AND HIGH TRAITS OF EMOTION DYSREGULATION

Francesca Fusina[1], Marco Marino[2,3], Zaira Romeo[1], Chiara Spironelli[1], Alessandro Angrilli[1]
[1]University of Padova, [2]KU Leuven, [3]IRCCS San Camillo Hospital

Descriptors: Emotion dysregulation, functional connectivity, EEG resting state

The present research aimed to clarify the brain network dynamics related to emotion dysregulation and to implement a potential biomarker for screening at-risk community samples. We selected 25 young women with high traits of emotion dysregulation (HD group) and 25 with low traits (LD group) and focused on the Ventral Attention Network (VAN) given its relevance in the automatic orienting of attention towards internal visceral states and emotional responses to intense stimuli. We recorded 64-channel EEG data during resting state and seed-based FC was computed on EEG Gamma power, with Alpha band power used as a control measure. In the HD group, we found stronger Gamma connectivity between the VAN and all other networks compared to the LD group. Moreover, a positive correlation was found between VAN Gamma power and the Depression/Elation subscale of Affective Lability Scale-18 (ALS-18) only for the HD group. Alpha power in the VAN and Default Mode Network correlated negatively with measures of affective lability, again in the HD group only. In conclusion, both resting state FC and network power in the VAN were found to be related to high emotion dysregulation, even in our non-clinical sample. In these participants, emotion dysregulation was characterized by a strong VAN connection to all other networks, pointing to a strong automatic orienting of attention towards their inner emotional turmoil, while Alpha power should be further investigated as a potentially protective index.

2–047 | WATCHING WITH ARGUS EYES: CHARACTERIZATION OF EMOTIONAL AND PHYSIOLOGICAL RESPONDING IN ADULTS EXPOSED TO CHILDHOOD MALTREATMENT AND/OR RECENT ADVERSITY

Alina Koppold[1], Alexandros Kastrinogiannis[1], Manuel Kuhn[1,2], Tina Lonsdorf[1]
[1]University Medical Center Hamburg-Eppendorf,
[2]Harvard Medical School and McLean Hospital

Descriptors: Affective Startle Modulation, Childhood Maltreatment, Recent Adversity

Exposure to adverse experiences is a well-established major risk factor for affective psychopathology. More specifically, childhood maltreatment has been suggested to be associated with the recruitment of specific and distinct defensive response profiles. To date it remains unclear whether these are specific or generalisable to recent adversity in adulthood. This preregistered study aimed to investigate the impact of exposure to childhood and recent adversity on emotional processing in 685 healthy adults with the "Affective Startle Modulation" Paradigm (ASM). First, we replicated higher trait anxiety and depression levels in individuals exposed to both types of adversity. Second, we observed blunted general skin conductance reactivity in individuals exposed to recent adversity. Third, individuals *exposed to childhood maltreatment* showed reduced, while individuals *exposed to recent adversity* showed increased discrimination between pictures of negative and neutral valence, compared to non-exposed individuals in SCR. Furthermore, explorative analyses revealed moderate dimensional and categorical agreement between two childhood maltreatment questionnaires. Our results support experience-dependent plasticity in sympathetic nervous system reactivity and suggest distinct response profiles in affective modulation in individuals exposed to early versus recent adversity. We emphasise the need to further explore distinct adversity profiles to further our understanding on specific psychophysiological profiles and their potential implication for prevention and intervention.

2–048 | FACE PERCEPTION IN VIRTUAL REALITY: AN ELECTROPHYSIOLOGICAL COMPARISON OF EVENT-RELATED POTENTIALS IN VR AND THE CONVENTIONAL LABORATORY

Merle Sagehorn, Marike Johnsdorf, Joanna Kisker, Thomas Gruber, Benjamin Schöne
University of Osnabrück

Descriptors: face perception, N170, virtual reality

Faces are inherently essential social cues and face perception is one of the most specialized visual processes in the human brain. Despite their social relevance, the perception of faces has mostly been studied in the conventional laboratory, i.e., 2D monitor set-ups. This rather distal presentation obscures self-relevance. VR can overcome this limitation in order to investigate cognition under more realistic conditions. To this end, the present study compares the perception of persons under laboratory conditions in 2D and in Virtual Reality (VR). Regular as well as blurred and scrambled control images of unknown persons were presented to 26 participants in 2D and 3D. Typical face specific event-related potential component N170 and subsequent components were analyzed for differences within and across modalities. As a result, N170 showed significantly stronger amplitude for regular and scrambled compared to blurred faces in 2D, but only for regular compared to blurred faces in 3D. Across modalities, perceptual baseline corrected N170 for faces was stronger in VR compared to 2D. Most interestingly, analysis of the later components revealed more differentiated face-specific processing in VR as indicated by more distinctive topographies. In summary, stronger N170 amplitude in VR implies more adaptive face processing resulting from higher self-relevance. Subsequent components, however, imply a more fine-tuned processing of faces only in VR casting doubt on the general meaningfulness of the N170 as a marker for real-life face processing since it does not reflect said processes.

2–049 | IMPACT OF THE COVID-19 PANDEMIC ON NEURAL RESPONSE TO REWARD

Clara Freeman, Loran Carpentier, Anna Weinberg
McGill University

Descriptors: Reward sensitivity, Stress, Event-related potentials

The COVID-19 pandemic has been a period of chronic stress due to social isolation, illness and death, and other major life disruptions. This increase in stress has been accompanied by increased rates of depression around the world. The present study sought to test whether one possible mechanism for the link between this ecologically-valid stressor and increases in depression could be stress-related decreases in neural responses to rewards. To do this, we compared two groups of young adult participants who completed a monetary reward task while EEG was recorded at two timepoints, one to three years apart. Our measure of reward sensitivity was the Reward Positivity (RewP), a neural marker that

has been linked to stress exposure and can prospectively predict depression. The first group ($N = 41$) completed both timepoints before the pandemic while the second group ($N = 39$) completed one before the pandemic and one during its second year (Fall of 2021). The COVID group reported having experienced significant stressors over the course of the pandemic. We did not observe a significant decrease in the RewP from time one to time two in the pre-COVID group. In contrast, in the COVID group, the RewP was significantly blunted at the follow-up visit. These results suggest that chronic naturalistic stressors can result in adaptations in neural responses to rewards. Our findings also suggest that blunted reward sensitivity is a possible mechanism linking stress to the development of depression.

2–050 | FROM "IMPOSSIBLE" TO "POSSIBLE": INVESTIGATING PERCEPTUAL INFERENCE AND NEURAL ACTIVITY ON 3D IMPOSSIBLE OBJECTS

Yi-Chen Hsieh[1], Kokichi Sugihara[2], Ching-Liang Tsai[3], Wen-Sung Lai[1]
[1]National Taiwan University, [2]Meiji University, [3]National Palace Museum

Descriptors: perceptual inference, prediction error, 3D impossible object

We lean on matching sensory inputs with experiences to process the dazzling world. Our brain tends to make predictions to facilitate this processing; however, the brain could commit errors—illusions. In contrast to the various research on 2-dimensional (2D) optical illusory stimuli, there is hardly any empirical neural investigation of 3D illusions. The second author has turned the 2D illusions into 3D impossible objects, whose appearance from the front view is incongruent with their reflection in the mirror. After conducting a spatial aptitude test to select 30 suitable 3D objects for this study, we created a set of video clips of authentic 3D impossible objects. Through the designed tasks: the peekaboo task and the perceptual inference task, we investigated the incongruent perceptions and the neural dynamics underlying the inference process of 3D illusion with the electroencephalogram (EEG). The result of the peekaboo task revealed significant differences between impossible objects and their counterparts in the time segment after the expected or unexpected sensory data inputs, which showed the differences in recollection and also reflected the predictive error signals. Applying multivariate pattern analysis (MVPA) to simultaneous EEG recordings, we found that the impossible objects can be discriminated from the possible ones in the perceptual inference task, even between two configuration levels. With these exploratory results, this study highlights the neural dynamics underlying illusory perception and shed the light on the sensory processing of 3D illusions.

2–051 | CARDIAC PRE-EJECTION PERIOD REACTIVITY AND BLOOD PRESSURE REGULATION IN AFRICAN AMERICAN COLLEGE STUDENTS

Jules Harrell, Elan Donnellan, Alysa Taylor, Marian Foster, Kareem Isaac, Aaron Patterson
Howard University

Descriptors: cardiac reactivity, blood pressure regulation, hypertension

Research points to cardiac sympathetic nervous system involvement in borderline hypertension. The cardiac pre-ejection period (PEP) is sensitive to cardiac sympathetic input. We examined the relationship between PEP during reaction time and stressful imagery and resting blood pressure (BP) levels and variability. BP levels were sampled during rest periods and during three inter-task intervals. Participants were 145 African American college students. Impedance cardiography assessed PEP continuously throughout the session. PEP reactivity was expressed as task minus resting levels. Principal components analysis (PCA) revealed that PEP changes for the reaction time tasks (three) and the racist imagery challenge (two) loaded on a single component, providing a composite PEP reactivity score. PCA revealed systolic (SBP) and diastolic (DBP) readings loaded on single components. BP variability was estimated as the variance of five readings. PEP reactivity was negatively correlated with the SBP and DBP component scores ($r = -247$, $p = .006$; $r = -.200$, $p = .026$ respectively). PEP reactivity was not associated with BP variability. SBP and DBP variability correlated positively with BP levels ($r = .227$, $p = .006$, SBP; $r = .290$, $p < .001$, DBP). Regression analysis revealed that PEP reactivity predicted SBP levels after controlling for body mass index and BP variability (R^2change $= .045$, p $= .015$). The findings support evidence that associates increased cardiac sympathetic activity with higher BP levels.

2–052 | UNRAVELING THE CONTRIBUTION OF SEROTONERGIC POLYMORPHISMS, PREFRONTAL ALPHA ASYMMETRY, AND INDIVIDUAL ALPHA PEAK FREQUENCY TO THE EMOTION-RELATED IMPULSIVITY ENDOPHENOTYPE

Florian Javelle[1], Andreas Löw[2], Wilhelm Bloch[1], Thomas Hosang[2], Thomas Jacobsen[2], Sheri Johnson[3], Alexander Schenk[4], Philipp Zimmer[4]
[1]German Sport University Cologne, [2]Helmut Schmidt University, [3]University of California, Berkeley, [4]Technical University Dortmund

Descriptors: Cortical activity, Serotonergic polymorphisms, emotion-related impulsivity

The unique contribution of the serotonin transporter-linked polymorphic region (5-HTTLPR), intronic region 2 (STin2), and monoamine oxidase A (MAO-A) genes to individual differences in personality traits has been widely explored, and research has shown that certain forms of these genes relate to impulsivity and impulsivity-related disorders. Humans showing these traits are also described as having an asymmetrical prefrontal cortical activity compared to others. This explorative study examines the relationship between serotonergic neurotransmission polymorphisms, cortical activity features (prefrontal alpha asymmetry, individual alpha peak frequency [iAPF]), and emotion-related and non-emotion-related impulsivity in humans. 5-HTTLPR, MAO-A, and STin2 polymorphisms were assessed in blood taken from 91 participants with high emotion-related impulsivity. Sixty-seven participants completed resting electroencephalography and a more comprehensive impulsivity index. In univariate analyses, iAPF correlated with both forms of emotion-related impulsivity. In multiple linear regression models, 5-HTTLPR polymorphism (model1: $R^2_{adj} = 15.2\%$) and iAPF were significant interacting predictors of emotion-related impulsivity (model 2: $R^2_{adj} = 21.2\%$). Carriers of the low transcriptional activity 5-HTTPLR and MAO-A phenotypes obtained higher emotion-related impulsivity scores than others. Our findings support an endophenotypic approach to impulsivity, showing that tri-allelic 5-HTTLPR polymorphism, iAPF, and their interaction are relevant predictors of one form of emotion-related impulsivity.

2–053 | IMPACT OF EMOTIONAL INHIBITORY CONTROL TRAINING ON EEG THETA/BETA RATIO IN TRAUMA-EXPOSED INDIVIDUALS

Kaveh Afshar, Richard Macatee
Auburn University

Descriptors: EEG theta/beta ratio, inhibitory control training, threat processing

Low resting EEG Theta/Beta ratio (TBR) is associated with greater inhibitory control (IC). IC is the capacity to disengage from irrelevant, salient stimuli (e.g., threat) and focus on goal-relevant stimuli, and is one of the key mechanisms of emotion regulation. Training IC in the context of threat-related stimuli (IC + T) may improve emotion regulation. However, the therapeutic impact of IC + T training in trauma-exposed individuals is unknown. Using TBR as a measure of IC over emotional processing, we addressed this gap in the literature. 60 trauma-exposed participants with elevated PTSD symptoms completed an emotional flanker task in which 85% of the IC demanding trials (e.g., $<<><<$) were paired with either fearful (IC + T group) or happy faces (IC + H group). Participants were randomly assigned to a training group. After the training, participants were instructed to write about their worst traumatic event for 15 minutes. TBR was measured during three resting tasks presented before and after the training as well as after the writing task. A fast Fourier transform was used to estimate spectral power density (μV^2) for frontal electrodes in the Theta (4–7 Hz) and Beta (13–30 Hz) frequency bands. T/B ratios were then log-normalized. There was a significant interaction between time and condition ($p = .042$, $\eta p^2 = .077$). This interaction was such that the IC + T group showed a greater reduction in TBR after the writing task compared to the IC + H group. As hypothesized, IC + T showed greater improvement in their capacity for exerting IC in the context of heightened negative emotional arousal.

2–054 | EVENT-RELATED BRAIN POTENTIALS ELICITED BY SELF AND OTHER REFERENCE IN LANGUAGE

Joanna Dolzycka, Cornelia Herbert
Ulm University

Descriptors: language, self, event-related brain potentials

Distinction between 'self' and 'other' is a basic feature of human language, but still little is known about its time course. Contributing to this ongoing debate, we

investigated the neural responses to 'self' in comparison to 'other' in a single word paradigm, in which personal and possessive pronouns referring to first (*I*, *mine*), second (*you*, *yours*) and third person (*she*, *hers*; *he*, *his*) were presented. Participants (N = 40, women and men) were exposed to the pronouns in a voluntary response task, and modulation of event-related potentials as assessed via electroencephalography (EEG) were analyzed. ERP modulation patterns revealed processing differences between pronouns related to 'self' and 'other' linguistic reference. The observed differences occurred in time windows of early ERP components related to linguistic and emotion processing (e.g., EPN component). Investigating the different processing stages of 'self-other' discrimination as conveyed by linguistic stimuli carrying self- and other-reference is novel and innovative. The results close important gaps in the scientific understanding of the relationship between bodily processes, linguistic representations of the self and the subjective experience of agency and body ownership.

2–055 | WHAT IF THE THREAT COMES? THE ROLE OF INTOLERANCE OF UNCERTAINTY IN ERROR PROCESSING AND FEAR EXTINCTION

Marcelo Malbec[1], Joshua Hindmarsh[1], Ingmar Franken[1], Marta Andreatta[1,2], Matthias Wieser[1]
[1]*Erasmus University Rotterdam,* [2]*University of Würzburg*

Descriptors: Intolerance of Uncertainty, EEG, Replication
Intolerance of uncertainty (IU) reflects the degree to which uncertain situations are perceived as threatening. IU includes two subfactors: prospective IU (active seeking of predictability) and inhibitory IU (behavioral paralysis). First, we tested the role of IU on performance monitoring since errors have been proposed as endogenous sources of threat. For this, we applied the Eriksen flanker task to elicit the ERN, an event-related potential reflecting variability in the sensitivity to errors. In a sample of 182 participants we found no relationship between IU and the ERN, which is in line with previous findings. Contrary to previous findings, neither inhibitory nor prospective IU were related with the ERN. In contrast, higher IU was related to smaller amplitudes of the CRN, the counterpart of the ERN present after correct trials. Also, contrary to previous findings IU did not moderate the relationship between depression and the ERN. Secondly, we tested the same individuals (n = 173) with a fear conditioning experiment. Behavioral ratings (expectancy, arousal, and valence) and SCR showed the expected differences between acquisition and extinction phases. However, when IU is included in the analysis, it does not predict patterns of fear and extinction learning. These studies provide new insights about the role of IU on the processing of threat and its relationship with physiological measures and point to the necessity of including larger samples when investigating individual differences in neurocognitive mechanisms of cognitive control and aversive learning.

2–056 | GENDER EFFECT ON BEHAVIORAL AND PSYCHOPHYSIOLOGICAL RESPONSES TO EMOTIONAL STIMULI

Zaira Romeo, Alessandro Angrilli, Chiara Spironelli
University of Padova

Descriptors: Gender, Emotion, EEG Source Localization
Past research showed a greater ability of women compared to men in perceiving facial expressions and prosody and in emotional tasks. Film clips are considered more effective, strong and ecological stimuli as compared with emotional slides. We aimed to study gender differences in emotional responses by comparing two methods: slide vs videoclip presentation. To this end, we carried out an EEG study in which men (n = 20) and women (n = 20) viewed erotic, fear and neutral slides and standardized videoclips, in separate blocks. Source analysis was computed with sLORETA on alpha EEG band (8–12 Hz). Compared to men, women showed lower valence and higher arousal scores to fear stimuli. Source analysis revealed men's greater alpha activity in the right secondary visual cortex (BA 18) to both neutral images and clips compared to fear ones. Instead, women showed greater alpha in left secondary visual cortex (BA 18) to neutral than fear images, and in the right homologous to neutral than fear clips. Furthermore, men showed higher alpha in right primary visual cortex (BA 17) to neutral than erotic images, and in right visual associative cortex (BA 31) to neutral than erotic clips, whereas women reported higher alpha in left secondary visual cortex (BA 18) to neutral vs. erotic images, and in right secondary visual cortex (BA 18) to neutral compared to erotic clips. Our results revealed clear sex differences in processing emotional stimuli presented with different modalities and suggest that they should be taken into account when looking at prevention and treatment of mental disorders.

2–057 | INDIVIDUAL DIFFERENCES IN GENERALIZING FEAR EXTINCTION LEARNING ACROSS THE SPECTRUM OF TRAIT ANXIETY

Edgar Nazarenus[1,2], Eva-Lotta Brakemeier[1], Jan Richter[1,2]
[1]University of Greifswald, [2]University of Hildesheim Foundation

Descriptors: fear conditioning, extinction learning, extinction learning generalization

Extinction learning is considered a core mechanism of exposure-based cognitive behavioral therapy. However, little is known about the specific process of extinction generalization. Therefore, this study investigated the existence of extinction generalization gradients. Three groups of 25 healthy subjects, each exhibiting low, moderate, and high levels of trait anxiety, respectively, and 25 anxiety disordered patients will participate in two new paradigms – one was tailored to investigate fear extinction generalization across a spectrum of cues, including a fear-conditioned/extinguished cue, a fear-conditioned/non-extinguished cue, and a non-conditioned safety cue, as well as several similar generalization cues; the other paradigm focused on context-related extinction generalization, meaning the recall of extinction learning in several generalization contexts. Both protocols included instructed fear acquisition and a 24-hour consolidation phase before extinction training and generalization test. Outcomes included skin conductance responses, fear-potentiated startle, and heart rate. Additionally, unconditioned stimulus (US) expectancy ratings and skin conductance responses (SCR) during US omission (omSCR) were used to evaluate prediction error processes. At this year's conference, data acquisition will still be ongoing. Therefore, our poster will present a detailed description of our study methods and preliminary results. In the final sample, we expect less pronounced cue- and context-related fear extinction generalization capacities in subjects with a higher anxiety load.
FUNDING: This poster and the associated project are funded by a grant from the DFG. The DFG is the self-governing organization for science and research in Germany.

2–058 | SPATIOTEMPORAL PROFILES OF ALPHA SUPPRESSION DURING BIMODAL SELECTIVE ATTENTION

Grace Clements[1], Mate Gyurkovics[2], Kathy Low[1], Diane Beck[1], Monica Fabiani[1], Gabriele Gratton[1]
[1]University of Illinois, Urbana-Champaign, [2]University of Glasgow

Descriptors: EEG alpha power, Selective attention, Multimodal processes

EEG alpha power varies under many circumstances requiring visual attention in behaviorally beneficial ways. However, there is growing evidence that alpha may not only serve visual processing, but also processing of stimuli presented in other sensory modalities, e.g., hearing. We previously showed that alpha dynamics during an auditory task vary as a function of competition from the visual modality (Clements et al., 2022) suggesting that alpha may be engaged in multimodal processing and associated cortical areas. Here we assessed the impact of allocating attention to the visual or auditory modality on the spatial distribution and dynamics of alpha during the preparatory period of a bimodal cued conflict task (n = 48). This task affords us the opportunity to assess alpha during modality specific preparation and while switching between modalities. We found evidence for an occipitally maximal, modality and task-specific alpha component related to visual attention processing and a parietally maximal, multimodal and task-general alpha component related to attention switching, evident regardless of attended modality. The occipital, visual alpha component was sustained over time, while the parietal, multimodal alpha component was more transient and predicted subsequent behavior. These data suggest that the unique time course and spatial extent of alpha power during attention preparation in multimodal contexts reflects both a modality, task-specific alpha component and a multimodal, task-general alpha component. Alpha, therefore, may serve multimodal, as well as visual processes.

2–061 | PUPIL RESPONSES TO EMOTIONAL IMAGES AND RELATIONS WITH ALEXITHYMIC AND AUTISTIC TRAITS

Margaret Grinshtein, Jennifer Wagner
City University of New York

Descriptors: autism, alexithymia, pupillometry

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by social communication and

interaction impairments, including difficulties in emotion recognition and understanding. Bird and Cook (2013) posited that these emotion-related difficulties in ASD are correlated instead with alexithymia, a distinct co-occurring phenomenon typified by difficulty in identifying and describing feelings. The current study examines this alexithymia hypothesis in a non-autistic sample, asking how autistic and alexithymic traits vary with pupillary measures of emotion processing. Pupil diameter was measured as college students viewed emotionally-valenced pictures (positive, neutral, negative), and self-report measures assessed autistic and alexithymic traits. Results showed that overall, pupil diameter was greater in response to negative images as compared to neutral and positive images ($ps < .001$). Further, greater pupil diameter in response to negative images was related to both higher levels of alexithymic traits ($p = .031$) and higher levels of autistic traits ($p = .045$). To test the alexithymia hypothesis, a final analysis looked at pupil diameter to negative images in relation to autistic traits after controlling for alexithymia, and results showed that this association was no longer significant ($p = .308$). Therefore, in line with prior work studying autistic individuals, the current study supports the notion that emotional difficulties that vary with levels of autistic traits in the broader population may also be attributed to alexithymia.

2–062 | DEPRESSION SEVERITY RELATES TO SMALLER AFFECT-MODULATED REWARD POSITIVITY AMPLITUDE

Garima Singh[1], Trevor Jackson[1], Mark Lavelle[1], Darin Brown[2], James Cavanagh[1]
[1]University of New Mexico, [2]Pitzer College

Descriptors: Reward Positivity, MDD, Affective Imagery
The Reward Positivity (RewP) is a positive deflection in the EEG sensitive to reward receipt. Recent evidence suggests that the RewP is modulated by both reward probability as well as affective valuation ("liking"). We hypothesize that this latter "liking" feature is specifically affected in major depression. We recruited 69 participants (MDD = 35, Control = 34) who completed a reinforcement learning task (green or red screen feedback) with concurrent affective images. We specifically examined the modulation of the RewP when paired with hedonically preferred images (puppies) vs. less-preferred images (cows). There was no group difference in "liking" ratings of puppy or cow pictures, nor were there differences in RewP between groups.

Across all participants, there was a significant negative correlation between BDI score and RewP amplitude difference (puppy-cow; $r = -0.246$, $p = 0.041$), confirming our hypotheses. Within MDD group alone, there was a significant negative correlation between depression severity (BDI score) and RewP amplitude difference (puppy-cow; $r = -0.321$, $p = .030$), indicating an inter-individual influence of self-reported depression on hedonically related RewP amplitudes. These findings suggest a domain-specific diminution of hedonic responsiveness in severely depressed people.

2–063 | IT'S A MATCH! PHYSIOLOGICAL SYNCHRONY IN A SPEED DATING EXPERIMENT

Stephanie Dimitroff[1], Bernadette Denk[1], Esther van Schwartzenberg[1], Maria Meier[1], Annika Benz[1], Ulrike Bentele[1], Eva Unternaehrer[1,2], Jens Pruessner[1]
[1]University of Konstanz, [2]University of Basel

Descriptors: physiological synchrony, speed dating, autonomic nervous system
Feeling socially accepted is one of the most rewarding feelings. However social acceptance does not come gratuitously; we must seek it by interacting with others until we find those with whom we "click". Scientifically, very little is known about the psychophysiology of mutually feeling a connection with someone. On a physiological level, does an interaction involving two interested parties differ from one where liking is non-mutual, or not present at all? The current study was designed to scientifically explore the psychophysiological correlates of reciprocal liking. 45 participants took part in one of three speed dating events, where all participants went on six to eight dates. Participants were fitted with H7 Polar heart rate sensors in order to continuously monitor autonomic activity throughout the event. After each date, participants indicated whether they wished to exchange contact information with their partner. A wavelet coherence analysis was conducted on paired autonomic activity as an index of physiological synchrony during each date. Results revealed that in-phase coherence was significantly higher in dates that were matches versus pairs with nonreciprocal liking or no liking from either side, $F(2,140) = 4.53$, $p = 0.012$. These data suggest that higher in-phase physiological synchrony may be indicative of reciprocal romantic interest. This project provides first evidence for physiological differences between successful and unsuccessful dates, and suggests that physiological synchrony may be higher between individuals who are mutually interested in one another.

2–064 | PERSON-KNOWLEDGE IMPACTS SELECTIVE ATTENTION TO PERCEPTUAL INFORMATION: EVIDENCE FROM ERPS AND FUNCTIONAL NETWORK CONNECTIVITY

Samuel Venezia, Eric Splan, Samwell Cleary, Jasmin Cloutier, Jennifer Kubota
University of Delaware

Descriptors: Person Perception, ERPs, Functional Connectivity Analysis
This pre-registered study examined how both perceptual cues (race) and person-knowledge (social status) simultaneously influence attention to faces during social categorizations. Participants ($n = 26$, US-based White identified) categorized faces by race and social status. We employed univariate ERP analyses to capture attention (as indexed by the P200) and multivariate functional network connectivity analyses to assess changes in an attention/executive function network (AEF; based on estimated ACC, IPS, VLPFC, DLPFC locations). We found enhanced P200s when categorizing race compared to status. In addition, we observed greater P200s to high-status White faces compared with high-status Black faces when categorizing by race. This effect was mirrored in the functional connectivity analyses. Within the AEF network, we observed greater functional connectivity in the beta band across the selected locations as a function of perceived race, status, and categorization task. Specifically, we observed greater functional connectivity in the AEF network to high-status White faces relative to low-status White faces when participants categorized faces by their race. These findings suggest that when asked to focus on race, attention is still modulated by status knowledge. Therefore, we obtained convergent evidence that person knowledge shapes attention even when focus is direct at a perceptual category.

2–065 | REWARD POSITIVITY-LOCKED HYPOACTIVATION OF VMPFC IN MAJOR DEPRESSIVE DISORDER: AN MEG STUDY

Christopher Hand Pirrung[1], Garima Singh[1], Davin Quinn[2], James Cavanagh[1]
[1]*University of New Mexico,* [2]*University of New Mexico School of Medicine*

Descriptors: Reward Positivity, MEG, Major Depressive Disorder
The Reward Positivity (RewP) is an ERP component elicited approximately 250–350 ms following rewarding outcomes. This signal is modulated by reward prediction error (RPE) indicating that the information content of rewards affects the RewP. The RewP is also smaller in major depression (MDD+), yet in spite of attenuated reward responsivity, individuals with MDD tend to show intact reward learning. This implies that individuals with MDD are still capable of recognizing and learning from reward; however, they either do not find the rewards as rewarding as the control group or they do not care about receiving a reward. To examine the affective (MDD+) and information content (RPE) contributions to the RewP, we collected MEG data on sixty participants (MDD+ = 32, Control = 28) while they completed a probabilistic selection task (PST). Using minimum norm estimation (MNE), we found that activation in the time region of interest was greatest in ventromedial prefrontal cortex (vmPFC), in line with the vast majority of fMRI research on valuation. After identifying the source of this signal, group differences were examined, showing that activation was diminished in the vmPFC in the MDD+ group ($p = .044$, $d = .545$). We also found that larger RPE was associated with greater activation of the lateral orbitofrontal cortex (lOFC) in both groups, providing further evidence that *information content* and *affective value* of a reward may be processed by parallel subsystems. These findings indicate that anhedonia may drive diminished vmPFC activation specifically related to valuation following reward.
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2–066 | DENSE SAMPLING APPROACHES IN PSYCHOPHYSIOLOGICAL RESEARCH: CURRENT REALITY AND FUTURE POSSIBILITIES FOR STUDYING REAL-WORLD BEHAVIOR

Amanda McGowan[1], Zachary Boyd[2], Danielle Cosme[1], Mia Jovanova[1], Yoona Kang[1], Farah Sayed[1], Megan Speer[3], Peter Mucha[4], Kevin Ochsner[3], Dani Bassett[1,5], Emily Falk[1], David Lydon-Staley[1]
[1]*University of Pennsylvania,* [2]*Brigham Young University,* [3]*Columbia University,* [4]*Dartmouth College,* [5]*Sante Fe Institute*

Descriptors: intensive longitudinal methods, experience-sampling, multimodal data
Human behavior is dynamic, playing out across multiple timescales. Whereas brain activation in response to environmental cues (e.g., lit cigarette) elicits craving almost immediately, withdrawal symptoms manifest across weeks, and alterations in reward-related neurocircuitry leading to drug-related reorganization of the brain takes longer. Although advances in computer portability have made it possible to take psychophysiology outside the lab, granular time scales are rarely used to study brain-behavior relationships *in situ*. This is unfortunate because

intensive longitudinal methods can be used to densely sample individuals in their everyday lives. Intensive longitudinal methods can help uncover individuals' unique lived experiences, the biopsychosocial correlates of those experiences, and characterize brain-behavior dynamics in everyday life–advancing both theory and applied research. By combining intensive longitudinal methods, such as smartphone experience-sampling, with traditional brain modalities (e.g., fMRI, EEG), researchers can overcome the limitations to each. We focus on advancements in combining smartphones and scanners; opportunities for incorporating intensive longitudinal methods into psychophysiological research; and discuss future directions to combine smartphones, scanners, and intensive longitudinal methods with a focus on digital health applications. These approaches hold promise for informing the design of ecologically-relevant personalized interventions and smarter technology that gives more accurate information about people's wellbeing.

2–067 | THE DEARTH OF SAMPLE DEMOGRAPHIC DESCRIPTION AND RACIAL REPRESENTATION IN CLINICAL PSYCHOPHYSIOLOGICAL RESEARCH

Angelica DeFalco[1], Lindsay Beaman[1], Jackson Cutler[1], Nicholas Doran[1], Mia Tognoli[1], Emily Perkins[2], Keanan Joyner[3], Daniel Bradford[1]
[1]Oregon State University, [2]Florida State University, [3]University of California, Berkeley

Descriptors: Equity, Social justice, Individual differences
Generalizability is substantially limited by a lack of racial representation and sample demographic descriptions in psychophysiology research. Researchers, including past SPR presidents, continue to explicitly call for increased and more nuanced reporting. Addressing these concerns is especially prudent for clinically relevant findings to accurately represent populations of interest and thus inform treatment. Here, we examine sample demographic reports in a preliminary literature review of 3 prominent academic journals that often include psychophysiological measures– *Psychophysiology, Journal of Psychopathology and Clinical Science (JPCS;* formally *Journal of Abnormal Psychology),* and *Clinical Psychological Science (CPS).* We coded articles containing studies with psychophysiological measures across 3 decades (1997–2020) for type, sample demographics and psychophysiology method(s) used. Less than 25% of empirical articles in *Psychophysiology,* 50% in *JPCS* and 75% in *CPS* reported race and/or ethnicity in the main text or supplemental materials. Most samples predominantly consisted of White, non-Hispanic participants. Though the description of samples varied by factors such as journal, year, and psychophysiological measure, reporting remains generally inadequate. Future research should more broadly assess journals and psychophysiology articles to fully characterize the issue. Researchers should continue to prioritize equitable representation in their samples and journal policy should assert the inclusion of such demographics – especially for clinically relevant implications.

2–068 | EEG AND MEG SOURCE ANALYSIS OF EMOTION AND FEATURE-BASED PERCEPTION

Andrew Farkas[1], Matt Gehr[1], Ansley Delaney[1], Markus Junghöfer[2], Dean Sabatinelli[1]
[1]University of Georgia, Athens, [2]University of Münster

Descriptors: Emotion, Perception, ERP.
The Early Posterior Negativity (EPN) and Late Positive Potential (LPP) are reliably modulated by emotionally arousing scenes. In two previous 64-channel EEG studies, we found that, unlike the LPP, the EPN is strongly modulated by exposed human bodies. To resolve potentially distinct cortical sources for body-specific and arousal-driven aspects of the EPN, we conducted scene perception data in healthy college-aged samples with 140-channel MEG ($n = 42$) and 128-channel EEG ($n = 16$, target $n = 40$). The scene content include erotica, sports victory, nudists, Black and White faces, neutral people, threatening people, and mutilations. In the MEG data, a late (300-900 ms) temporoparietal modulation of cortical activity was strongest during erotic scene perception, followed by mutilation and nudist scenes. Early reactivity (150-300 ms) varies across scene content, but reliability is unclear at this stage of analysis. In the EEG data, the LPP is most strongly modulated by erotic scenes, followed by nudist and mutilation scenes. EPN modulation replicated prior findings, with the strongest modulation driven by

nudist scenes compared to all other contents. Additional analyses will investigate the relationship between MEG and EEG sources, for face / body-driven early activity, and later arousal-driven slow activity, with a goal to determine shared and unique modulation patterns across clusters of cortex.

2–070 | DOMAIN AND SYMPTOM-LEVEL CORRELATES OF REDUCED P3 AMPLITUDE AMONG YOUNG ADULTS AT RISK FOR PSYCHOSIS

Lisa Brown, Keisha Novak, Dan Foti
Purdue University

Descriptors: Psychosis, Schizotypal, ERPs
The P3 is an event-related potential (ERP) response to task-relevant stimuli. An abnormal P3 is an established biological neural marker of schizophrenia. The goal of the present study was to test the relationship between the P3 and specific positive schizotypal symptoms in an at-risk group. We focused on associations with overall positive symptom severity, as well as specific symptoms within the positive domain. Subclinical symptoms were assessed using the Schizotypal Personality Questionnaire (SPQ). Participants were recruited from Indiana and completed a two- phase protocol in which they were first screened over the phone and then later participated in a laboratory visit. Participants were eligible for the study if they were between the ages of 18 and 35 years old, and if they endorsed at least one item on the screening questionnaire for the assessment of subthreshold psychotic-like experiences using the Community Assessment of Psychic Experiences (CAPE). The association between P3 amplitude and total positive symptom severity was not significant ($r = -.225$, $p = .092$). Candidate associations were observed, however, with two specific symptoms within the positive domain: P3 amplitude was significantly correlated with paranoid ideation ($r = -.293$, $p = .027$), and a similar, trend-level effect was observed for unusual perception ($r = -.256$, $p = .055$)., such that as we hypothesized, higher P3 is correlated with higher paranoid ideation and unusual perception. Our results highlight the value of taking a fine-grained approach for linking neural markers of psychosis to clinical features.

2–071 | PSYCHOMETRIC PROPERTIES OF TELEHEALTH EEG ASSESSMENT AMONG FAMILIES AFFECTED BY ANGELMAN SYNDROME

Roslyn Harold, Kimberly Galvez-Ortega, Wei Siong Neo, Bridgette Kelleher, Dan Foti
Purdue University

Descriptors: Angelman Syndrome, Telehealth, EEG
Angelman Syndrome is a rare neurogenetic syndrome which affects approximately 1:20,000 live births and causes an array of neurological difficulties such as seizures, motor impairments, and intellectual disability. A key phenotypic marker of Angelman syndrome is increased delta activity in resting-state EEG. Increased delta has been suggested as a potential treatment outcome measure for clinical trials. However, accessibility to EEG recording is limited in this population, who may live hundreds of miles away from the nearest academic medical center, and for whom travel is especially difficult. Thus, our team sought to develop a protocol to collect EEG via telehealth using a dry cap system which we shipped to participants. Over the course of a week, seven families affected by Angelman Syndrome (two caregivers, one affected child, and one unaffected sibling) each completed three telehealth EEG sessions, resulting in 84 total assessments. We assessed test–retest reliability of delta activity and found excellent reliability between sessions one and two ($r = .90$, $p < .001$), two and three ($r = .76$, $p < .001$), and one and three ($r = .79$, $p < .001$). Additionally, we assessed split-half reliability and found that we achieved excellent internal consistency across all sessions ($\alpha = .99$). These findings suggest that resting-state EEG can be reliably collected via telehealth with no technician on site, which has implications for accessibility of clinical trials participation for children with Angelman Syndrome, as well as for other populations who are typically underrepresented in EEG research.

2–072 | STARTLE REACTIVITY, SELF-REPORTED DISTRESS, AFFECT, AND BASELINE ALPHA AS MEASURES OF SOUND SENSITIVITY

Payton Chiasson, Faith Gilbert, Skylar Mcilvanie, Caitlin Traiser, Kierstin Riels, Ryan Mears, Jourdan Pouliot, Richard Ward, Andreas Keil
University of Florida

Descriptors: misophonia, startle response, regression analyses

Misophonia is a common disorder characterized by strong negative emotional reactions in response to specific sounds that are considered "triggering". The most common sounds that generate this response, regardless of intensity and loudness, are eating, drinking, and breathing. After completing a series of surveys, participants (n = 39) were presented with three different tones (varying in pitch; i.e., CS+, GS1, GS2) in both habituation and acquisition phases of an aversive generalization task, with a noxious loud noise (92 dB) serving as unconditioned stimulus (US). We measured behavioral ratings of valence and arousal to each tone and found that, after conditioning, CS+ was rated as more unpleasant and arousing compared to the GSs. Interindividual differences in emotion psychopathology and distress were measured using the Liebowitz Social Anxiety Scale (LSAS), Beck's Depression Inventory (BDI), The State–Trait Anxiety Inventory (STAI), and the Misophonia Symptom Scale (MSS). Startle responses were scored from vertical electrooculogram sensors, in response to the US. Regression analyses found that participants with a higher startle response also tended to score high on measures of anxiety and negative affect, combined through principal component analysis. We found a negative relation between baseline alpha and startle magnitude, and ongoing analyses point to a discriminative role of startle reactivity with respect to self-reported misophonia symptoms.

2–073 | NEURAL CORRELATES OF ERROR MONITORING IN SOCIAL CONTEXTS ACROSS ADOLESCENCE AND YOUNG ADULTHOOD

Grace Allison, Iulia Banica, Anna Weinberg
McGill University

Descriptors: Error Related Negativity (ERN), Event-Related Potential (ERP), Adolescence and emerging adulthood

Abnormalities in error monitoring have been implicated in the etiology and course of anxiety and obsessive–compulsive disorders. As neural markers of these abnormalities often emerge prior to the onset of clinical symptoms and may confer risk for future psychopathology, it is critical to understand their development. Further, error monitoring in specific contexts (e.g., social evaluation), may be especially salient during particular developmental stages. This study sought to characterize the developmental trajectory of neural correlates of error monitoring during social evaluation in adolescents and young adults. Participants (N = 72) between 10 and 24 years old (M = 15.36, SD = 3.55) completed a standard flanker task to elicit the Error Related Negativity (ERN), a neural response to error commission. Participants also completed a social flanker task in which they were told that they were competing against a peer; they received feedback about their performance compared to the peer and were told the peer could also see how they were doing. The ERN in the social context was larger than in the non-social context. Moreover, this increase showed a quadratic association with participant age, such that it was largest in mid-adolescence, a period when feedback from peers is particularly salient. This suggests the influence of contextual factors on the ERN may change across development, and that understanding these effects may be useful for clarifying the ways in which aberrant error monitoring contributes to anxiety and obsessive–compulsive pathologies across development.

2–074 | INTEROCEPTIVE ACCURACY MODERATES THE EFFECT OF AFFECTIVE EMPATHY ON REACTIVITY TO DISTRESS IN OTHERS

Frederica Rockwood[1], Stephanie Dimitroff[2],
Anita Restrepo[1], Emily Silver[1], Greg Norman[1]
[1]University of Chicago, [2]University of Constance

Descriptors: Affective Empathy, Interoception, Cardiac reactivity

Affective empathy is the ability of an individual to understand and share emotional states of others. This complex phenomenon is sensitive to context, particularly one's own emotional and physiological state, and relies on the self-other distinction for attribution of emotions. Thus, individual differences in interoceptive accuracy (IA), the ability to perceive one's own physiological functioning, may impact the relationship between affective empathy and the perception of others' emotions. This study sought to explore the interaction between affective empathy, IA, and physiological reactivity to observing distress in others. Participants (N = 92) completed a heartbeat perception task and then viewed 21 videos of speakers in varying levels of distress. While viewing the videos measures of autonomic cardiac reactivity were collected and following each video participants provided ratings for the perceived anxiety of the speaker. Of the autonomic measures, only sympathetic cardiac reactivity was independently predicted by IA, affective empathy,

and their interaction. There was additionally a significant three-way interaction between video condition, IA, and affective empathy on anxiety ratings, indicating the relationship between IA and affective empathy influences perception of emotion in others. Together, these data suggest the effect of affective empathy on emotional appraisal may depend on knowledge of one's own physiological and emotional state.

2–075 | AUDITORY ERPS IN A PROPOSED GENETIC MODEL AND A PHENOTYPIC MODEL OF ADHD – EVIDENCE OF INATTENTION

Logan Brewer[1], Jankiben Patel[1], Frank Andrasik[1], Jeffrey Sable[2], Samantha Regan[3,4], Michael Williams[3,4], Charles Vorhees[3,4], Helen Sable[1]
[1]The University of Memphis, [2]Christian Brothers University, [3]University of Cincinnati College of Medicine, [4]Cincinnati Children's Research Foundation

Descriptors: Animal Model, ADHD, ERP
The auditory N1, an event-related potential (ERP), is considered a measure of automatic attention. In humans, those with attention deficit hyperactivity disorder (ADHD) have been observed to have a reduced N1 to salient sound stimuli. In addition, variations of the latrophilin-3 (Lphn3) gene have been linked to ADHD, but the functional significance remains unclear. This study had two objectives: 1) examine whether these findings in humans persist within animal models of ADHD, and 2) assess the relevance of the Lphn3 gene on automatic attention. To accomplish this, we assessed auditory ERPs (P1-N1) in two models of ADHD: a genetic model, the Lphn3 knockout (KO) and their control line (wildtype/WT), as well as a phenotypic model, the Spontaneously Hypertensive Rat (SHR) and their control line (Wistar-Kyoto/WKY). Electroencephalographs (EEG) were recorded using subdermal needle electrodes at frontocentral sites while freely-moving rats were presented 5-tone trains (50-ms tones, 400-ms tone onset asynchronies) with varying short (1-s) and long (5-s) inter-train intervals. As we previously reported at SPR, KOs and WTs did not demonstrate any meaningful differences in peak amplitudes. Thus, the lack of Lphn3 expression in KOs does not appear to incur notable deficits in automatic attention. However, SHRs had significantly reduced peak P1 and P1-N1 amplitudes relative to all other lines, reflecting deficits in automatic attention that are analogous to those found in humans with ADHD. These findings also provide further support to the validity of the SHRs as a rodent model of ADHD.

2–076 | ATTENUATED GENERAL STARTLE REACTIVITY IN ADOLESCENT ATHLETES WITH A CONCUSSION HISTORY

Daniel Bradford[1], Sarah Willwerth[2,3], Angelica DeFalco[1], Rebekah Mannix[2,4], William Meehan, III[2,3,4], Jessie Oldham[3,5]
[1]Oregon State University, [2]Boston Children's Hospital, [3]The Micheli Center for Sports Injury Prevention, [4]Harvard Medical School, [5]Virginia Commonwealth University

Descriptors: General startle reactivity, Concussion, Sensorimotor
Mild traumatic brain injuries (i.e., concussions) are a significant public health problem. While most concussion symptoms resolve within two weeks, lingering and difficult-to-detect sensorimotor impairments can lead to ~2x increased risk of musculoskeletal injury (e.g., ankle sprain, ACL tear) observed for months following a concussion. Standard clinical assessments used to clear athletes to return to sport currently lack the sensitivity and reliability to detect lingering and subtle—yet critical—post-concussion sensorimotor deficits. As the startle response is directly brainstem mediated, it is liable to be more impacted by concussion than other physiological responses. In fact, rodent models suggest suppressed general startle reactivity post-concussion. We sought to translate these findings to humans by assessing the general startle reactivity of adolescent athletes with and without a history of concussion. General startle reactivity was significantly lower in adolescents with a concussion history compared to healthy controls. Our results suggest potential for general startle reactivity as a marker of brainstem mediated sensorimotor dysfunction that may identify otherwise imperceivable effects of concussion. As general startle reactivity continues to be used within NIMH RDoC's Sensorimotor Domain to study the importance of innate, reflexive movement patterns in maintaining health, its ability to aid clinical identification of concussion recovery and readiness to return to sport should be further explored.

2–077 | EVALUATION OF CEREBELLAR TMS AS A TOOL FOR MODULATING CORTICAL OSCILLATIONS AND COGNITIVE DEFICITS IN INDIVIDUALS WITH BIPOLAR DISORDER

Victoria Muller Ewald, Nicholas Trapp, Aaron Boes, Krystal Parker
University of Iowa

Descriptors: Cognition, Psychiatry, EEG
Abnormal functioning of the cerebello-thalamo-cortical network is associated with the presentation of psychiatric symptoms including difficulties in cognitive processing. There is growing interest in targeting the cerebellar node of this network via TMS (cebTMS) to ameliorate these cognitive symptoms. However, mechanistic insights into how cerebellar stimulation affects neural oscillations and performance on cognitive tasks are lacking. The present work stems from secondary analyses associated with a double-blind clinical trial assessing the safety and efficacy of utilizing cebTMS in bipolar disorder. Men and women suffering from bipolar disorder ($n = 34$) were pseudorandomly divided into active and sham treatment groups with optional crossover at the end of the trial. Neuro-navigated TMS of the cerebellar vermis or sham treatment was provided 2x/day for 5 days. A theta-burst stimulation protocol was utilized, consisting of 50 Hz triplets repeated at 5 Hz delivered for 2 s and followed by an 8 s pause, for a total of 600 pulses. Results indicate that active cebTMS treatment significantly reduced alpha (8–13 Hz) oscillations in comparison to sham treatment. Additionally, the duration of this effect was dependent on the number of treatments received. These results might indicate changes in synaptic plasticity induced in the cerebello-thalamo-cortical circuit due to cebTMS. However, although individuals with bipolar disorder were impaired in interval timing and stop-signal task performance compared to neuronormative controls, cebTMS did not rescue task performance.

2–078 | UNDERSTANDING THE TIME COURSE OF SEMANTIC PROCESSING ACROSS THE VISUAL FIELD DURING READING: RECONCILING EVIDENCE FROM ERPS AND EYE MOVEMENT BEHAVIOR

Clara Lopes, Brennan Payne
University of Utah

Descriptors: visual attention, perceptual span, converging evidence
Readers are sensitive to the plausibility of upcoming words, suggesting that high-level semantics are processed in parafoveal vision. At the same time, there is a disparity between event-related potential (ERP) and eye-tracking (ET) measures regarding the time course of these effects. First, we present results from an RSVP-with-flankers ERP study showing evidence that plausibility effects on the N400 are first processed parafoveally, followed by a reduced (foveal) target N400. These findings suggest parafoveal processing facilitates subsequent foveal processing, consistent with a trans-saccadic integration (TSI) account. However, this experiment did not examine naturalistic reading. Therefore, we present the results of a recent ET reading experiment using the gaze-contingent boundary paradigm wherein participants read sentences with plausible and implausible target words that were either valid or invalid parafoveal previews. Results revealed the presence of an early and direct effect of parafoveal plausibility on target processing, irrespective of the match between the preview and target (in contrast to predictions from TSI), while later eye movement effects appeared to favor a TSI account, in line with ERP findings. Collectively, these findings suggest multiple stages of plausibility on word processing that unfold dynamically over the visual field during reading. We also highlight future directions using co-registration of ERPs and ET, which will allow us to further delineate the time course of neural semantic processing during naturalistic and ecologically valid reading.

2–079 | THE INFLUENCE OF TRUST ON DRIVER COGNITIVE STATES DURING AUTOMATED DRIVING

Amy McDonnell[1], Kaedyn Crabtree[1], Joel Cooper[2], David Strayer[1]
[1]University of Utah, [2]Red Scientific

Descriptors: applied psychophysiology, driving, workload
There is concern that the introduction of automated technology in vehicles may lead to low driver workload and subsequent disengagement from the driving environment. EEG measures of frontal theta and parietal alpha can provide insight into a driver's mental workload and visual engagement, respectively. In a previous on-road study, we found no difference in frontal theta power or parietal alpha power when driving in manual mode compared to driving under partial vehicle automation. However, it is possible that the automated technology was novel enough that participants remained engaged with the driving environment at all times. In the current study, thirty participants completed the same experimental session as before; however, after initial testing, participants took the vehicle home with them and practiced driving on their daily commute in order to gain comfortability with, and trust in, the automated system. After six weeks, they returned to the lab and completed the same experimental protocol

again. We compared frontal theta and parietal alpha metrics during automated driving before and after the six-week familiarization phase. We found that even after six weeks of practice in the automated system, participants had comparable levels of frontal theta and parietal alpha power during manual and automated driving. These results suggest that the concern surrounding driver disengagement under automated driving may not be grounded in physiological evidence. This study expands our understanding of the effects of trust in vehicle automation on drivers' cognitive states.

2–080 | DYNAMIC CHANGES IN ALPHA POWER DURING SOCCER REFEREE DECISION-MAKING SITUATIONS USING ELECTROENCEPHALOGRAPHY

Hatem Elbanna[1,2,3], Dirk Koester[4], Ahmed Elshafey[3], Thomas Schack[1,2]

[1]Center of Excellence - Cognitive Interaction Technology (CITEC), [2]Bielefeld University, [3]Mansoura University, [4]BSP Business School Berlin

Descriptors: Decision-making (DM), Alpha Power spectra (PSD), Soccer referee
Electroencephalogram (EEG) is one of the oldest techniques for evaluating the relationship between brain and behavior, more recently has become a popular tool for sport psychophysiology studies, and decision-making research. This research discusses how decision-making (DM) can be analyzed with assist from EEG signal power variance produced by soccer referee. We recorded EEG from 64 scalp sites using ANT Neuro EEGO sport amplifier (ANT Neuro, Netherlands), during a series of baseline) fixation (task and DM task, in a group of 21 official soccer referee (ages 18–38, $M = 24.8$, $SD = 5.6$ years). The DM task designed to simulate real decision situations in soccer matches. EEG signal created from DM task and baseline task were used in this study. We observed significant negative changes occurred across alpha band from the baseline to the DM task. Moreover, it appears that the DM task uniquely engages more left frontal lobe than the right frontal lobe. There were also negative correlations between alpha spectra differences from baseline to the DM task and performance on DM task. In summary our study indicates that it is possible to observe changes uniquely related to DM performance within the alpha band.

2–081 | A STUDY EXAMINING AUTHORITARIAN PARENTING AND THREAT-RELATED ATTENTIONAL BIAS IN 7- TO 12-YEAR-OLD CHILDREN USING EYE-TRACKING

Enrique Cibrian, Lyndsey Chong, Alexandria Meyer
Florida State University

Descriptors: Attention Bias, Parenting, Eye Tracking
Attentional bias to threat has been implicated in psychological disorders such as anxiety, post-traumatic stress disorder, and depression. Exposure to adverse childhood experiences has been shown to increase attention to threatening stimuli, which may lead to the development of anxiety. However, studies on attentional bias to threat in children have focused on severe environmental stressors (e.g., physical abuse), and few have examined this phenomenon in less severe environmental contexts (e.g., harsh parenting). Previous work has suggested that parent presence plays a crucial role in threat sensitivity development, yet no study has investigated parent presence in relation to child attentional bias to threat. In the current study, we investigated attentional bias to threat and its link to harsh parenting styles and parent presence in 7- to 12-year-old children ($N = 91$). Eye-tracking data was collected using a free-viewing task with threat and neutral stimuli, as well as parent-in-the-room and experimenter-in-the-room conditions. Overall, children with more authoritarian parents demonstrated an increased threat bias as compared to children with less authoritarian parents, regardless of condition. Results also revealed that children with less authoritarian parents had marginally increased attentional bias to threat in the experimenter condition as compared to the parent condition. Findings from this study contribute to the developmental literature on attentional bias to threat and may have important clinical implications for parenting interventions.

2–082 | DEPRESSION AND GENERALIZED ANXIETY SYMPTOMS PREDICT THE DEVELOPMENT OF THE ERROR-RELATED NEGATIVITY ACROSS ADOLESCENCE

Elise Cummings[1], Aline Szenczy[1], Alexandria Meyer[2], Greg Hajcak[2], Brady Nelson[1]
[1]Stony Brook University, [2]Florida State University

Descriptors: ERN, Depression, Anxiety
Depression and generalized anxiety disorder have been associated with an attenuated and enhanced error-related negativity (ERN), respectively. Cross-sectional

evidence suggests that the ERN increases across adolescence. However, no studies have examined within-person changes in the ERN—and whether childhood psychopathology predicts development of the ERN across adolescence. In a sample of 241 8 to 14-year-old girls from the community ($M_{age} = 12.45$, $SD_{age} = 1.73$), the present study examined self-report measures of depression (Children's Depression Inventory) and generalized anxiety symptoms (Screen for Child Related Anxiety Disorders) at baseline and the ERN at baseline, 2-year, and 4-year follow-ups. Multilevel modeling indicated a linear increase in the ERN across adolescence. Moreover, results indicated an interaction between baseline depression and generalized anxiety symptoms in relation to the slope of the ERN across adolescence, such that lower depression and higher generalized anxiety symptoms predicted the steepest rate of change. The present study suggests that childhood-onset psychopathology symptoms predict the development of the ERN across adolescence.

2–085 | EFFECTS OF MUSICAL TEMPI ON TEMPORAL PERCEPTION AND EEG ACTIVITY IN MUSICIANS

Luis Ruiz Gómez[1], Julieta Ramos-Loyo[1], Araceli Sanz-Martin[1], Markus Müller Bender[2]
[1]University of Guadalajara, [2]Autonomous University of Morelos State, Cuernavaca

Descriptors: Timing, Musicians, EEG
Humans can use external stimuli to measure time. This is optimized when those stimuli occur in a regular and periodic way, like in music. Musicians must develop their capacity to perceive and reproduce time intervals in a precise manner. It has been previously found that in participants without any musical training, the presentation of musical stimuli previous to the production of time intervals affects their accuracy and brain electrical activity. The purpose of the present study was to assess the effects of musical *tempo* on time perception. We evaluated 29 musicians who were asked to produce a 2.5 seconds interval after silence and after listening to a musical stimulus at different *tempi* (90, 120, 150 bpm). We found that participants overestimated the time produced in all conditions, without finding any significant differences between them, though. We also found that the absolute power of delta and theta bands at the frontocentral region increased during the task. Results suggest that, although musicians overestimated the interval, musical tempi did not affect their performance. This

might be explained by the musician's ability to inhibit the interference generated by external stimuli over their internally generated intervals. EEG changes could be related to the cognitive demands of the task, such as working memory and inhibition, in addition to time processing. The results of this study contribute to the understanding of the cognitive processes related to time perception in participants who have been trained in processing the temporal characteristics of auditory stimuli.

2–086 | ACUTE STRESS AND REINFORCEMENT PROCESSING IN CANNABIS USERS

Thomas Preston[1], Brian Albanese[1], Norman Schmidt[2], Richard Macatee[1]
[1]Auburn University, [2]Florida State University

Descriptors: Cannabis, EEG, Reward
Chronic cannabis use is maintained in part through dysregulated stress and reward response systems. Stress-related negative affect is thought to act as a salient motivator for chronic substance use. Models of addiction posit that the transition from positive to negative reinforcement motives for substance use is a key mechanism of disordered use. However, research in substance-using samples has not assessed stress-related neural processing of both positive and negative reinforcement. Therefore, the current study utilized laboratory stress induction to examine how stress affects the reward positivity, an event-related potential sensitive to both positive (RewP) and negative (relief-RewP) reinforcement, in 87 cannabis users (58.10% Female, M_{age} = 19.40) varying in Cannabis Use Disorder (CUD) severity and, as part of larger study aims, history of traumatic brain injury (TBI). We predicted greater CUD severity would be associated with a blunted RewP and enhanced relief-RewP, particularly after stress induction, independent of TBI status. Findings indicated that CUD severity was not associated with RewP/relief-RewP amplitude regardless of acute stress. Exploratory analyses revealed that among those with history of traumatic brain injury (TBI+), CUD severity was associated with greater stress-elicited blunting of the RewP and enhancement of the relief-RewP. These findings suggest that history of traumatic brain injury may influence the extent to which stressful experiences modulate the neurophysiology of both positive and negative reinforcement reward processing in CUD.

2-087 | LATE BREAKING
COMPLEMENTARY STUDIES CONFIRM THE IMPORTANCE OF USING MULTIPLE NEUROPHYSIOLOGICAL MEASURES WHEN INVESTIGATING THE DEVELOPMENT OF BRAIN-BEHAVIOR RELATIONSHIPS

Susan Mingils[1], Patricia Davies[1], Mei-Heng Lin[2], William Gavin[1]
[1]Colorado State University, [2]Rutgers University

Descriptors: development, regression, structural equation modeling

Using bivariate measures to study brain-behavior relationships often results in weak correlations which are inconsistent across studies. In two studies, multivariate measures were used to enhance understanding of development and brain-behavior relationships. In the first study, 204 typically developing 7- to 25-year-olds completed a novelty oddball task during an EEG recording. EEG measures included N2 and P3 baseline-to-peak (B2P) amplitudes, P3 peak-to-peak (P2P) amplitude (P3-B2P minus N2-B2P) and P3 latency for each tone type (frequent, target, and novel) at Fz and Pz. In this first study, regressions for all tones and sites revealed N2-B2P amplitude was a stronger predictor of P3-B2P amplitude than age and sex. Regressions on P3-P2P amplitude and P3 latency revealed sex differences and developmental trends suggesting children require more neural resources than adults to discriminate and evaluate stimuli. In the second study, 143 typical children (8–12 years) participated in a speeded flanker task in two EEG sessions 1–3 weeks apart. Behavioral measures included response times. EEG measures included B2P amplitude of stimulus- and response-locked ERPs at FCz. Structural equation modeling (SEM) results demonstrated significant coefficients for trait and state effects, between successive ERP components (N1 to P3), and for prediction of task behavior, highlighting the importance of considering multiple ERP components to study phases of brain processing. In summary, multivariate statistics should be used to examine complex brain-behavior relationships across the lifespan.

2-088 | LATE BREAKING
EFFECT OF SINGLE SESSION SMR NEUROFEEDBACK TRAINING ON PUTTING PERFORMANCE OF PROFESSIONAL GOLFERS

Jia-Hao Wu[1], Ting-Yu Chueh[1], Kuo-Pin Wang[2], Chien-Lin Yu[1], Tsung-Min Hung[1]
[1]National Taiwan Normal University, [2]Bielefeld University

Descriptors: Neurofeedback Training, Sensorimotor rhythm, Sport performance

Sensory-motor rhythm (SMR) activity has been associated with automation and flow in motor execution. According to previous study, neurofeedback training (NFT) could be effective in improving sport performance. However, the effectiveness of a single session of NFT targeting on SMR on motor performance in professional athletes were rarely addressed. Forty right-handed professional golfers were recruited for this study. A crossover design with randomized order of experimental and control conditions was employed. Participants were asked to perform a 10-foot putt while electroencephalograms (EEGs) were recorded before and after the NFT and control conditions. Several visual analog scales (VAS) were administered before and after the conditions to measure attention, control, and relaxation. Paired t tests showed that NFT was effective in improving putting performance ($p = 0.006$) and increasing SMR power ($p = 0.011$) compared to the control condition. Moreover, NFT also resulted in reduced attention ($p < 0.000$) and control ($p < 0.000$) of the motor details, and more relaxed ($p = 0.001$) as manifested in VAS. These findings suggest that a single session of NFT aiming to increase SMR is effective for improving golf putting performance, which provides great practical implication as a single session of NFT is more feasible for implementation in field. Future studies might add a retention test to test the retention effect of a single session NFT, so as to improve the application value in the actual field.

2-089 | LATE BREAKING
RELATING THE STRENGTH OF CONJUNCTIVE REPRESENTATIONS TO EPISODIC RETRIEVAL EFFECTS IN TASK-SWITCHING

Benjamin Rangel, Eliot Hazeltine, Jan Wessel
University of Iowa, Iowa City

Descriptors: Episodic, Event-file, Switching

While unlocking your front door, the external stimulus (door) is paired with an appropriate action (retrieving/inserting the key) and an intended outcome (the opening). The Theory of Event Coding proposes that the temporal association of stimulus, action, and outcome representations leads to their integration into an episodic memory trace, also known as an "event-file." While the retrieval of such event-files from memory allows for more efficient reactivation of their contained representations, this retrieval process is automatic, and may not always be appropriate in a changing environment. Such scenarios are simulated using task-switching paradigms in which task stimuli first cue the retrieval of a preexisting event-file but are then followed by task conditions that are incommensurate with the action contained in said event-file – resulting in a "Partial Repetition Cost" to reaction time. Recently, Kikumoto & Mayr (2020) used Linear Discriminant Analysis and Representational Similarity Analysis of Electroencephalography data to produce the first direct neurophysiological evidence for the effects of event-files on human task performance. Utilizing these methods, we successfully estimated the representational strength of individual task components (cue/target/response) and their combined conjunctive representation (event-file), on a trial-by-trial basis, while subjects (n = 35) performed a task switching paradigm. A mixed-model analysis demonstrated that event-file strength in a previous trial predicts RT in the current trial when retrieval is prompted by a repeated cue.

2-090 | LATE BREAKING
EFFECTS OF CEREBELLAR OPTOGENETIC THETA BURST STIMULATION ON PREFRONTAL CORTEX PHYSIOLOGY

Parker Abbott, Krystal Parker
University of Iowa

Descriptors: Stimulation, Cerebellum, Physiology

Through wide-reaching polysynaptic connections, the cerebellum can influence regions of the cerebral cortex that are involved in cognitive processes. Because of this, the cerebellum is being studied as a therapeutic node for treating cognitive dysfunction. Intermittent theta burst stimulation (iTBS) in particular has been delivered to the cerebellum of healthy and psychiatric patients to influence cognitive functioning. One brain region known to be involved in cognition across mammalian species that is likely manipulated by this form of cerebellar stimulation is the medial frontal cortex (MFC). Literature has shown that evoked cerebellar activity can induce physiological changes in the rodent prelimbic cortex (PrL). Little is known about plasticity effects in the PrL after iTBS of the cerebellum. In this ongoing work, the lateral cerebellar nucleus (LCN) is stimulated using optogenetic iTBS to focus on measures of electrophysiology and dendritic properties. Multisite local field potential (LFP) recordings were performed in the rat brain during the theta burst stimulation, with an optrode placed in the LCN for simultaneous recording and stimulation. After 10 sessions of iTBS, brains were collected for dendritic spine analysis in the PrL. It is hypothesized that LCN stimulation will result in changes to both LCN and PrL LFP dynamics and lead to altered quantities and morphological qualities of dendritic spines in the PrL. Results have important implications for the administration of cerebellar iTBS in the clinic as a treatment of frontal cortical dysfunction.

2-092 | LATE BREAKING
THE AUDITORY STEADY-STATE RESPONSES AND AUDITORY PERCEPTION IN YOUNGER AND OLDER ADULTS

Jaime Morales[1], Dylan Pearson[1], Yi Shen[1,2], Devin McAuley[3], William Hetrick[1], Gary Kidd[1], Brian O'Donnell[1]
[1]Indiana University Bloomington, [2]University of Washington, [3]Michigan State University

Descriptors: Auditory Steady State Response, Aging Effects, Auditory Entrainment

The effects of aging on auditory steady state responses (ASSRs) are not well understood, nor is the relationship of ASSRs to auditory perception in adults. The present study examined the relationship of 10, 20, 30, and 40Hz ASSR power to aging, hearing thresholds, and behavioral rhythm discrimination in older adults (N=29, aged 55-87) compared to younger adults (N=52, aged 18-30). Participants listened to 1000ms click trains of each frequency. Fast-Fourier analysis was used to measure the phase-locked ASSR to each frequency. An audiogram assessed hearing

thresholds. In addition, participants completed entrainment tasks assessing rhythm perception and discrimination. Older adults had significantly lower 40Hz power compared to younger adults, but no group differences were found for 10, 20, and 30Hz frequencies. In young but not older adults, Spearman's correlation analyses showed greater 40Hz power was associated with better performance in a simple rhythm discrimination condition (with a statistical trend in the same direction for a complex rhythm condition). Further, older adults had significantly worse hearing thresholds compared to younger adults, yet did not differ in neural entrainment to 10, 20, and 30Hz. Findings suggest that 40Hz neural entrainment to auditory steady-state stimuli is sensitive to aging. Further, 40Hz gamma neural synchrony in younger, but not older, adults appears to be related to beat and rhythm discrimination, suggesting that neural synchrony might be an area of interest for understanding mechanisms associated with entrainment ability.

2-093 | LATE BREAKING
EEG-BASED CORTICAL CONNECTIVITY IN PARKINSON'S DISEASE

Brooke Yeager[1], Arturo Espinoza[1], Rachel Cole[1], Arun Singh[2], Nandakumar Narayanan[1]
[1]University of Iowa, [2]University of South Dakota

Descriptors: Parkinson's disease, Connectivity, Brain networks

Cortical networks are abnormal in Parkinson's disease (PD) and may be a mechanism that contributes to cognitive impairment. Two cognitive networks specifically affected by PD include the frontoparietal network (FPN) and default mode network (DMN). Our recent work has found decreased functional connectivity between these networks in PD patients from the Parkinson's Progression Markers Initiative dataset. Here, we collected EEG activity from 100 PD patients (34 who had mild cognitive impairment and 19 who had dementia) and focused on low-frequency cortical connectivity between the FPN and DMN. We used wavelet-based time-frequency decomposition to isolate connectivity in delta, theta, and beta bands and subsequently calculated Spearman's correlation coefficients from resting-state data. Our results will provide insight into the cortical contributors to cognitive dysfunction in PD.

2-094 | LATE BREAKING
ACTIVE EXERCISE ELICITS A MORE ROBUST HEMODYNAMIC RESPONSE AND MORE PERSISTENT EXECUTIVE BENEFIT COMPARED TO PASSIVE EXERCISE

Benjamin Tari, Joshua Ahn, Connor Dalton, James Van Riesen, Mustafa Shirzad, Sun Young Choo, Matthew Heath
University of Western Ontario

Descriptors: passive exercise, cerebral blood flow, antisaccades

Elevated cerebral blood flow (CBF) associated with a single bout of active exercise is a candidate mechanism supporting a transient (i.e., <60-min) postexercise executive function (EF) benefit. Passive exercise (i.e., limb movement independent of volitional muscle activation) similarly increases CBF – via a mechanism distinct from active exercise – and provides an immediate postexercise EF benefit. It is, however, unknown for how long passive exercise sustains an EF benefit. To address this, participants (N=22) completed separate 20-min sessions of light intensity active exercise (i.e., via cycle ergometer), passive exercise (i.e., via motorized cycle ergometer), and a non-exercise control condition while transcranial Doppler ultrasound was used to measure blood flow velocity (BV) of the middle cerebral artery. EF was assessed at baseline and immediately, 30- and 60-min after each condition via the antisaccade task (i.e., saccade mirror symmetrical to a target) because antisaccades are mediated via EF networks that show task-based modulation following acute exercise. Results showed that active and passive exercise increased BV with a larger increase observed in the former condition and that both conditions shortened antisaccade RTs (ps<0.009) immediately postexercise. In turn, antisaccade RTs 30-min postexercise were only shortened following active exercise and no condition improved RTs 60-min postexercise. Accordingly, our results provide a link between the magnitude of an exercise-related hemodynamic response and the persistence of a postexercise executive benefit.

2-095 | LATE BREAKING
EXPERIENCING FREQUENT RECENT INTERPERSONAL STRESSORS RELATES TO A LARGER ERN IN CHILDREN AND ADOLESCENTS

Lushna Mehra, Greg Hajcak, Alexandria Meyer
Florida State University

Descriptors: error-related brain activity

The error-related negativity (ERN) is an established neural marker of anxiety and its risk across development. Approximately 50% of the variance in the ERN can be attributed to environmental factors, such as punishment and parenting styles. In the present investigation, we studied the association between the ERN and another environmental factor—stressful life events. In a sample of 176 girls, aged 8 to 15 years, we examined the association between frequency of stressors and the ERN, and whether interpersonal stressors or non-interpersonal stressors uniquely predict the ERN. We also explored whether age moderates the association between stressors and the ERN. Participants completed a self-report measure assessing the frequency of recent life stressors over the past 3 months (ALEQ) and a flankers task during EEG. Results suggest experiencing more frequent stressors is associated with a larger (i.e., more negative) ERN, r(174)=-0.13, p=.043. A multiple linear regression revealed interpersonal stressors uniquely predict the ERN when controlling for non-interpersonal stressors, β=-0.21, t=-2.20, p=.029. Finally, exploratory analyses indicated age moderates the association between interpersonal stressors and the ERN, such that the relation between stressors and the ERN was significant only for younger children. Future studies should clarify the role of specific interpersonal stressors, such as discrimination experiences, in shaping the ERN during development.

2-096 | LATE BREAKING
HEART RATE VARIABILITY AND EXPRESSIVE SUPPRESSION INTERACT TO PROSPECTIVELY PREDICT COVID-19 PANDEMIC-RELATED POST-TRAUMATIC STRESS SYMPTOMS

Francesca Mura, Carola Dell'Acqua, Elisabetta Patron, Simone Messerotti Benvenuti, Daniela Palomba
University of Padua, Padua, Italy

Descriptors: Post-Traumatic Stress Symptoms, Heart Rate Variability, Expressive Suppression

The COVID-19 pandemic is a unique period of stress that, in some cases, led to maladaptive or even post-traumatic stress symptoms (PTSS). Nevertheless, stressful events are more consequential for some individuals than for others. Expressive suppression (ES), a maladaptive emotion regulation strategy related to reduced emotional expression and exacerbation of the physiological response to stress, predisposes individuals to greater risk to develop PTSS. Heart rate variability (HRV), an index of cardiac autonomic balance strictly related to emotion regulation, was also shown to predict PTSS. The present study investigated whether pre-pandemic use of ES and reduced resting-state HRV would predict pandemic-related PTSS severity. Before the pandemic, a total of 83 (58 females) university students completed the Emotion Regulation Questionnaire (ERQ) and a three-minute electrocardiogram recording at rest. Following 12 months, 61 (45 females) participants completed self-report measures of pandemic-related PTSS and the ERQ. ES and reappraisal remained stable overtime. While neither emotional regulation strategies nor HRV predict pandemic-related PTSS, a significant interaction between pre-pandemic reduced HRV and ES in predicting pandemic-related PTSS emerged, where those who had both higher levels of expressive suppression and reduced HRV showed higher levels of PTSS. Taken together, this evidence suggests that an integrated assessment of HRV and ES might be useful for identifying individuals that are more vulnerable to the development of PTSS during times of crisis.

2-097 | LATE BREAKING
L-DOPA AND OXYTOCIN INFLUENCE THE NEUROCOMPUTATIONAL MECHANISMS OF SELFISH AND PROSOCIAL REINFORCEMENT LEARNING

Myrthe Jansen[1], Jo Cutler[2], Patricia Lockwood[2], Ellen de Bruijn[1]
[1]Leiden University, [2]University of Birmingham

Descriptors: Prosocial reinforcement learning, Dopamine, Oxytocin

Reinforcement learning theory describes how we learn to obtain rewards through prediction errors (PEs) that signal the discrepancy between anticipated and actual outcomes. Importantly, to behave in a socially adequate manner we do not only need to learn how to obtain rewards for ourselves but also how to benefit others. Recent studies suggest that learning for others is in underpinned by domain general as well as social-specific neurocomputational

processes. Yet, little is known about the neurochemical mechanisms underlying these computations. We investigated whether oxytocin (OT) and the dopamine precursor L-DOPA impact the neurocomputational mechanisms underlying prosocial reinforcement learning. Using a double-blind placebo-controlled cross-over design, 30 healthy male volunteers were administered OT, L-DOPA, or placebo in three sessions. In each session participants performed a probabilistic learning task in the scanner where they could gain rewards for themselves, another participant, or no one. L-DOPA and OT increased negative PE signaling in areas of the salience network. Interaction contrasts comparing OT with placebo demonstrated different tracking patterns in specific regions of this network (i.a., insula, dorsal ACC, and superior temporal gyrus) for selfish vs. prosocial PEs. These findings suggest that both L-DOPA and OT induce a context-independent shift in saliency towards negative PEs. Moreover, in line with its presumed role in salience attribution to social cues, OT appears to alter PE signaling in salience networks when learning to benefit self vs. others.

2-098 | LATE BREAKING

A 2.5% HYPERCAPNIC ENVIRONMENT AFFECTS VENTILATION BUT NOT BLOOD VELOCITY OR EXECUTIVE FUNCTION

Mustafa Shirzad, James Van Riesin, Benjamin Tari, Nikan Behboodpour, Matthew Heath
Western University

Descriptors: Hypercapnia, Cerebral Blood Flow

The nominal operational limit set by NASA for CO_2 concentration on a spacecraft/habitat is markedly greater than normocapnic air (i.e., 0.04%) and when combined with a reduced O_2 environment has been shown to elicit a range of adverse symptoms (e.g., headaches) and the subjective sense of task-based performance decrements. Our group previously demonstrated that acute exposure to 5% CO_2 (i.e., hypercapnic environment) increased cerebral blood flow and resulted in a surprising post-hypercapnic executive function (EF) benefit. Notably, our previous work did not examine EF during the hypercapnic exposure. The present work examined metabolic, cortical hemodynamic and EF responses (via the antisaccade task) prior to, during and immediately following a 10-min hypercapnic exposure at 2.5% CO_2 and during a same-duration normocapnic control condition. Results indicated that the hypercapnia condition produced a baseline to steady-state increase in ventilation ($\dot{V}E$) and end-tidal CO_2 ($PETCO_2$) but did not alter blood velocity through the middle cerebral artery. Most notably, our measure of EF taken during and after the hypercapnic exposure did not vary from baseline (ps>0.76) and did not vary from performance during the normocapnic control condition (ps>0.59). Hence, although a 10-min exposure to hypercapnic produced a salient cardiorespiratory response it did not affect our measure of cortical hemodynamics, nor did it impede the efficiency and effectiveness of an oculomotor-based measure of EF.

2-100 | LATE BREAKING
CIRCADIAN VARIATION IN PEDIATRIC AMBULATORY BLOOD PRESSURE: A META-ANALYSIS

Hillary Rowe, Neressa Noel, Jennifer McGrath
Concordia University

Descriptors: children, circadian rhythms, ambulatory blood pressure

Blood pressure follows a circadian rhythm characterized by nocturnal dipping and a morning surge. Ambulatory blood pressure monitoring (ABPM) is an important tool in capturing daily blood pressure fluctuations. Youth-specific ABPM guidelines are relatively new and we lack research on 24-hour blood pressure in youth. The aims of this meta-analysis were to examine 24-hour blood pressure patterns in healthy youth, as well as to evaluate the state of the pediatric ABPM literature. A systematic literature search yielded 32 studies that recorded 24-hour ABPM in youth. Demographics, anthropometrics, and study methodology were coded. Hedges' g effect sizes were calculated to test meta-analytic models comparing day and night blood pressure. Circadian variation was pronounced in youth, with large effect sizes in day versus night systolic (g =-1.382) and diastolic blood pressure (g =-1.968). These findings were robust after accounting for demographic, anthropometric, and methodological variables. Few studies followed pediatric ABPM guidelines, and there was little focus on developmental or physiological factors that influence measurement in children. Understanding circadian patterns in pediatric blood pressure is necessary to improve measurement, diagnosis, and prevention among at-risk youth. Future studies should sharpen methodological precision to account for the impact of developmental changes on blood pressure circadian variation. Given that pediatric blood pressure tracks into adulthood, it is important to optimize measurement so that at-risk youth are identified earlier in life.

2-101 | LATE BREAKING
INVESTIGATING MULTIPLE NEURAL MEASURES OF REWARD SENSITIVITY IN EARLY ADOLESCENCE USING TIME-FREQUENCY ANALYSIS

Seonwoo Hong, Anna Weinberg, Simon Morand-Beaulieu
McGill University

Descriptors: Reward positivity, Time-frequency, Principal component analysis

Recent event-related potential (ERP) studies have provided evidence for category-specificity, rather than domain-generality, in reward processing (i.e., varying reward sensitivity across incentive types). However, most of these studies have used traditional time-domain approaches, which cannot isolate underlying signals that contribute to a trial-averaged ERP component. The current study used time-frequency analysis, focusing on power in the reward-sensitive delta and loss-sensitive theta frequency bands, to examine similar and dissimilar responses to different incentive types (i.e., money, food, social reward). Participants (N = 37, ages 10 to 15) in an ongoing study completed reward tasks to elicit the reward positivity (RewP), an ERP that is sensitive to reward and loss feedback. Preliminary results of principal component analysis of time-frequency distributions revealed delta and theta activities appearing in the time-window of the RewP. Feedback type significantly interacted with reward type to predict theta power, such that theta increased following negative outcomes only for monetary and food reward tasks. In contrast, delta was enhanced following receipt of rewards, regardless of type. These findings suggest category-specific differences in theta activity in early adolescence but domain-general responding in delta, and highlight the importance of investigating individual differences in reward processing, which may be linked to distinct cognitive-affective impairments.

2-102 | LATE BREAKING
THE IMPACT OF LONG-TERM STRESSORS ON PHYSIOLOGICAL REACTIVITY TO DAILY STRESSORS

Sam Dutton[1], Patrick Hill[2], Zac Imel[1], Monika Lohani[1]
[1]University of Utah, [2]Washington University, St. Louis

Descriptors: Stress, Life Events, Heart Rate

Long-term and daily stressors are associated with adverse psychological and physical health outcomes, including distress and increased likelihood of developing chronic illness. Higher exposure to long-term stressors may have a cumulative effect, exasperating reactivity to daily stressors. In the present study, we investigated how physiological reactivity to common types of daily stressors was moderated by individual differences in experiences of long-term stressors. Twenty-nine community members (Mean age = 28.17, SD = 8.78; Female = 76.9%) completed the Holmes Rahe Stress Inventory as a measure of long-term stressors they have experienced in their past year. They were shown images of daily stressors (related to work, home, environment,

commute, negative self, and argument), while their heart rates were recorded to measure their physiological reactivity. The presence of long-term stressors interacted with daily stressors. Specifically, relative to low levels of long-term stress (-1 SD), high levels of long-term stress levels (+1 SD) were associated with greater physiological reactivity when exposed to images of arguments, commute, home, and negative-self stressors. For those with high levels of long-term stress, viewing images of arguments produced the greatest effect, predicting higher heart rate than home, negative-self, environment, and work stressors. The present findings highlight the pervasive role of long-term stressors and the importance of stress management.

2-103 | LATE BREAKING
A DIFFERENT RELATIONSHIP BETWEEN PHYSIOLOGY AND SYMPTOMS FOR SEXUAL AND GENDER MINORITIES

Scott McKernan[1], Wendy D'Andrea[1], Greg Siegle[2]
[1]*The New School for Social Research,* [2]*University of Pittsburgh School of Medicine*

Descriptors: Sexual and Gender Minority, Psychopathology
Sexual and gender minority (SGM) populations have higher rates of psychopathologies and physical illnesses. Evidence suggests that the relationship between physiology and physical and mental health may be different for minoritized individuals, but few studies have investigated how SGM individuals' physiology relates to these disparities. The current study examined the relationship between symptomology and physiology in SGM and cis-gendered heterosexual (CGH) participants. Respiratory sinus arrhythmia (RSA) data was gathered during a stress-inducing digit sorting task and symptom profiles were created. Different symptom profiles emerged for CGH and SGM participants: high (N = 86) and low symptom (N = 83) CGH participants were differentiated by affect dysregulation while high (N = 13) and low (N = 32) symptom SGM participants were differentiated by identity-related symptoms (e.g., abandonment concerns). Although only marginally significant, for CGH participants the low symptomatic group showed greater parasympathetic activity (Mdiff=0.333, p = .113) whereas for SGM participants the high symptom group had more parasympathetic activity. In other words, the most symptomatic group physiologically responded like the least symptomatic group. One interpretation of these findings is that the "symptoms" in the high symptom SGM group are not so much related to psychopathology, but rather a real lived experience of abandonment related to their identity and that active engagement with an oppressive world resulted in a physiological benefit.

Virtual Poster Session

Friday, September 30, 2022

VIRTUAL-001 | STARTLE HABITUATION PATTERN ON SHAPELETS IDENTIFIES INDIVIDUALS WITH LOW VAGALLY MEDIATED HEART RATE VARIABILITY

Xiao Yang, Yi He
Old Dominion University

Descriptors: *Startle Habituation, Vagally mediated Heart Rate Variability, Machine Learning*

Vagally mediated heart variability (vmHRV) is thought to index top-down recourses that are needed to inhibit subcortical threat circuits in safe contexts. Low vmHRV is linked to various psychopathology and poor performance in cognitive tasks. The startle response (SR) is a defensive response to potential threats and its habituation reflects top-down control on threat processing. Although it is hypothesized that low vmHRV is related to less SR habituation, their quantitative relationship remains unclear, partly due to the lack of SR habituation models. The present study aimed to examine whether SR habituation pattern can differentiate between low vmHRV individuals from those with normal levels. Resting vmHRV was derived from electrocardiogram of 90 college-aged subjects who received 18 auditory SR trials. SR was measured by electromyography activity of eyeblink. Based on prior studies, low vmHRV individuals were defined as the first quartile of vmHRV in the sample. Shapelet-based classifier (SBC), a machine learning model that identifies temporal variation patterns, was used to characterize the correlation between time series SR data and vmHRV. Results showed that the SBC model classified an individual into the low and normal vmHRV groups with a high accuracy (90.6%), suggesting a strong correlation between SR and vmHRV. The findings help delineate quantitative relationships among physiological measures from different domains and highlight data-driven approaches in the study of trait differences in emotion and cognition.

VIRTUAL-002 | PHYSIOLOGICAL LINKAGE PREDICTS SUCCESSFUL EMOTION DETECTION WHILE VIEWING VIDEOS OF EMOTIONS COMMUNICATED VIA TOUCH

Heather Kissel, Alyssa Tsui, Mikaley Bolden, Deanna Driver, Bruce Friedman
Virginia Tech

Descriptors: *Physiological linkage, Dynamic linear time series modeling, Touch*

Research has demonstrated that distinct emotions can be communicated via touch alone and that others viewing videos of these touch communications can also decode them (e.g., Hertenstein et al., 2006). In stranger-female dyads, physiological linkage plays a role in the mechanism of emotion communication, because touch seems to strengthen and lengthen linkage (Kissel, 2020). The current study examined if physiological linkage between video observers and those in the video (assessed using dynamic linear time series modeling) plays a role in successful detection of the recorded emotions. 43 female participants (mean age = 19.45) viewed 24 1-minute touch emotion communication videos of participants from Kissel (2020) while ECG signals were acquired by Mindware Mobile devices. 12 emotion clips showed a dyad in which the original receiver correctly detected all 12 emotions; the other 12 clips depicted a dyad in which the receiver incorrectly detected all 12 emotions. Order of video presentation between the two sets of clips was counterbalanced. Results showed that physiological linkage occurs between "live" and recorded participants. Participants demonstrated longer linkage times with the initial dyad they viewed, $t(21) = 2.45, p = .02$. Linkage with videoed communicators whose communications were correctly perceived by the videoed receivers had a larger influence on emotion word, valence, intensity, and circumplex model quadrant detection accuracy by observers. Based on these results, physiological linkage may influence empathic accuracy in virtual settings.

VIRTUAL-003 | COGNITIVE REAPPRAISAL OF HIGH- AND LOW-CALORIE FOOD CUES IN RESTRAINED EATERS: A PRELIMINARY ERP INVESTIGATION

Matteo Giraldo[1], Marta Ghisi[1], Gioia Bottesi[1], Michela Sarlo[2]
[1]University of Padua, [2]University of Urbino

Descriptors: *Cognitive reappraisal, Food processing, Restrained eating*

Cognitive reappraisal is an emotion-regulation strategy that might help to control food intake. Restrained eating is characterized by a cognitive effort to resist the urge to eat, aiming to control body weight. The present study investigated the neural correlates of emotional processing and reappraisal of high- (e.g., pizza, cookies) and low-calorie (e.g., boiled rice, fresh fruit) food stimuli in female restrained eaters. Restrained (RES; n = 12) and unrestrained eaters (UNRES; n = 15) were presented with pictures of high- and low-calorie foods. ERPs were recorded in a block-design task in which participants were instructed either to passively look at the pictures (Watch) or to change the appetitive value of food (Increase, Decrease). Results showed that the LPP amplitude in the 500-700 ms time window was larger for RES than UNRES, for high- than low-calorie food, and during both reappraisal conditions than during passive viewing. In the 700-1000 ms time window, RES showed a lower LPP amplitude during the Decrease condition for both types of food, as compared to the Watch condition, with no differences for UNRES. These results suggest that, in contrast with UNRES, RES showed early increased attention towards food that ended in a successful down-regulation of the appetitive value of both high- and low-calorie foods. This emotion-regulation strategy might help to control overeating at the sight of palatable food and to engage in a healthier food choice in everyday life. However, when extended to low-calorie food, it might result in a problematic eating behavior.

VIRTUAL-004 | PHYSIOLOGICAL EVIDENCE OF ZOOM FATIGUE: THE EFFECT OF NON- AND MEDIATED HUMAN COMMUNICATION ON MENTAL EFFORT

Jingjing Han, Han Zhou
Fudan University

Descriptors: RSA, Mental effort, Interpersonal Communication
The pandemic has made many people highly dependent on videoconferencing. "Zoom fatigue" as a way to describe videoconferencing caused exhaustion has been widely discussed. To understand the physiological and psychological mechanism of zoom fatigue, this study examined differences in mental effort levels as a function of conversing using four different communication modalities (e.g., face-to-face, videoconferencing, voice call, and texting). A total of 99 dyads participated this study. Each dyad had an unstructured conversation for two minutes, during which ECG, EDA and facial EMG were measured. Respiratory sinus arrhythmia (RSA) was calculated from the ECG signal to indicate mental effort level. Results of multilevel modeling showed a significant talking condition by time interaction effect. Compared to the face-to-face condition, the texting group exhibited the highest level of mental effort, followed by the voice call and then the videoconferencing group. While the face-to-face, videoconferencing, and vocal call conditions exhibited a decreasing trend of mental effort over time, texting required a consistent amount of mental effort. This study suggests that compared to the mediated talking conditions, the evolved face-to-face conversation might be the most energy-saving option for human communication.

VIRTUAL-005 | INCREASES IN TRAFFIC VOLUME ARE ASSOCIATED WITH MEASURABLE CHANGES IN EEG IN URBAN CYCLING LANES

Daniel Robles, Kyle Mathewson
University of Alberta

Descriptors: Mobile EEG, attention, ERP
In this study, twenty-four participants completed an auditory-oddball task while riding a bicycle in three different conditions. A low traffic condition where participants rode in a fully separated bike lane alongside a quiet residential street, an intermediate traffic condition where participants rode alongside a busy residential street in a painted lane, and a heavy traffic condition where participants rode alongside fast/heavy traffic on a shared-use path. We found that heavy traffic cycling was marked by increased reaction times and a trend in lower accuracy relative to low traffic. Relative to low traffic, we also found an increase in N1 amplitude during heavy traffic that we associate with increases in attentional filtering. This increase in N1 amplitude follows the pattern of traffic noise: higher N1 amplitude following heavy traffic, intermediate amplitude following intermediate traffic, and the lowest amplitude in the low traffic condition. We found no reliable differences in P3 amplitude and alpha power between the different traffic conditions.

VIRTUAL-006 | THE ROLE OF EMOTION REGULATION STRATEGIES IN THE RELATIONSHIP BETWEEN POSITIVE AFFECT AND THETA AND BETA BAND POWER: A RESTING STATE EEG STUDY

Arooj Abid, Matt Judah
University of Arkansas

Descriptors: emotion regulation, spectral analysis, positive affect

Maladaptive emotion regulation (ER) strategies are a trans-diagnostic construct in psychopathology. ER depends on cognitive control, so brain activity associated with cognitive control, such as frontal theta and beta, may be a factor in ER. This study investigated the association of theta and beta power with positive affect and whether emotion regulation strategies explain this association. 124 undergraduate students (mean age = 20.74, SD = 5.29; 73% women) completed self-report questionnaires, including the Emotion Regulation Questionnaire and the Positive and Negative Affect Schedule. Spectral analysis was performed on resting state frontal electroencephalogram activity that was collected for 8 1-minute periods of alternating open and closed eyes. Relative beta and theta band power were extracted relative to global field power at frontal channels. Regression analysis revealed that positive affect is significantly predicted by theta power ($\beta = .23$, $p = .007$) and beta power ($\beta = -.33$, $p < .0001$). There was an indirect effect of beta power on positive affect via reappraisal [$\beta = -.08$, 95% C.I. $(-.16, -.005)$], but not suppression [$\beta = -.009$, 95% C.I. $(-.04, .009)$]. Additionally, theta power significantly predicted suppression ($\beta = .18$, $p = .04$), but no indirect effect was observed between theta power and positive affect. These findings are consistent with a prior study reporting a positive and negative relationship between theta and beta power, respectively, and positive affect induction. This study elucidates how modulation of theta and beta bands link to ER strategies.

VIRTUAL-007 | THE UNILATERAL FEEDBACK AFFECTS THE STIMULUS-PRECEDING NEGATIVITY (SPN) AND THE ANTERIOR INSULA: ERP AND FMRI STUDIES

Yoshimi Ohgami[1], Yasunori Kotani[1], Nobukiyo Yoshida[2], Hiroyuki Akai[2], Akira Kunimatsu[3], Shigeru Kiryu[3], Yusuke Inoue[4]

[1]*Tokyo Institute of Technology,* [2]*The University of Tokyo,* [3]*International University of Health and Welfare,* [4]*Kitasato University*

Descriptors: Anticipation, Anterior insula, Hemisphere difference

Stimulus-preceding negativity (SPN) appears before feedback (FB) stimulus and has right hemisphere dominance that is caused by activity in a network involving anterior insula. The present study examined the effects of unilateral stimulus presentation on the right hemisphere dominance of the SPN in the ERP experiment, and aimed to elucidate whether unilateral stimulus presentation affects activations in the bilateral anterior insula in the fMRI experiment. Separate fMRI and ERP experiments were conducted using visual and auditory stimuli by manipulating the position of stimulus presentation (left side or right side) with the time estimation task. There were five experimental conditions: (a) Visual/Left condition, (b) Visual/Right condition, (c) Auditory/Left condition, (d) Auditory/Right condition, and (e) Control condition, where the feedback stimulus was omitted. The ERP experiment revealed a significant right hemisphere dominance during left stimulation and no laterality during the right stimulation. The fMRI experiment revealed that the left anterior insula was activated only by the right stimulation using auditory and visual stimuli whereas the right anterior insula was activated by both left and right stimulations. The visual condition retained a contralateral dominance, but the auditory condition showed a right hemisphere dominance in a localized area. The results of this study indicate that the SPN reflects perceptual anticipation, and also that the anterior insula is involved in its occurrence.

VIRTUAL-008 | MUSICAL TEMPO CHANGES THE ALPHA FUNCTIONAL CONNECTIVITY INVOLVED IN TIME ESTIMATION

Sergio Rivera-Tello, Rebeca Romo-Vázquez, Andrés González-Garrido, Julieta Ramos-Loyo
University of Guadalajara

Descriptors: EEG Connectivity, Time estimation, Music

Time perception is a complex cognitive ability that requires the integration of temporal clues and can be susceptible to the rate of external stimulation. Music is a relevant synchronizer that can affect behavioral timing and share with time estimation the co-activation of several brain regions. Alpha rhythm increases during music listening as well as in time estimation. Here, we aimed to observe the effects of musical tempo on the alpha connectivity patterns involved in time estimation. Twenty-eight men participated in the study, who performed a time production task in silence and after listening to music at different tempi, 90-, 120- and 150-bpm. We calculated the correlation matrices between 32 electrodes of filtered signals (alpha1: 8–10.5 Hz, alpha2: 11–13 Hz) during rest and task. During time estimation in silence there was mainly a decrease in the overall alpha correlation compared to rest, except for an increased connectivity mainly between frontal, central and temporal regions, with a predominant right lateralization of alpha2. Moreover, musical tempo changed the

level of correlation, where both alphas increase significantly with music at 150-bpm and only alpha2 decreased at 90-bpm. Our findings show that time estimation requires the alpha synchronization between frontal, central and temporal regions, likely related to top-down anticipation. Which suggest that musical tempo can modulate the temporal expectation, where slower music could diminish the connectivity involved in time estimation, while faster music can enhance it.

VIRTUAL-009 | ASYMMETRIC ACTIVATION OF FRONTAL BRAIN REGIONS DURING COGNITIVE REAPPRAISAL GENERATION – A FUNCTION OF IMPLEMENTED REAPPRAISAL STRATEGY?

Corinna Perchtold-Stefan, Andreas Fink, Ilona Papousek
University of Graz

Descriptors: hemispheric asymmetry, cognitive reappraisal, prefrontal cortex
Lateralized prefrontal cortex activity facilitates several affective functions like emotion regulation by cognitive reappraisal. Yet, differences in methods (EEG, fMRI) and task instructions have yielded disparate findings whether relatively greater left or right prefrontal activity is more beneficial for reappraisal success. Earlier research on the generation of multiple reappraisals specifically (reappraisal inventiveness) found left prefrontal activity linked to higher reappraisal fluency, but more recent lab findings have been mixed. We argue that differences in hemispheric activation patterns during reappraisal efforts may depend on the specific and highly diverse cognitive strategies utilized to reappraise negative stimuli. In this EEG study, n = 100 participants were randomly assigned to three groups and instructed to either generate problem-oriented reappraisals, positive re-interpretations, or distancing reappraisals for anger-eliciting situations, while EEG alpha asymmetry changes in the prefrontal cortex were recorded (electrodes F3-F4, F7-F8). Group comparisons showed a right-lateralized frontal activation pattern for engaging in problem-orientation and positive re-interpretations (lowest fluency, more difficult), but a left-lateralized frontal EEG pattern for distancing reappraisal (highest fluency, less difficult). Overall, higher reappraisal capacity correlated with right-lateralized frontal activity. Frontal EEG alpha asymmetry observed during reappraisal may be a specific function of implemented reappraisal strategy rather than general ideational fluency.

VIRTUAL-010 | ELECTROPHYSIOLOGICAL CORRELATES OF SOCIAL FEEDBACK PROCESSING IN HEALTHY AND DEPRESSIVE INDIVIDUALS

Sebastian Scholz[1], Sebastian Schindler[1,2], Johanna Kissler[1]
[1]Bielefeld University, [2]University of Münster

Descriptors: EEG/ERP, Social neuroscience, Depression
The significance of social feedback partly depends on the social context. Previous research revealed that feedback acceptance and electrophysiological processing of social feedback depends on the origin of this feedback. For instance, individuals are more influenced by feedback if this information is supposedly delivered by another person than by a computer. Since individuals suffering from depression are especially sensitive to negative social information, these individuals might be even more influenced by the original of social feedback. To investigate the influence of social context on feedback processing, control and depressive participants were led to believe that they would be confronted with feedback by either a peer next door or randomly acting computer. Positive, neutral, or negative trait adjectives were supposedly judged by the two senders to either match or mismatch the participants' personality based on a self-disclosure interview. EEG results revealed enhanced ERP components along the complete processing stream if feedback was supposedly delivered by another person rather than a computer. This enhancement started early with the P2 component and encompassed the P3 and LPP components. Moreover, the valence of the given feedback influenced the ERP components only for human senders, indicating that the social interactive context influenced feedback processing. Individuals suffering from depression showed even stronger enhancements in the components, representing a specific alteration in social feedback processing in depression.

VIRTUAL-011 | DIFFERENT ACTIVATION PATTERN BETWEEN THE LEFT AND RIGHT ANTERIOR INSULA EVOKED BY SWITCHING STIMULI WITH REWARD INFORMATION

Yasunori Kotani[1], Yoshimi Ohgami[1], Nobukiyo Yoshida[2], Hiroyuki Akai[2], Akira Kunimatsu[3], Shigeru Kiryu[3], Yusuke Inoue[4]
[1]Tokyo Institute of Technology, [2]The University of Tokyo, [3]International University of Health and Welfare, [4]Kitasato University

Descriptors: insula, salience network, default mode network

The right anterior insula (aINS) has a function of switching brain networks between the default mode network and the central executive network. However, it is still unclear whether the left aINS is also involved in the switching function. In the present fMRI study, we manipulated the reward information conveyed by a switching stimulus (SW) to compare activation in the left and right aINS. Participants (N = 15) performed a time estimation task, and there were three conditions: reward (RW), no-reward (NR), and no-feedback (NF) conditions. In the RW and NR, the SW indicated that a feedback stimulus with reward (RW) or without reward (NR) would be presented a few seconds after the SW. In the NF, the SW indicated that the feedback stimulus would not be presented, which meant the end of the trial. The fMRI analyses revealed that the left aINS was activated only in the NF condition, while the right aINS was activated in the NR and NF. The results of the right aINS suggest that participants might expect and wait to receive the reward from the beginning and might not need to switch to the central executive network in the RW. In contrast, the left aINS was activated only in the NF, where the SW meant the end of the trial. Späti et al. (2014) suggested that the left aINS is involved in cognitive control processes important for subsequent behavioral adaptations, and this might be why the left aINS was activated only at the end of the trial. The findings of the present study suggest that the left aINS might be involved in behavioral updates rather than switching the brain networks.

VIRTUAL-012 | SOCIAL SUPPORT AS A MEDIATOR BETWEEN ADHD STATUS AND BLOOD PRESSURE

Diana Heath[1], Chanelle Gordon[2]
[1]University of California, Berkeley, [2]Boys Town National Research Hospital

Descriptors: Blood Pressure, Attention-Deficit/Hyperactivity Disorder, Social Support
Attention-Deficit/Hyperactivity Disorder (ADHD) has been associated with poor social outcomes (Mikami, 2010). Studies also show that people with ADHD have increased blood pressure measurements (Fuemmeler et al., 2011). Furthermore, social support (SS) can provide an important buffer for high blood pressure (Piferi, 2006). Thus, we explore if SS mediates the link between ADHD status and blood pressure. We utilized data from the All of Us research program, which aims to collect biological, environmental, and behavioral data from a diverse sample of participants across the U.S. Our sample included data from 2346 participants aged 20 to 65. Those diagnosed with ADHD comprised 4% of the sample which is consistent with the estimated national prevalence of adult ADHD (Visser et al., 2014). Social support was collected after the initial ADHD diagnosis and within 6 months prior to the blood pressure measurement. Overall SS was associated with ADHD status and systolic blood pressure (SBP). ADHD status had an indirect effect on SBP through overall SS. This finding did not hold for diastolic blood pressure (DBP). When SS was further divided into individual categories, ADHD status was associated with affectional, positive, coping, and tangible support. Although emotional support was the only SS category not associated with ADHD status, it was the only SS category linked to SBP. Neither ADHD status nor any of the individual SS categories were associated with DBP. Future research should explore other mediators between ADHD status and blood pressure.

VIRTUAL-013 | CHARACTERISTICS IN MOTIVATIONAL SYSTEMS AND AFFECTIVE INFORMATION PROCESSING OF JAPANESE COLLEGE STUDENTS INTERESTED IN DRUG ABUSE

Satoko Kurita[1], Jun'ichi Katayama[2]
[1]Kobe Women's University, [2]Kwansei Gakuin University

Descriptors: P300, Individual differences, Substance abuse
While the number of college students who abuse illegal drugs is increasing in Japan, their psychological characteristics are not well understood. In this study, we reanalyzed data including ERPs of 38 college students in order to examine whether their interest in using illegal drug is related to their characteristics in appetitive and aversive systems (measured by miniMAM: A. Lang, et al., 2011) and sensation seeking, as well as affective information processing. The ERP data were elicited by electrical probes randomly applied (mean ISI = 10.75 sec) to their wrists during 2 minutes each for 12 video clips (3 from 4 emotional categories: neutral, highly pleasant, highly unpleasant, and highly coactive). After viewing the video clips, subjects reported their degree of feeling (arousal and valence) toward each video clip. The results showed a potential tendency of Japanese college students who are interested in using illegal drug. Overall, their trait level of activation in aversive system was lower than the non-interested group but their sensation seeking level was not higher. P300 amplitude indicated that the interested group

tended to pay more attention to highly aversive stimuli. However, interestingly, they experienced lower degree of arousal during the same stimuli. These results may have important implication in terms of optimal level of arousal (OLA). That is, they might have biological characteristics that make it difficult for them to subjectively experience arousal.

VIRTUAL-014 | INDIVIDUAL DIFFERENCES IN MEMORY-GUIDED ATTENTION

Shimin Mo[1,2], Manda Fischer[1,2], Morris Moscovitch[1,2], Claude Alain[1,2]

[1]University of Toronto, [2]Rotman Research Institute, Baycrest Hospital

Descriptors: Attention, Individual differences, Electroencephalography

Long-term memory can bias auditory attention and improve signal detection. Yet, the magnitude of this benefit varies substantially between studies. This study aimed to clarify the source of this variability by examining the performance and neural activity of 122 young adults. At learning, participants listened to everyday sound-clips (half included a lateralized target tone) and classified the clip as a man-made or natural sound (Exp 1) or judged if the tone was low or high in pitch (Exp 2 and 3). At test, they responded to a lateralized faint target tone embedded in each clip and answered questions about their memory. Hierarchical clustering with a predetermined cluster number ($K = 2$) showed different memory-guided attention patterns for the two groups. Both groups showed comparable response times on trials where the clips were previously associated with the target tone (i.e., memory trials). Surprisingly, the groups differed for trials that did not have a clip-tone association (i.e., neutral trials). One group (g1) was faster on memory trials than neutral trials, while the other (g2) was faster on neutral trials than memory trials. Scalp-recorded event-related potentials showed greater lateralization over left central-parietal areas for neutral clips in group 1 compared to group 2, suggesting a motor preparation strategy that speeded up group 1's response. The study reveals individual differences in memory-guided attention and shows that the control condition that establishes a baseline for effect comparison, could show individual differences in cognitive strategies.

VIRTUAL-015 | BLUNTED INSULA CORTICAL ACTIVATION DURING REWARD ANTICIPATION IN MAJOR DEPRESSIVE DISORDERS

Xi Ren[1], Evan White[1], Mariah Nacke[1], Elisabeth Akeman[1], Mallory Cannon[1], Ahmad Mayeli[1,2], James Touthang[1], Obada Al Zoubi[1,3], Timothy McDermott[1,4], Namik Kirlic[1], Jessica Santiago[1], Rayus Kuplicki[1], Martin Paulus[1,4], Michelle Craske[5], Kate Wolitzky-Taylor[5], James Abelson[6], Christopher Martell[7], Ashley Clausen[8], Robin Aupperle[1,4], Jennifer Stewart[1,4]

[1]Laureate Institute for Brain Research, [2]University of Pittsburgh, [3]Harvard Medical School/McLean Hospital, [4]University of Tulsa, [5]University of California, Los Angeles, [6]University of Michigan, [7]University of Massachusetts, Amherst, [8]St. Vincent Hospital

Descriptors: Stimulus preceding negativity, Insula, Depression

The stimulus preceding negativity (SPN) is a slow event-related potential (ERP) recorded during electroencephalography (EEG), thought to reflect anticipatory brain activity. Previous studies with healthy adults suggested that the source of SPN is the insula cortex, an area thought to be disrupted in individuals with major depressive disorder (MDD). However, it is unclear whether MDD display abnormal insular activation during reward anticipation. The current experiment utilized ERP source localization in concurrently recorded fMRI-EEG data and compared the source-resolved insula activity of SPN (referenced to linked mastoids, time-locked to feedback onset, baseline at -1700 to -1500 ms, ERP measured between -200 to 0 ms) between 30 MDD and 28 healthy controls (CTL) during reward anticipation in the Monetary Incentive Delay task. MDD showed lower bilateral insular SPN source activation than CTL ($F = 7.88$, $p = .007$, $d = 0.75$) and within MDD, lower activation was related to higher Positive and Negative Affect Scale (PANAS) state negative affect ($r = -0.45$, $p = .04$). The identification of blunted reward sensitivity across multiple levels of analysis (i.e., fMRI, EEG) that offer different measurement strengths (i.e., in temporal/spatial resolution, differences in mobility and cost-efficiency) may provide new insights for informing the development of prognostic or treatment biomarkers in MDD. Future work is warranted to determine whether SPN source signals can predict future changes in clinical episode status, symptoms of negative affect, and/or treatment response in individuals with MDD.

VIRTUAL-016 | RECREATIONAL CANNABIS USE IS RELATED TO INCREASED NOCTURNAL HEART RATE VARIABILITY IN YOUNG AFRICAN AMERICAN COLLEGE STUDENTS IN THE ABSENCE OF DEPRESSION

Kimberly Bell[1], Niyana Rasayon[2], Kaleb Adams[1]

[1]North Carolina Agricultural and Technical State University, [2]University of the District of Columbia

Descriptors: nocturnal heart rate variability, cannabis use

Heightened autonomic nervous system (ANS) arousal is a major contributor to the effect of stress on adverse cardio-vascular health outcomes which disproportionately affect African Americans. ANS arousal is normally attenuated during sleep and compromise of this shift appears to play a significant role in a spectrum of comorbidities among African Americans. Parasympathetic nervous system (PNS) dominance during sleep can be altered by cumulative environmental stressors. Use of Cannabis has been recognized to contribute to ANS function, but with mixed results. This study examined relationships between self-reported cannabis dose (g/day) and nocturnal ANS activity indexed by heart rate variability in healthy African American men and women. One-Hundred and forty-two participants completed NIDA drug assessment questionnaires including self-reported dosage in grams per day, and 24-hour electrocardiogram recordings. Normalized high frequency for PNS activity was computed for 5-minute epochs while awake and sleep. Pearson's correlations were run between variables. Stepwise multiple regression analyses indicated that cannabis dosage (g/day) significantly predicted nocturnal HRV, $F(12,149) = 2.022$, $p = .027$, $R^2 = .150$ after controlling for covariates. Increased cannabis dosage was positively related to nHF during sleep, but not while awake. Findings suggest that cannabis use in grams per day influences nocturnal ANS activity may be a pathway by which cannabis consumption positively affects cardiac health, sustained restful sleep, and a potential factor in corollary health outcomes.

VIRTUAL-017 | SEX-RELATED DIFFERENCES IN RESTING-STATE FUNCTIONAL CONNECTIVITY UNDER EMOTIONAL BURNOUT (RESISTENCE STAGE)

Sergii Tukaiev[1], Dmytro Harmatiuk[2], Anton Popov[2], Mykola Makarchuk[1]

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

Descriptors: emotional burnout, EEG, coherence

The phenomenon of burnout generates the most interest due to relation to complete or partial disengagement of emotions, cognitive impairment, impairment of long-term and working memory. The neurophysiological mechanisms of emotional burnout remain insufficiently studied. Data related to gender characteristics are contradictory. To establish the gender related EEG markers of burnout was our aim. 621 volunteers (443 females) aged 18 to 24 years participated in this study. EEG was registered during the resting state (3 min, closed eyes condition). The interhemispheric and intrahemispheric average coherence across all EEG segments in all frequencies from 0.2–45 Hz was estimated. Psychological testing was performed before the registration of EEG. To determine the level of burnout formation the Boyko's Syndrome of Emotional Burnout Inventory (SEB) was used. The Resistance phase of emotional burnout was formed in 139 women and 42 men. Development of Resistance stage in female includes formation of new intrahemispheric connections predominantly in the left frontal region (alpha1,2,3-subbands) and the midline frontal-central axis (Fz-Cz, alpha1,2 and theta2-subbands). At the same time new intrahemispheric links in men under Resistance development are formed mainly in the right frontal region (alpha1,2,3-subbands). Connectivity patterns displayed gender-related variations that are associated with the difference in the alterations in the attention focusing, working memory, and emotional processes under burnout formation.

VIRTUAL-018 | MODULATION OF EYEBLINK AND SKIN CONDUCTANCE RESPONSES TO A STARTLE PROBE BY PREPULSE AND AMBIENT ILLUMINATION

Xiao Yang, Jessica Inman, Kasie De Jesus, Zulu Cameron

Old Dominion University

Descriptors: Startle Response, Prepulse Inhibition, BIS/BAS

Prepulse inhibition (PPI) of startle (SR) is thought to reflect sensory gating, and reduced PPI is associated with various mental disorders. SR is also modulated by environmental factors, such as ambient illumination. However, trait differences that link reduced PPI and SR modulation to mental disorders remain unclear. The present study aimed to examine the effects of behavioral activation and inhibition systems (BAS/BIS) on PPI and SR modulation by ambient light. Forty-five college-aged participants completed the BAS/BIS scale and received 32 trials of a SR probe with and without a prepulse with a 60-ms lead interval in light and dark conditions. The eyeblink and skin conductance responses (SCR) to the SR probe were recorded and were submitted to 2 (prepulse condition) X 2 (light condition) repeated measures ANOVA separately. The relationship between BAS/BIS scores and SR modulation scores were assessed by Pearson correlations. Results showed that SR eyeblink magnitude was decreased by prepulse but was not influenced by ambient illumination. However, SCR was enlarged under the light condition and was reduced by prepulse. There was also an interaction between the prepulse and light conditions: the effect of prepulse on SCR was smaller under the light condition compared the dark condition. Further, PPI was negatively correlated with BAS-Drive score, $r = -.37$, suggesting BAS underlies reduced sensory gating in psychiatric disorders. Additionally, different patterns of SR eyeblink and SCR indicate the specificity of autonomic and somatic responses in SR modulation.

VIRTUAL-019 | LOUDNESS IS TIED TO STRONGER SKIN CONDUCTANCE AND AFFECTIVE RESPONSES OF AUDITORY PERCEPTION

Mercede Erfanian, Maria Chait, Tin Oberman, Jian Kang
University College London (UCL)

Descriptors: Auditory perception, Perceptual attributes, Skin Conductance Response (SCR)
Certain acoustic properties such as frequency content or temporal modulation may affect the auditory perception. Regardless, it seems once the sound is louder than a certain level, it is perceived as unpleasant. Therefore, we aim to measure the perceptual pleasantness and eventfulness, main attributes of auditory perception, and skin conductance response in response to natural and mechanical sounds presented in three loudness levels of low (10 Sones), medium (20 Sones), and loud (30 Sones). The auditory stimuli are ~15 s in which are presented in two separate listening tasks (passive and active) in individuals with poor and normal psychological well-being. Twenty-five participants took part in this study (14 females; age mean $= 27.44 \pm 9.76$, age-range 18–45). The results suggest that regardless of the sound category (natural and mechanical), skin conductance response and perceptual eventfulness increase with the loudness increment, whereas the perceptual pleasantness reduces when loudness increases. No difference was observed in the perceptual pleasances and eventfulness, and skin conductance response among individuals with poor and normal psychological wellbeing. These findings present evidence to support the effect of loudness level on the auditory perception and its underlying skin conductance response.

VIRTUAL-020 | EMOTION REGULATION STRATEGIES DIFFERENTIALLY MODULATE NEURAL ACTIVITY ACROSS AFFECTIVE PREDICTION STAGES: AN HD-EEG INVESTIGATION

Fiorella Del Popolo Cristaldi[1], Giovanni Mento[1], Giulia Buodo[1], Michela Sarlo[2]
[1]University of Padua, [2]University of Urbino Carlo Bo

Descriptors: ERPs, S1-S2 paradigm, emotion regulation
Emotion regulation (ER) strategies can influence how affective predictions are constructed by the brain (generation stage) to prearrange action (implementation) and update internal models according to incoming stimuli (updating). However, the neural correlates of the regulation processes are unclear. In a hd-EEG study we investigated if suppression vs. cognitive reappraisal ER strategies predicted ERPs and brain source activity across prediction stages, as a function of contextual uncertainty. A S1-S2 paradigm with emotional faces and pictures as S1s and S2s, respectively, was presented to 36 undergraduates. Contextual uncertainty was manipulated across three blocks with 100%, 75%, or 50% S1-S2 congruency. The effects of ER strategies (assessed through the Emotion Regulation Questionnaire) on ERP and brain source activity were tested for each prediction stage through linear mixed-effects models. No ER strategy affected prediction generation. During implementation, in the 75% block a higher tendency to suppress emotions predicted a higher activity in the left supplementary motor area at 1500–2000 ms post-stimulus, and a smaller amplitude of the CNV at 2000–2500 ms. During updating, in the 75% block a higher tendency to cognitively reappraise emotions predicted larger P2 and LPP, whereas no significant effects were found on brain source activity. Results suggest that in a moderately predictive context, allowing a partial

control on stimuli predictability, different ER strategies are deployed to modulate information processing along different affective prediction stages.

VIRTUAL-021 | REDUCED NEURAL RESPONSE TO CUE AND FEEDBACK STIMULI IN THE MID TASK PREDICTS ADOLESCENT DEPRESSIVE SYMPTOMOLOGY

Brittney Thompson, Nicholas Santopetro, C.J. Brush, Greg Hajcak
Florida State University

Descriptors: Depression, Adolescent, Reward

Depression is believed to arise due to a person's failure to modulate their behavior in response to a reward. Evidence has shown that deficits within the consummatory phase of reward processing increases risk and symptomology of depression, but few studies have examined the other aspects of reward processing in relation to depression risk. In the current study, a community sample of 121 adolescents ($M_{age} = 13.1$, 54% male) completed self-report questionnaires regarding depression symptoms and the monetary incentive delay (MID) task while EEG was recorded. Results indicated that a reduced cue-P300 as well as, a reduced reward positivity (RewP) and feedback negativity (FN) were associated with increased depressive symptomology. An exploratory analysis employing a multiple regression where cue-P300, RewP and FN were inputted as predictors of depression revealed that a reduced cue-P300 and FN were uniquely associated with depressive symptoms; a trend was evident for a unique association between a reduced RewP and increased higher depressive symptoms. The current study demonstrates that reduced cue-P300, RewP and FN amplitudes are correlates of higher depressive symptoms, while also illuminating the distinct deficits in reward processing in adolescents with increased depression. This study is one of the first to assess the MID task in relation to adolescents and depressive symptoms, allowing for a more in-depth view of the individual differences in reward processing among adolescents with higher depressive symptomology.

VIRTUAL-022 | THE ANTENATAL P300 AND LATE POSITIVE POTENTIAL PROSPECTIVELY PREDICT INCREASED POSTNATAL DEPRESSION AND ANXIETY

Elizabeth Mulligan[1], Jessica Simon[1], Magen Lowe[2], Nicholas Santopetro[1], Heather Flynn[1], Greg Hajcak[1]
[1]Florida State University, [2]Washington State University

Descriptors: Postpartum depression, postpartum anxiety, event-related potentials

Postnatal depression and anxiety are highly prevalent conditions that are impairing for mothers, infants, and their families. Despite their prevalence, neural biomarkers of risk for postnatal increases in depression and anxiety are understudied. Past research suggests that two different event-related potentials, the P300 and the late positive potential (LPP), may predict the course of depressive and anxious symptoms in non-perinatal populations. The present study administered an emotional interrupt task in a sample of 221 pregnant women to examine whether antenatal P300 and LPP amplitudes may predict the course of depressive and anxious symptoms from pregnancy to the early postpartum period. We measured the P300 to target stimuli (i.e., arrows) and the LPP to images of happy babies (positive images) vs. household objects (neutral images). Zero-order correlations and linear regressions revealed that a reduced antenatal P300 to target stimuli and an enhanced LPP to positive infant images were uniquely associated with postnatal depressive and anxiety symptoms, respectively. These ERPs were independent predictors beyond antenatal self-reported depression and anxiety. Furthermore, women with heightened depressive symptoms in pregnancy exhibited a stronger negative association between antenatal P300 amplitude and postnatal depressive symptoms. Our findings suggest measurement of ERPs during pregnancy could one day serve as a screening tool for risk for perinatal depression and anxiety, and thereby assist with identifying individuals who might benefit from prevention efforts.

VIRTUAL-023 | EFFECT OF MUSICAL CHANGE AND COMPLEXITY ON HRV DURING LISTENING

Scott Leimroth, Frances De Blasio, Robert Barry, Timothy Byron
University of Wollongong

Descriptors: Heart Rate Variability, Music, Cognitive Processing

Cognitive processing during music listening appears to result in changes to frequency domain measures of Heart Rate Variability (HRV). Most research uses known musical works as stimuli, with confounds arising due to prior learning, individual emotional response, and changes in multiple musical elements such as pitch, harmony, rhythm, timbre, or expression. The present study aimed to

modulate information processing by varying only rhythmic elements, considered the major determinants of physiological changes to music, to assess the impact on HRV frequency domain measures while controlling for emotional response. Thirty-five participants (age $M = 21.8$ years, $SD = 4.3$) completed the musical contour and rhythm recognition subscales of the Montreal Battery of Evaluation of Amusia, and their HRV data were assessed for three 3 min blocks during eyes-open rest, and while passively listening to two repeating chord patterns that differed in musical complexity (an unexpected rhythm change) but were otherwise identical. High-frequency (HF) HRV was significantly reduced during passive listening compared to eyes-open rest, and while listening to the more complex compared to less complex stimulus. The relative difference in HF HRV between passive listening blocks correlated significantly with rhythm discrimination ability. The observed relationship between HRV and musical change supports assumptions that HRV reflects cognitive processing of auditory information. The correlation between HRV and rhythm discrimination ability suggests the value of future research exploring this relationship.

VIRTUAL-024 | MEDICAL FACE MASKS AFFECT CONFIGURAL AND EMOTIONAL FACE PROCESSING: EVIDENCE FROM THE N170 EVENT-RELATED POTENTIAL

Annika Lutz, Nora Welter, Katharina Dincher, Lynn Erpelding, Claus Vögele
University of Luxembourg

Descriptors: N170, facial expressions, gender differences
During the COVID-19 pandemic many countries adopted protective measures, such as obligations to wear (medical) face masks in public. Face masks cover half of the face. This reduced visibility of facial features may alter configural and emotional face processing, with potential gender differences. 57 women and 21 men passively viewed emotional faces (neutral, happy, angry, fearful) of 6 actors (3 male, 3 female). Each face was presented without and with a medical mask (digitally added), upright and inverted, and repeated 5 times (30 trials per category). A 64-channel EEG was recorded. The N170 was quantified as mean amplitude from 128 to 188 ms, averaged across P7, PO7, PO9, P8, PO8, PO10. Difference waves between upright and inverted faces were calculated per category to reflect configural processing (inversion effect). Medical masks led to reduced inversion effects on the N170 as compared to unmasked faces. Without masks, angry and fearful faces produced smaller inversion effects than happy and neutral faces. With masks, only fearful faces differed significantly from neutral faces. Women showed larger inversion effects than men for unmasked faces; this gender difference disappeared for masked faces, and did not differ by emotional expression. Medical masks disrupt configural and emotional face processing. Processing of fearful faces appears less affected by inversion and masks, possibly due to an evolutionary relevance for survival. Women and men differ in configural, but not early emotional face processing. Medical masks may reduce women's advantage in early face processing.

VIRTUAL-025 | LOW DEFENSIVE CARDIAC REACTIVITY AS A PHYSIOLOGICAL CORRELATE OF PSYCHOPATHIC FEARLESSNESS IN WOMEN

Victoria Branchadell, Pilar Segarra, Rosario Poy, Pablo Ribes-Guardiola, Javier Moltó
Jaume I University

Descriptors: Psychopathic Personality Inventory-Revised, Fearlessness, Cardiac Defense Response
Given the growing body of knowledge about the physiological correlates of the fearlessness underlying psychopathic personality, here we explored the usefulness of the second accelerative component (A2) of the Cardiac Defense Response (CDR; Vila et al., 2007) —a complex pattern of heart rate changes in response to an aversive, intense, and unexpected stimulus— as a new physiological correlate of trait fearlessness. A sample of 156 undergraduates (60 men), assessed by the Psychopathic Personality Inventory-Revised (PPI-R; Lilienfeld & Widows, 2005), participated in a defense psychophysiological test. Repeated measures general linear models on the CDR pattern (10 medians) including gender and each PPI-R subscale separately as a continuous between-subjects factor revealed gender-specific effects of PPI-R Fearlessness scores on the CDR ($p = .034$), with higher fearlessness associated with lower heart rate changes during the A2 (i.e., medians 5 to 8) in women, but not in men. This finding was confirmed by correlational analyses between PPI-R Fearlessness scores and a simpler quantitative index of the A2 –the mean of the 6 consecutive highest heart rate change values within seconds 15 to 45 after onset: rs $= -.25$ and $.19$, ps $= .016$ and $.156$, for women and men, respectively. These results suggest that the second accelerative component of the CDR could be considered as a new candidate physiological indicator for a psychoneurometric operationalization of threat sensitivity, at least in women. Future research should clarify the relationship between CDR and psychopathic traits in men.

VIRTUAL-026 | ANXIOUS ATTACHMENT INCREASES EMOTIONAL REACTIVITY FOLLOWING ROMANTIC RELATIONSHIP THREAT

Erin Palmwood, Elsa Baumgartner, Kendall McCracken, Brian Merski, Margaret Millar
University of Mary Washington

Descriptors: Romantic relationships, Attachment, LPP
Romantic relationship threat is defined as any stimulus that has the potential to negatively impact that relationship. Although threat detection is an evolutionarily useful process, certain traits may predispose individuals to respond to such a threat in a manner which increases, rather than decreases, the risk to the relationship. While much is known about traits that impact general reactivity to perceived threat (e.g., anxiety, neuroticism), relatively little research attention has been given to traits that influence reactivity to romantic relationship threat in particular. As attachment style plays a significant role in overall relationship functioning, the present work sought to examine whether anxious attachment influences individuals' emotional reactivity immediately following relationship threat detection. For this study, 58 participants were randomly assigned to a threat vs. control condition, after which electroencephalography (EEG) data were recorded while they completed an emotional reactivity task. Findings indicated that, following relationship threat exposure, individuals with higher levels of attachment anxiety evidenced larger late positive potential (LPP) amplitudes when viewing negative stimuli relative to those with low attachment anxiety, highlighting insecure attachment as a potential mechanism by which relationship threat results in acute emotional dysregulation and subsequent maladaptive behavioral responses.

VIRTUAL-027 | THE EFFECT OF INTEROCEPTION ON UNINTENTIONAL THOUGHT SWITCHING

Mai Sakuragi, Satoshi Umeda
Keio University

Descriptors: Mind Wandering, Interoception, Subliminal Perception

Mind wandering (MW) is a phenomenon in which thoughts wander to matters unrelated to the action currently being performed. This study focused on the role of interoception, which is the sense of the body's internal state, as the trigger of spontaneous MW. We hypothesized that the alteration of interoception is closely related to thought switching. Participants ($N = 91$, 61 women) completed two tasks, Heartbeat detection task (HDT, Schandry, 1981) and Vigilance Task (VT). Based on the performance of HDT, we divided the participants into two groups, high/low interoceptive accuracy group. In VT, the participants pressed the key when the target stimuli appeared. During this task, we asked the participants to report the content of their thoughts. In the latter half of VT, we presented subliminal vibration stimuli for inducing alteration in heart rate (= vibration block). The results showed that in vibration block, the participants of high interoceptive accuracy group were more likely to report transition to MW and continuation of MW than those of low interoceptive accuracy group. These data suggested that changes in interoception due to subliminal presentation of vibration may induce the generation of MW in individuals with accurate interoception.

VIRTUAL-028 | THE EFFECT OF RECENT FEEDBACK AND DECISION HISTORY ON THE REWARD POSITIVITY

Nathan Hager[1,2], Matt Judah[3]
[1]Old Dominion University, [2]Virginia Consortium Program in Clinical Psychology, [3]University of Arkansas, Fayetteville

Descriptors: reward positivity, feedback, decision-making
The reward positivity (RewP) is thought to reflect neural processing of feedback as better or worse than expected (i.e., a reward prediction error [RPE]). Despite the theorized role of expectancy, little research has examined how feedback and decision history impact the RewP. The RewP was measured as 125 participants completed a modified doors task in which they chose one of three doors and received random, equiprobable win (+$0.50), loss (−$0.25), or draw ($0.00) feedback. The effects of current trial matching previous trial feedback (*feedback match*) and door choice (*door match*) were examined with multilevel modeling. Recent feedback sequence was also examined. Feedback match predicted the RewP and interacted with current trial feedback ($ps < .001$). Feedback match was associated with a larger RewP for win ($b = 3.34$, $p < .001$) and draw ($b = 1.47$, $p = .002$) but not loss ($b = .43$, $p = .39$). Door match predicted the RewP ($p < .001$) and interacted with feedback match ($p = .04$) The effect of feedback

match was larger when door mismatched ($b = 1.67$, $p < .001$) than matched ($b = 1.00$, $p = .02$). The sequence of recent feedback impacted the RewP, such that the RewP was largest for a sequence of win/win/win. Receiving the same feedback as in previous trials may violate expectancies and increase the RewP, but only on win and neutral trials, not loss. The smaller effect of feedback match when choosing the same door suggests that recent feedback-congruent decisions increase expectancies. Findings partially support the RPE model but indicate a complex impact of recent history on the RewP.

VIRTUAL-029 | OPTIMAL METHODOLOGY FOR THE IDENTIFICATION OF RESTING-STATE EEG CORRELATES OF NON-CLINICAL DEPRESSION AND ANXIETY

Clare O'Toole, Frances De Blasio, Robert Barry
University of Wollongong

Descriptors: fPCA, EEG Asymmetry, Non-Clinical Depression and Anxiety

Frontal and parietal asymmetries in the traditional alpha band have long been associated with clinical and non-clinical depression and anxiety, yet inconsistencies in these literatures have impeded the identification of spectral biomarkers. Aiming to clarify the asymmetry patterns and their association with depression and anxiety in a self-reported non-clinical population, the present study utilised traditional analyses and frequency Principal Components Analysis (fPCA) to quantify regional asymmetries within and beyond the traditional alpha band. Forty-seven young adults (18–33 yrs; 18 male) completed the Hospital Anxiety and Depression Scale (HADS) and had EEG continuously recorded during 2 min blocks of eyes-open (EO) and eyes-closed (EC) resting. Separately for EC and EO, the DC–30 Hz spectral amplitudes were extracted and used to compute the frontal and parietal hemispheric means and regional hemispheric asymmetry for four traditional bands and several fPCA components. Right greater than left activity was seen in each condition and traditional band and was generally larger in the parietal than frontal region, but EEG asymmetry showed no association with either HADS subscale. The EO fPCA components showed similar outcomes. Across regions in EC, a delta fPCA component showed greater left activity, and an alpha-beta component had greater right activity; their frontal asymmetries correlated with the depression and anxiety scores, respectively. The assessment of frontal asymmetry in EC resting fPCA components may help elucidate spectral markers of depression and anxiety.

VIRTUAL-030 | DO DOMAIN-GENERAL EXECUTIVE CONTROL DEMANDS IMPACT ELECTROPHYSIOLOGICAL CORRELATES OF SEMANTIC DISTANCE?

Karolina Rataj[1], Patrycja Kakuba[1], Walter van Heuven[2]
[1]Adam Mickiewicz University, [2]University of Nottingham

Descriptors: semantic processing, executive control, event-related potentials

What role domain-general executive control plays in semantic processing is an important question. Radel et al. (2015) employed a non-linguistic executive control task with high and low inhibition demands prior to a semantic judgment task (SJT), and found larger priming effects for remotely related word pairs after a non-linguistic executive control task with high relative to low inhibition demands. The present study used electrophysiological methods to further examine the influence of inhibition demands on semantic processing. Similar to Radel et al., it involved two 20-min Simon task sessions with low (10% incongruent) and high (50% incongruent) inhibition demands. In each session, the Simon task was followed by a SJT in which we presented closely related (CR), remotely related (RR), and unrelated (UR) word pairs in Polish. Behavioral data from 21 native speakers of Polish showed that RR primes elicited priming effects only after high inhibition demands, partially corroborating Radel et al.'s findings. Electrophysiological data showed that the N400 amplitudes were strongly modulated by semantic distance, but not by inhibition demands. CR pairs elicited the smallest and UR the largest N400 amplitudes. Amplitudes for RR word pairs fell in-between, showing priming effects smaller than those for CR pairs. Between 500–800 ms, sustained negativity was found, showing the same pattern as in the N400 time window. Implications of these findings for the role of domain-general executive control demands in semantic processing will be discussed.

VIRTUAL-031 | STIMULUS-INDUCED CHANGES IN 1/F-LIKE ACTIVITY IN EEG

Mate Gyurkovics[1], Grace Clements[2], Kathy Low[2], Monica Fabiani[2], Gabriele Gratton[2]

[1]University of Glasgow, [2]University of Illinois, Urbana-Champaign

Descriptors: 1/f activity, frequency domain, event-related changes

Research into $1/f$-like, non-oscillatory electrophysiological activity has been growing exponentially in recent years in cognitive neuroscience. The shape of this activity has been linked to the balance between excitatory and inhibitory neural circuits, which is thought to be important for information processing. However, to date, it is not known whether the presentation of a stimulus induces changes in the parameters of $1/f$ activity that are separable from the emergence of event-related potentials (ERPs). Here, we analyze event-related broadband changes in scalp-recorded EEG both before and after removing ERPs to demonstrate their confounding effect, and to establish whether there are genuine stimulus-induced changes in $1/f$ activity. Using data from a passive and an active auditory task (n = 23), we found that the shape of the pre- and post-event spectra differed significantly after removing the frequency-content of ERPs, and that this difference reduced significantly after accounting for a shift in $1/f$ activity. This $1/f$ change manifests as an increase in low and a decrease in high frequencies. Importantly, the magnitude of this rotational shift was related to the attentional demands of the task. The $1/f$ change is consistent with increased inhibition following the onset of a stimulus, and likely reflects a disruption of ongoing excitatory activity proportional to processing demands. Finally, these findings contradict the central assumption of baseline normalization strategies in time-frequency analyses, that background EEG activity is stationary across time.

VIRTUAL-032 | NUMERICAL RATIO AND CONGRUENCE EFFECTS IN THE QUANTITY ESTIMATION: ERPS STUDY

Timofey Adamovich[1], Julia Marakshina[2], Yulia Kuzmina[3], Marina Lobaskova[2]

[1]Lomonosov Moscow State University, [2]Psychological Institute of Russian Academy of Education, [3]Higher School of Economics

Descriptors: number sense, numerical ratio effect, congruence

The aim of this study was to reveal the numerical ratio and congruence effects in the separate and intermixed formats of stimuli presentation in the non-symbolic comparison test "Blue-yellow dots" in adolescents (N = 36) that asked to evaluate which of the sets was larger. For each condition of the stimuli presentation the event-related potentials (ERPs) were recorded. The global field power (GFP) was calculated in P3, P7, CP5, O1 in the left hemisphere and in the symmetrical sites in the right one. The maximum amplitude and its latency in the ERPs in the range 280–600 ms were calculated. Main effects of the congruence, ratio, format, hemisphere and interactions between factors with a mixed ANOVA were evaluated. The analysis of the maximum amplitude revealed a main effect for the format of the presentation ($F[1576] = 11.69$, $p < .001$, $\eta^2p = .02$), hemisphere ($F[1576] = 5.01$, $p = .026$, $\eta^2p = .009$), interaction between congruence and ratio ($F[1576] = 5.28$, $p = .022$, $\eta^2p = .009$). Post-hoc analysis with Tukey's test revealed the increased maximum amplitude in the separate format ($t = -3.42$, $p < .001$, Cohen's $d = -0.281$) and in the right hemisphere ($t = -2.24$, $p = .026$, Cohen's $d = -0.184$), the decreased maximum amplitude for the difficult ratio in the incongruent condition ($t = 2.927$, $p = .019$, Cohen's $d = 0.3403$). The analysis of the latency revealed the significant interaction between congruence and ratio ($F[1576] = 5.6$, $p = .018$, $\eta^2p = .01$), however post-hoc analysis didn't find any significant differences. Results can be discussed in terms of the direct and indirect (visual) mechanisms of quantity estimation.

VIRTUAL-033 | FEEDBACK NEGATIVITY AND FEEDBACK-RELATED P3 DURING THE MONETARY INCENTIVE DELAY TASK IN INDIVIDUALS AT HIGH AND LOW FAMILY RISK FOR DEPRESSION

Yifan Gao[1], Lidia Panier[1], Marc Gameroff[1,2], Randy Auerbach[1,2], Jonathan Posner[1,2], Myrna Weissman[1,2], Jürgen Kayser[1,2]

[1]New York State Psychiatric Institute, [2]Columbia University

Descriptors: event-related potentials (ERPs), reward processing, depression risk

Blunted responses to reward feedback have been linked to major depression (MDD) and MDD risk. To explore the impact of family risk and lifetime history of MDD (+ vs −), we recorded 72-channel ERPs from 29 high and 32 low

risk (HR/LR) individuals (15–58 years, 30 male) during a monetary incentive delay task with win, loss or neutral outcomes. Linked-mastoids ERPs and their reference-free current source density (CSD) transforms were quantified by temporal principal components analysis, revealing two distinct stages of reward feedback processing: feedback negativity (FN) peaking at ~310 ms (mid-anterior) and P3 (fb-P3, ~380 ms, mid-posterior). Whereas ERP components were highly consistent with prior findings, their CSD counterparts had more focal topographies. All subgroups showed: 1) greater FN to loss than win and neutral trials, suggesting FN sensitivity to negative valence; 2) greater fb-P3 to win and loss than neutral trials, suggesting fb-P3 indexes motivational salience and allocation of attention. Group × condition interactions were more subtle and dependent on transformation (ERP vs CSD). For example, for fb-P3, ERPs were greater for HR than LR for win and loss but not neutral (no MDD effects), whereas CSDs were greater for MDD− than MDD+ for win and neutral but not loss (no risk effects). These findings collectively suggest largely comparable feedback processing in individuals at low and high risk for MDD and with or without a history of MDD, however, methodological aspects are of critical importance for uncovering subtle group differences of reward processing.

VIRTUAL-034 | QUANTITY ESTIMATION IN THE BRAIN: POSSIBLE MECHANISMS

Timofey Adamovich[1], Julia Marakshina[2],
Yulia Kuzmina[3], Marina Lobaskova[2]
[1]Lomonosov Moscow State University, [2]Psychological Institute of Russian Academy of Education, [3]Higher School of Economics

Descriptors: number sense, connectivity, EEG
It is assumed that the number sense can be achieved through the operation of two systems of quantity estimation. The direct ("quantitative") system is thought to be crucial in the intermixed format of stimuli presentation, the visual system is more important in the separate format. The goal of this study was to identify the activation of two systems related to the dorsal and ventral brain streams. 33 adolescents performed a non-symbolic comparison test «Blue-yellow dots». Participants asked to evaluate which of the sets was larger. Simultaneously electroencephalogram (EEG) data from 64 active

electrodes (International 10–10 system, Brain Products ActiChamp amplifier) was recorded. Effective connectivity between brain areas was estimated with Transfer Entropy measure. Wilcoxon paired samples t-test was used to evaluate differences between means, standard deviations (SD) and maximums of connectivity distributions in the compared conditions. The differences between standard deviations and maximums were accepted as indicators of the connectivity heavy-tailed distributions. The differences between the direct and the visual systems were found in the ventral stream structures for means ($p = .005$), SD ($p = .024$): the direct system showed the increased values. The differences between the ventral and the dorsal structures were revealed in the direct system for means ($p < .001$) and in the visual system for means ($p < .001$), maximums ($p = .001$): the dorsal structures demonstrated the increased values. Results show the involvement of both visual streams in the quantity estimation.

VIRTUAL-035 | NEUROPHYSIOLOGICAL CORRELATES OF REGULATORY CONTROL DEFICITS AMONG OFFSPRING AT RISK FOR DEPRESSION

Zhixin Zhou[1], Christina Koshy[1], Emma Millon[2],
Sydney Taylor[3], Catherine Monk[2,3], Rachel Marsh[2,3],
Randy Auerbach[2,3], Akina Umemoto[2]
[1]Teachers College, Columbia University, [2]Columbia University, [3]New York State Psychiatric Institute

Descriptors: Cognitive Control, Mother–Child Transmission, Depression
Major Depressive Disorder (MDD) is characterized by a wide range of regulatory control deficits, and although maternal MDD is a robust predictor of depression onset in offspring, it is unclear whether control deficits are passed on intergenerationally. To address this gap, we tested the intergenerational transmission of regulatory control in children ($N = 59$; ages 4–10 years) with and without a maternal history of MDD. Children were administered a Go/NoGo Task while EEG data were collected while mothers (ages 24–46) completed the Flanker Task. *First*, across all children, frontal midline theta during the Go/NoGo Task increased with age ($p = .049$). *Second*, controlling for age, worse Go/NoGo Task accuracy associated with reduced error-related negativity (ERN; $p < .01$), error positivity

(Pe; $p < .01$), and delta power ($p = .046$) in children. *Third*, worse Flanker accuracy in mothers associated with reduced Go/NoGo accuracy ($p = .01$), ERN ($p = .03$), Pe ($p = .01$), and delta power ($p = .01$) in children. *Last*, greater maternal depression symptom severity related to worse Go/NoGo accuracy in children ($p = .02$). Taken together, maternal depression and associated regulatory control deficits in mothers may lead to control deficits in children that emerge early in development.

VIRTUAL-036 | BRAIN NETWORKS INVOLVED IN DECISION-MAKING ARE CHARACTERIZED BY HIGHER SEGREGATION AND LOWER INTEGRATION IN DEPRESSION

Ekaterina Slovenko, Andrey Kiselnikov, Alisa Komarova, Irina Tan, Maria Yurlova, Dina Mitiureva
Lomonosov Moscow State University

Descriptors: Depression, Functional connectivity, Decision-making

Introduction. Recent studies provide evidence that decision-making process is impaired in depression, but reports of changed EEG activity during decision-making are inconsistent. Objective. Our goal was to perform graph-based analysis of EEG during decision-making task and to compare correct and erroneous trials. Method. We recorded 19-channels EEG during modified Stroop-task requiring choice between congruent and incongruent stimuli. The sample consisted of 10 female participants with high Beck Depression Inventory (BDI) score (BDI – 48.9 ± 9.6; age – 21.1 ± 1.6) and 12 female participants with low BDI score (BDI – 4.0 ± 0.9; age – 21.3 ± 1.8). Characteristic path length (CPL), density (D), clustering coefficient (CC), index of modularity (Q) and small-world index (SWI) were calculated in sensors- and sources-level networks constructed in 4 frequency bands (4–8, 8–13, 13–30, 4–30 Hz) using weighted phase-lag index (wPLI). To estimate the between-group differences we applied the permutation test ($p < 0.05$). Results and Discussion. All the significant effects were found on sources-level in the theta band (4–8 Hz) for correct trials and in wide frequency range (4–30 Hz) for erroneous trials. In the depressive sample CC and SWI were increased both in correct and erroneous trials, and CPL was increased in erroneous trials. Conclusion. The results suggest that brain networks involved in decision-making in depression tend to be stronger segregated generally, and weaker integrated in erroneous choices specifically.

VIRTUAL-037 | NEURAL OBJECT PROCESSING IN INFANTS AND ADULTS IS INFLUENCED BY THE PERSPECTIVE OF OTHERS

Anna-Lena Tebbe[1], Katrin Rothmaler[1], Moritz Köster[2], Charlotte Grosse Wiesmann[1]
[1]Max Planck Institute for Human Cognitive and Brain Sciences, [2]University of Regensburg

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

Infants' ability to track what other people can see develops quickly within the second year of life, referred to as visual perspective taking. Notably, we do not only take into account the perspective of others when we actively reason about them. Others' perspective also seems to shape our own representation of the environment, even when it is irrelevant to what we are currently doing. Here we ask how others' visual perspective modulates adults' and infants' neural object processing. To test this, we use steady-state visual evoked potentials (ssVEP) as a specific neural signature of our object representation. Participants were presented with an agent observing an object flickering at 4 Hz. The object either disappeared into a tunnel (blocking the participant's and the agent's view) or behind an occluder (blocking only the participant's but not the agent's view). We hypothesized that adults and infants (aged 12–14 months) also show entrained oscillations in reaction to someone else seeing the object, even when they no longer see it themselves. Indeed, adults (N = 40) showed a higher ssVEP response when the agent continued to see the object (occluder condition) compared to when she could no longer see it (tunnel condition). This was the case while the object disappeared as well as after it had been fully occluded. Infants (N = 56) also showed a higher 4 Hz signal in the occluder compared to the tunnel condition but only after the object had been fully occluded. These findings show an altercentric modulation of infants' and adults' neural object processing.

VIRTUAL-038 | SHIELDING CHIPS REDUCE EFFECTS ON EEG BRAIN ACTIVITY AND CONCENTRATIONAL PERFORMANCE INDUCED BY ELECTROMAGNETIC RADIATION IN THE 5G RANGE IN CAR DRIVING

Diana Henz
Stiftung für Gesundheit und Umwelt

Descriptors: EEG, mobile phones, 5G

Research shows that electromagnetic fields (EMFs) emitted by mobile phones induce systematic changes in EEG

brain activity. In previous studies, it was shown that shielding chips that are applied in mobile phones reduced effects of mobile phone-emitted EMFs on brain activity. In the present study, we investigated the effects of shielding chips when subjects were exposed to EMFs in car driving. Subjects were exposed to EMFs emitted by a smartphone (Apple iPhone 13) in the 5G range during a standardized car drive in virtual reality. We tested the following experimental conditions in a randomized double blind design: (1) smartphone with application of a shielding chip (Gabriel-Tech), (2) smartphone without shielding chip, (3) control condition with smartphone switched off. Each condition was tested for four hours. High-density EEG was recorded from 128 electrodes before, during, and after each experimental condition, as well as HRV, RTs in braking, and mood. Results showed increases in EEG beta and gamma activity in frontal, temporal, parietal, occipital, and limbic areas when subjects were exposed to the smartphone without application of a shielding chip. Further, LF/HF ratios, RTs, and mood disturbances increased over time. EEG beta and gamma activity decreased in frontal, central, temporal, parietal, occipital, and limbic areas with decreased LF/HF ratios, RTs, and improved mood when the shielding chip was applied. Results indicate that application of the shielding chip reduces effects on psychophysiological measures induced by smartphone-emitted EMFs in the 5G range.

VIRTUAL-039 | BRAIN NETWORKS DURING THE EMOTIONAL REGULATION TASK ARE HYPERCONNECTED IN DEPRESSION

Alisa Komarova, Andrey Kiselnikov, Irina Tan, Ekaterina Slovenko, Maria Yurlova, Dina Mitiureva
Lomonosov Moscow State University

Descriptors: Depression, Functional connectivity, Emotional regulation
Introduction. Specific symptoms of depression are under-researched in network neuroscience. Emotional regulation (ER) difficulties seem to be one of the central symptoms. Objective. We aimed to compare functional connectivity (FC) patterns during the ER task in students with a high and a low level of depressive symptoms. Method. We recorded 19-channels EEG while participants were asked to positively reappraise negative IAPS pictures. The first sample comprised 10 female participants with high Beck Depression Inventory scores (48.9 ± 9.6; 21.1 ± 1.6 y.o, 1 left-handed), the second sample comprised 12 female participants with low BDI scores (4.0 ± 0.9; 21.3 ± 1.8 y.o., all right-handed). We constructed FC networks using weighted phase-lag index (wPLI) at sensors and sources levels in 4–8, 8–13, 13–30, and 4–30 Hz bands, and

computed density (D), characteristic path length (CPL), clustering coefficient (CC), index of modularity (Q), and small-world index (SWI). We applied the permutation test ($p < 0.05$) to compare the two samples. Results. The depressive sample was characterized by lower CPL (sensors level – in 4–30 Hz and 13–30 Hz bands; sources level – in 8–13 Hz band) and higher D (sensors level – in 4–30 Hz band; sources level – in 8–13 Hz band). Discussion. The results reflect the global hyperconnectivity which is frequently observed in resting-state experiments. We suggest that ER task accentuated the core changes in FC in depression. Conclusion. People with high severity of depressive symptoms demonstrated global functional hyperconnectivity during the emotional regulation process.

VIRTUAL-040 | BRAIN NETWORKS RANDOMIZE DURING PROVOKING RUMINATION IN FEMALE DEPRESSION: AN EEG STUDY

Irina Tan, Andrey Kiselnikov, Alisa Komarova, Ekaterina Slovenko, Maria Yurlova, Dina Mitiureva
Lomonosov Moscow State University

Descriptors: Depression, Functional connectivity, Rumination
Introduction. Recent studies have shown that in adult depression there is an impairment in the dynamic functioning of networks associated with negative ruminations. Objective. The purpose of the study was to examine an abnormal graph structure in a sample with depressive symptoms by analyzing EEG during ruminations. Method. The sample comprised 10 female participants with high Beck Depression Inventory (BDI) score (BDI – 48.9 ± 9.6; age – 21.1 ± 1.6; all right-handed), and 12 female participants with low BDI score (BDI – 4.0 ± 0.9; age – 21.3 ± 1.8; 1 left-handed). The procedure included 19-channels EEG recordings during the task of provoking depressive rumination. Functional connectivity (FC) were computed for 4 frequency bands (4–8, 8–13, 13–30, 4–30 Hz) at sensors and sources levels. We calculated characteristic path length (CPL), clustering coefficient (CC), index of modularity (Q), small-world index (SWI) and density (D) in FC networks constructed using weighted phase-lag index (wPLI). Permutation test ($p < 0.05$) was applied to study between-group differences in these metrics. Results and Discussion. The group comparison showed decreased SWI and CC (theta-band; sensors-level) and increased Q (theta-band; sources-level) in the depressive group. The results indicate greater randomization of the brain network and reduced brain efficiency in depression. Conclusion. Depressive participants revealed a more random network architecture during the task of provoking depressive ruminations.

VIRTUAL-041 | INTELLIGENCE NEGATIVELY CORRELATES WITH BETA-BAND EEG NETWORK CHARACTERISTIC PATH LENGTH IN COGNITIVE LOAD

Maxim E. Mikheykin, Andrey A. Kiselnikov, Tatyana A. Gorshkova, Anna E. Vovnenko, Ekaterina I. Demkina, Anastasia A. Korobkova, Ekaterina M. Usaeva, Dina G. Mitiureva, Alisa V. Komarova
Lomonosov Moscow State University

Descriptors: Intelligence, Functional connectivity, Characteristic Path Length

Introduction. Functional connectivity (FC) during cognitive load can provide additional information about the processes of cognitive functioning. Objectives. We aimed to investigate relationships between intelligence and characteristic path length (CPL) in the resting-state and cognitive load conditions. Methods. The 60-channels EEG was recorded in closed-eye and open-eye resting-state and cognitive load conditions in 38 healthy participants (21.2 ± 2 y.o., 19 female, all right-handed). Individual level of intelligence was measured using the Raven's Standard Progressive Matrices Plus ('SPM Plus', 60 figures). FC networks were constructed for all possible combinations of sensors/sources-levels and 4 frequency bands (4–8, 8–13, 13–30, and 4–30 Hz) using weighted Phase-Lag Index (wPLI), then CPL of FC networks was calculated. The Spearman coefficient (with FDR correction) was used for correlational analysis. Results. Intelligence correlated with CPL negatively in the cognitive load condition in the 13–30 Hz band (R = -0.341, p corr. < 0.05) and positively in the 8–13 Hz band (R = 0.378, p corr. < 0.05) and in the resting-state condition in the 13–30/4–30 Hz band (R = 0.332/0.385, p corr. < 0.05). Conclusion. The interplay between anticorrelated brain systems in the cognitive load condition (primary beta- and second alpha-band systems) can be the neural basis of intellectual ability. These results are in line with the theory of neural efficiency (Haier et al., 1992) and previous findings (Langer et al., 2012).

VIRTUAL-042 | MINDFULNESS MEDITATION IS ASSOCIATED WITH INCREASED CLUSTERING COEFFICIENT AND SMALL-WORLD INDEX IN EEG THETA-BAND

Ekaterina Golova, Andrey Kiselnikov, Alexandra Pokidko, Sofya Skripkina, Dina Mitiureva, Alisa Komarova
Lomonosov Moscow State University

Descriptors: Mindfulness meditation, Functional connectivity, Clustering Coefficient

Introduction. The network neuroscience approach can reveal the complexity of neurocognitive architecture of mindfulness meditation. Objectives. This study examines functional connectivity patterns of the mindfulness meditation state compared to the resting-state. Method. The sample comprised of 25 participants (mean age – 23.3 ± 5.0, 19 females, all right-handed) with previous meditation experience. 19-channels EEG was recorded at rest and in the mindfulness meditation state (each for 5 minutes with eyes closed) contrasted by audio instructions. The meditation instruction included general psychological components of mindfulness (Kabat-Zinn, 2003). Functional connectivity networks were constructed in 4 frequency bands (4–8, 8–13, 13–30, 4–30 Hz) using weighted Phase-Lag Index (wPLI). The global graph theoretical measures comprised of characteristic path length (CPL), clustering coefficient (CC), index of modularity (Q), small-world index (SWI) at sensors- and sources-level. To compare the states of meditation and non-meditation rest the Wilcoxon test ($p < .01$) was applied to all metrics in all frequency bands. Results and Discussion. Results indicate an increased CC ($p = .007$) and SWI ($p = .008$) in theta-band (4–8 Hz) and increased SWI ($p = .004$) in alpha-band (8–13 Hz) in the state of meditation compared to the resting-state. Conclusion. The increase in CC and in SWI show enhanced capacity for local specialization and global information integration (Xue et al., 2014), which means that during meditation the brain shows a more energy-efficient functional connectivity pattern.

VIRTUAL-043 | HEART RATE VARIABILITY BIOFEEDBACK REDUCES ANXIETY SENSITIVITY IN YOUNG HEALTHY INDIVIDUALS

Miriam Hufenbach[1,2], Carlos Ventura Bort[1], Alfons Hamm[2], Mathias Weymar[1], Julia Wendt[1]
[1]University of Potsdam, [2]University of Greifswald

Descriptors: Heart rate variability, Biofeedback, Anxiety Sensitivity

Anxiety sensitivity refers to the fear of the concomitant symptoms of anxiety that are misinterpreted as dangerous. Increased anxiety sensitivity is considered a risk factor for the development of anxiety disorders. In contrast, a high heart rate variability (HRV) is considered a protective factor against the development of anxiety symptoms. In this study, we examine the effect of 4 weeks of HRV biofeedback training aimed at increasing HRV on anxiety sensitivity in young healthy individuals. As indicated by a significant interaction between group and assessment time in our current sample (biofeedback group: N = 49; control group: N = 45; $F[1,92] = 4.74$, $p = .032$), participants in the biofeedback group showed a stronger reduction of anxiety sensitivity scores after completing the training. Moreover, in the biofeedback group, an increase in HRV after completing the training was associated with a reduction in anxiety sensitivity (Spearman's rho = −.351, $p = .013$), whereas we observed no significant correlation of change scores in the control group (Spearman's rho = −.047, $p = .766$). Thus, our findings support the usefulness of HRV biofeedback as a preventive measure to reduce anxiety sensitivity as a risk factor for the development of anxiety disorders and maintain mental health.

VIRTUAL-044 | THIS PERSON IS DANGEROUS! ENHANCED DEFENSIVE PSYCHOPHYSIOLOGICAL RESPONDING TO INSTRUCTED AND REVERSED THREAT PERSONS

Florian Bublatzky, Inga Niedtfeld, Christian Schmahl
Central Institute of Mental Health

Descriptors: social learning, face and person perception, startle reflex
Learning about other people – whether they are helpful, trustworthy, or dangerous – often works through verbal communication. Moreover, such verbal threat and safety associations can be easily changed by reversal instructions. This shift from threat to safety (and vice versa) is important for both adequate social interactions and therapeutic interventions. Here, we examine verbal learning of shock threat or safety in a transdiagnostic dimensional sample ranging from healthy to highly anxious to severely traumatized participants. Thirty-five participants have completed a combined threat-of-shock and reversal paradigm using four neutral faces as conditioned stimuli (CS+/CS−) while psychophysiological responding (e.g., startle reflex, SCR), interpersonal distrust, and self-reported ratings were examined. Preliminary results confirm pronounced effects of instructed and reversed threat/safety learning. CS+ faces were perceived as more unpleasant, arousing,

threatening, and distrustful compared to CS− faces. Moreover, threat-potentiated startle reflex was observed at the physiological level. Interestingly, threat effects could be modified by repeated reversal instructions, and interactions emerged between defensive responding and participants' anxiety level. In summary, socially acquired threat and safety associations can be flexibly reversed and updated by new information about others. Such reversal processes may vary with interindividual differences, especially among individuals with severe anxiety and stress-related symptomatology.

VIRTUAL-045 | CONTEXT-INDUCED EMOTION RESPONSES TO NEUTRAL WORDS ALTER SUBSEQUENT BRAIN RESPONSES TO THESE WORDS: EVIDENCE FROM BRAIN POTENTIALS

Wei-Hung Lin, Po-Heng Chen, Chia-Lin Lee
National Taiwan University

Descriptors: Emotion, Predictive processing, Anterior positivity
This study examined the role of valence in inducing contextualized emotion responses to neutral words by manipulating the consistency between valences of the sentential context and the sentence-final word. Event-Related Potentials were recorded from 30 young native Taiwan Mandarin speakers while they read congruent sentences word-by-word from a monitor. Emotion anticipation effects on sentence-final words were seen in both negative and positive contexts, albeit larger in the negative one—with reduced N400s to emotionally expected emotion words, and an anterior positivity to emotionally unexpected neutral words. With emotion anticipation built over the emotion context, contextualized emotion responses to sentence-final neutral words were seen— with enhanced LPCs similarly seen to emotion words in the neutral contexts. These results indicated that, regardless of valence, emotion contexts engaged motivational circuits and attention resources like emotion words did in the neutral context, triggering deeper affective evaluation for the incoming words. The influences of the emotional context further extended to a later word recognition task—with larger N200 responses to isolated neutral words previously seen in negative contexts than in positive or neutral contexts, implicating emerging competition from the newly-induced negative sense. These results demonstrated that contextualized emotion perception at least temporarily alters subsequent brain

responses to the same neutral words, providing evidence for a possible precursor for how emotion connotations are acquired.

VIRTUAL-046 | PHYSIOLOGICAL OR SELF-REPORTED AROUSAL: THE IMPACT ON SEXUAL DECISION MAKING

Hedwig Eisenbarth, Joseph Savio, Natasha Knack
Victoria University of Wellington

Descriptors: Sexual arousal, Decision making

The "heat of the moment" coined the hypothesis that sexual arousal would contribute significantly to more risky and less considerate decisions in sexual interactions. However, the mechanisms of an impact of state sexual arousal on acute behaviour are still not clear. Here, we included 91 male and female student participants to investigate the impact of sexual arousal in comparison to amusement related arousal and anger related arousal and a control condition on hypothetical sexual behaviour, measuring physiological correlates of arousal (HR, GSR and pupil dilation) and self-reported arousal. We induced arousal via sexually explicit, anger- and amusement-related video clips in a between subject design, and administered a questionnaire with hypothetical sexual behaviours. The manipulation check showed a significant increase in self-reported arousal in all three arousal induction conditions comparing baseline to post induction time points. The sexual arousal induction was distinctively associated with more risky sexual hypothetical behaviours compared to all other conditions, when excluding items with extremely low acquiesence rate. However, subjective arousal reports were not correlated with HR, GSR or pupil dilation, nor did physiological activity predict hypothetical behaviours. There were no gender effects or interactions. Thus, although there was a small but specific effect of self-reported sexual arousal on hypothetical risky decisions, the missing link with physiological reactivity might point to a rather cognitive effect in the context of hypothetical scenarios.

VIRTUAL-047 | ALTRUISM IS LINKED TO PROLONGED N170 LATENCY TO SCARED FACES AND REDUCED SMALL-WORLDNESS IN EEG FUNCTIONAL CONNECTIVITY

Dina Mitiureva, Andrey Kiselnikov, Veronika Zubko, Polina Kabanova, Evgenia Terlichenko, Vasilisa Abrosimova, Elizaveta Krivchenkova, Daria Verkholaz, Sofya Skripkina, Varvara Udartseva, Alisa Komarova
Lomonosov Moscow State University

Descriptors: N170, functional connectivity, altruism

Introduction. As altruism is characterized by a specificity in fear perception (Marsh et al., 2014), ERP to implicit fear perception and brain functional connectivity (FC) could reflect a person's altruism. Objectives. The objective of the study was to investigate a link between reactivity to fear, prosocial decision-making and related dispositional FC architecture. Methods. The sample included 39 participants (19 women), 21.2 ± 2.1 y.o. Participants filled out the Interpersonal Reactivity Index (IRI) questionnaire. Resting-state 60-channels EEG was recorded with eyes closed for 5 minutes and was followed by the "Pain versus Gain" (PvsG) task. In the ERP session, neutral and scared faces from Paul Ekman's atlas were presented. Amplitude and latency of the N170 was obtained from right parietal-occipital leads. FC (wPLI) between cortical sources was calculated for resting-state EEG, graph metrics were obtained from mean-thresholded matrices. Results. The measure of altruism (the money given up in PvsG task) correlated with IRI Perspective Taking (PT) (R Spearman $= 0.42$, $p < 0.01$) and N170 latency to scared faces in CPz (R $= 0.37$, $p < 0.05$). The PT inversely correlated with clustering coefficient (CC) and small-world index (SWI) in the alpha-band (R $= -0.48$, $p < 0.05$). Conclusions. Our results suggest that persons with increased PT have reduced alpha-band FC integration through low SWI and CC, and behave more altruistically in the PvsG task. Increased altruism in the PvsG task is related to delayed reaction to other's fear, which could be a mechanism of effective compassion.

VIRTUAL-049 | THE P300 DURING A GO/NO-GO TASK IN ADOLESCENT DEPRESSION: WITHIN-TASK CHANGE AND AVERAGE AMPLITUDE DIFFERENTIALLY RELATE TO ANHEDONIA AND NEGATIVE MOOD

Alexander Kallen, Christopher Brush, Christopher Patrick, Greg Hajcak
Florida State University

Descriptors: Depression, P300, go/no-go
Prior research has consistently found a reduced P300 in adult and adolescent depression. It is relatively unclear whether the P300 is a correlate of general depression, or reflects more specific features (i.e., negative mood versus anhedonia). The current study extended previous work by examining associations between core symptoms of depression (i.e., negative mood and anhedonia) and both average and trial-level trajectories of P300 during a go/no-go task in a community sample of 72 adolescents. Analyses revealed a suppressor effect: anhedonia related to smaller average go-P300s, whereas negative mood related to larger go-P300s. Trial-level analyses indicated that increased anhedonia was related to smaller initial P300 and larger trial-by-trial decrease in go-P300 amplitude across the task; however, negative mood only related to a larger initial P300 (i.e., intercept). Results suggest that negative mood may relate to heightened task engagement in general, while anhedonia showed the opposite effect at the average and trial-level, highlighting the utility of examining both average and trial-level P300. Given dimensionality of internalizing psychopathology, current findings may further our understanding of psychophysiological irregularities in positive and negative affect-based symptom domains.

VIRTUAL-050 | FROM HANDS TO HEART: A TREND FOR HIGHER INTEROCEPTIVE ACCURACY IN LEFT-HANDED AS COMPARED TO RIGHT-HANDED FEMALE PARTICIPANTS

Sam Bernard, Meggie Barnabo, Mareike Boos, Franziska Leufgen, Jessica Goergen, Emily Schramm, Joy Steinmetzer, André Schulz
University of Luxembourg

Descriptors: Interoception, Hemispheric laterality, heartbeat counting task
There is a discrete anatomical organization of the neural substrates of mental processes. Right hemispheric dominance was repeatedly shown for interoception, the perception and processing of signals from inside the body. Right hemispheric dominance is supported by stronger heartbeat-evoked potentials (HEPs) over the right hemisphere, which represent neurophysiological indicators of cardiac interoception. These findings, however, are based on individuals with left hemispheric dominance, manifesting predominantly in right-handedness. Left-handed individuals may show a facilitation of processes with a right-hemispheric relevance, such as interoception, which remains yet unclear. N = 42 healthy participants (21 left- and right-handed each) performed the heartbeat counting task (HCT) to assess cardiac interoceptive accuracy ("IAc", i.e., the correspondence between actual and perceived bodily signals), as well as a time estimation task, as previous studies suggested that IAc in the HCT may be confounded by time estimation accuracy (TEAc). We found a trend-level difference among female participants, with left-handers presenting higher IAc scores than right-handers. There were no differences in TEAc or heart rate between groups. These preliminary findings suggest a potential facilitating effect of right hemispheric dominance on interoception, which seems to be specific for additional hemispheric specialization effects related to female sex. Future studies are warranted to replicate this trend and to reveal neurophysiological mechanisms of this effect.

VIRTUAL-051 | THE RELATIONSHIP BETWEEN TRAUMATIC BRAIN INJURY AND DISRUPTIONS IN HEART RATE VARIABILITY: A SYSTEMATIC REVIEW

Leah Talbert, Zoey Kaelberer, Emma Gleave, Annie Driggs, Ammon Driggs, Patrick Steffen, Michael Larson
Brigham Young University

Descriptors: heart rate variability (HRV), traumatic brain injury (TBI)
Heart rate variability (HRV) is a modality to measure autonomic dysfunction following traumatic brain injury (TBI); there may be a relationship between post-injury HRV, TBI severity, and recovery. An evidence-based understanding of HRV and recovery of clinical symptoms following TBI is necessary. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Two raters coded articles and provided quality ratings with discrepancies adjudicated by a third. Eighty-five papers met inclusion criteria. Forty-seven studies (55%) included a control group. Sample sizes ranged from 1 to 11,977 (mean = 232.1, median = 30, SD = 1317.5). For outcome measures, 8 studies (9%) focused on HRV as a predictor of mortality following moderate-to-severe TBI; 9 studies (10%) included a measure of post-concussive symptom improvement; 7 studies (8%) included a measure

of mood disturbance/change; 3 studies (3%) assessed the relationship between HRV and return to consciousness. Key findings indicated that: 1) TBI of any severity is associated with decreased (i.e., worse) HRV; 2) the severity of TBI appears to moderate the relationship between HRV and recovery, with lower HRV associated with more severe TBI and improved HRV parameters as individuals recover from injury; 3) decreased HRV following TBI predicts mortality beyond age; 4) HRV disturbances may persist beyond return-to-play and symptom resolution following mild TBI. Overall, HRV may be a potential indicator of physiological change following TBI as well as a potential predictor of recovery.

VIRTUAL-052 | TRAIT MEANNESS PREDICTS BLUNTED TOP-DOWN ATTENTION TO AFFECTIVE MATERIAL: EVIDENCE FROM THE LATE POSITIVE POTENTIAL

Pablo Ribes-Guardiola[1], Carlos Ventura-Bort[2], Victoria Branchadell[1], Rosario Poy[1], Pilar Segarra[1], Javier Moltó[1]
[1]Universitat Jaume I, [2]University of Potsdam

Descriptors: Emotion Processing, Late Positive Potential, Psychopathic Meanness

This study examined the impact of attentional focus on affect processing in relation to the triarchic constructs of boldness, meanness, and disinhibition. Event-related potentials were measured while 144 undergraduate students –assessed for psychopathy using the Triarchic Psychopathy Measure (TriPM)– performed two tasks in which pleasant, neutral, and unpleasant framed pictures were presented. In the first task, participants had to indicate the color of the frame (alternative-focus task), while in the second task they were instructed to indicate the emotional category of the image (affect-focus task). Late Positive Potential (LPP) was measured as an index of attention to affective information, which was reliably modulated by *Affect* in both tasks ($Fs > 40.78$, $ps < .001$), with affective stimuli eliciting greater LPP amplitudes than neutral stimuli. Repeated measures ANOVAs including TriPM scale scores as covariates only revealed a significant *Task x Affect x TriPM Meanness* interaction, with participants scoring high in Meanness showing reduced affective modulation of the LPP response in the affect-focus task, $r (144) = -.23$, $p = .005$, but not in the alternative-focus task, $r (144) = .00$, $p = .989$. These findings suggest that individuals scoring high in meanness are characterized by blunted elaborative processing of affective stimuli when

their salience is determined in a top-down manner (i.e., when it is task-relevant). Our results highlight the need for further study of the bottom-up and top-down dynamics of attention to affective information in psychopathy.

VIRTUAL-053 | IT GETS OLD QUICK: EDA DRIVEN BY NOVELTY-HABITUATION RESPONSE PATTERN

Brittany Nackley, Bruce Friedman
Virginia Tech

Descriptors: EDA, arousal, novelty

Electrodermal activity (EDA) is commonly used as an index of arousal and sympathetic activation, although it also increases to stimulus novelty, an effect that habituates quickly (Barry, 1981; Davidson & Smith, 1991). Our study compared EDA responses to self-reported arousal. Thirty-four undergraduates (11 male) watched a series of three videos that represented a marine life imagery as "vanilla baseline" pre-stimulus, an action movie clip stimulus, and another marine life video post-stimulus. EDA was recorded throughout, and subjects also continuously moved a dial to indicate their changing subjective sense of body activation. Pearson correlation coefficients between EDA and the subjective slider were calculated by subject and condition. All correlations were statistically significant, although they showed wide variation across subjects and conditions *(Range: r = -0.852 to 0.896; p < 0.001)*. Time series analysis suggests that stimulus novelty had a much stronger effect on EDA than did self-reported arousal to the stimuli. Furthermore, EDA followed a predictable pattern across subjects that reflected a sharp increase to novelty followed by return to baseline over the subsequent 5 minutes of each condition. Video content subjectively rated to be highly activating typically had minimal effect on EDA levels, which instead followed a sequence of novelty-habituation responses for each of the 3 videos. These results point to the need to account for the novelty-habituation pattern when using EDA to index psychological or emotional arousal.

VIRTUAL-054 | A STUDY OF TWO MODELS OF ANALYSIS OF FUNCTIONAL NEUROIMAGING DATA DURING THE PROCESSING OF AVERSIVE AND NEUTRAL PICTURES

Aline Bastos, Aline Cardoso, Eliane Volchan,
Fatima Erthal
Federal University of Rio de Janeiro

Descriptors: Functional neuroimaging, Amygdala, Insula
Neuroimaging studies have identified the amygdala and insula as key brain regions involved in the processing of aversive stimuli. However, the diversity of data analysis methodologies and tools, combined with the high researcher degrees of freedom can lead to sizable variation in the results. This study aims to demonstrate how changing a functional magnetic resonance imaging (fMRI) analysis parameter - the duration of the predictor of interest - can cause differences in the results of hypothesis tests when employing very brief stimuli presentation. fMRI data were collected from 23 participants while viewing neutral and mutilation pictures randomly presented for 250 ms each. Two models were developed for data analysis. In Model 1, the predictors corresponding to pictures presentation were specified with a duration of 0 s. In Model 2, we specified the predictors with a duration of 2 s. Anatomical masks of the amygdala and insula were used for a region of interest (ROI) analysis to assess the difference between BOLD response to mutilation and neutral pictures. Model 2 showed increased activity in the left ($p = 0.014$) and right amygdala ($p = 0.008$), as well as in the left ($p = 0.031$) and right ($p = 0.024$) insula. There was no significant difference in the BOLD response in any of the ROIs using Model 1. The findings lay the foundations for a better understanding of how changes in the duration of the predictors of interest can influence outcomes resulting from the brief presentation of aversive pictures.

VIRTUAL-055 | VISUAL-VESTIBULAR SENSORY CONFLICT IN VIRTUAL REALITY: CHANGES IN THE BALANCE SYSTEM

Artem Kovalev, Anna Ganicheva
Lomonosov Moscow State University

Descriptors: Visual-vestibular sensory conflict, virtual reality, balance system
Visual-vestibular sensory conflict (VVC) is a theoretical mismatch between sensory information coming from the visual and vestibular systems. This condition can occur in vehicles, as well as in virtual reality systems that are gaining popularity. In this study the changes in the balance system under conditions of VVC in virtual reality were studied. To simulate VCC we used a virtual opto-kinetic drum in CAVE virtual reality system – a rotating striped (black and white) regular pattern. 17 healthy subjects took part in the study: 15 females and 2 males (average age – 18,5). Each subject stood still on the stabilometry platform and was exposed to virtual opto-kinetic drum 12 times (3 rotational velocities (30, 45 and 60 degrees per second), 2 directions (clockwise and counterclockwise), twice). Stabilometric recordings were carried out outside the virtual environment before and after the experiment for 30 seconds with open eyes and also during virtual rotation. The statokinesiogram length before and after drum rotations was significantly shorter ($p < 0,05$) in comparison to drum rotation condition; did not differ before and after rotations (in optokinetic tests). The same significant differences were obtained in the energy consumption index. The results showed that disturbances of the balance maintenance system under conditions of VVC in virtual reality during observing the moving environment are likely to disappear in condition of static stimulation. Thus VVC may be considered as an adaptive mechanism for signaling to the subject about being in unfavorable conditions.

VIRTUAL-056 | AUTONOMIC CONTROL UNDER THREAT IN A 2-DIMENSIONAL SPACE

Lily Seah, Youngjin Cho, Brittany Nackley, Pang Du,
Bruce Friedman
Virginia Polytechnic Institute and State University

Descriptors: Autonomic Control, Clustering, Functional Linear Modeling
Autonomic (ANS) control is more complex than a continuum between sympathetic (SNS) and parasympathetic (PNS) dominance. Representing ANS control in

2-dimensonal space can better accommodate multiple modes of interactions between SNS and PNS, such as reciprocal, coactive, and uncoupled activation. We demonstrate the application of functional data analysis to autonomic data to provide a novel depiction of the complexity of ANS interactions. ECG and impedance cardiographic data were acquired from 19 subjects (5 male; mean age 19.4) who were exposed to a 13-minute virtual-reality experience that simulated a threatening situation. Time series of cardiac pre-ejection period (PEP) was derived as a SNS index, and respiratory sinus arrhythmia (RSA) as a PNS index. Subjects were clustered into two groups based on PEP change in response to the threat stimulus at two time points. Correlations between PEP signals over time for Groups 1 and 2 were more than 0.5 and close to 1 respectively. Functional principal component analysis of PEP signals showed that Group 1 had two principal components (PCs) accounting for 95% of the variability, whereas Group 2 had one PC accounting for 98% of the variability with uniform loadings over time. These differences may imply that subjects in Group 2 had an internally driven process and were not responsive to the external stimulus. Functional linear modeling of PEP as the independent function and RSA as the response function in Group 1 showed a fairly constant slope (1125 to 1375) over time, implying that SNS was the dominant force in synchrony with PNS.

VIRTUAL-057 | THE ASSOCIATION OF N2 ERP AMPLITUDES WITH HARSH PARENTING AND INHIBITORY CONTROL IN EARLY CHILDHOOD

Benjamin Swanson, Alexis Hosch, Isaac Petersen
University of Iowa

Descriptors: N2, Inhibitory Control, Parenting
Harsh parenting practices have been consistently associated with inhibitory control (IC) deficits in children. However, the neural processes underlying this association are unknown. A candidate process is the N2 event-related potential (ERP) component, which is thought to reflect neural activity associated with response inhibition. Supporting this notion, smaller N2 amplitudes during inhibition trials of a go/no-go paradigm have been associated with IC deficits. The current study examined whether smaller N2 amplitudes mediate the association between harsh parenting practices and children's poorer IC. Children (N = 117) ages 3–7 years completed a go/no-go task, in which N2 ERP amplitudes were assessed. Children also completed behavioral tasks assessing IC. Parents self-reported harsh parenting practices. Controlling for child age and socioeconomic status, hostile (non-corporal) harsh parenting was associated with smaller no-go N2 amplitudes ($\beta = .19$), but not with IC. Corporal harsh parenting was associated with poorer IC ($\beta = .11$), but not with N2 amplitudes. Indirect effects were non-significant for both physical and hostile harsh parenting on IC via N2 amplitudes. Thus, we did not find evidence of mediation. This study provides novel evidence that effects of corporal versus hostile punishment are dissociable, and that hostile parenting specifically is related to smaller N2 amplitudes. Speculatively, parenting behaviors such as exploding in anger and providing punishment based on the parent's mood may have a unique role in young children's neural development.

VIRTUAL-058 | TRAINING THE SKILL OF TURNS IN VIRTUAL REALITY REDUCES THE SEVERITY OF SIMULATOR SICKNESS

Artem Kovalev, Arina Rakhimova, Elizaveta Luniakova, Margarita Belousova
Lomonosov Moscow State University

Descriptors: virtual reality, sensory conflict
Virtual Reality (VR) is considered one of the most influential technologies of the last decade. However, simulator sickness (SS) remains a significant limitation of its use. We hypothesized that forming the turn motor skill in VR can reduce the severity of SS. In this work the participant was motionless in the center of a virtual optokinetic drum which was painted in black and white vertical stripes. He could turn round or rotate the wall of the drum only with the help of the controller. Two groups of participants ($N = 40$) trained different movements for 3 days. One group ($N = 20$) trained to turn to the vertical red stripe on the wall of the optokinetic drum and point to it with the controller. The other group ($N = 20$) trained to rotate the vertical wall of the optokinetic drum so that the red bar was directly opposite the controller. The severity of SS was assessed based on the results of heart rate, tapping test, reverse counting with subtraction and Simulator sickness questionnaire indicators. It was found that the severity of SS was significantly higher in the group forming the motor skill of space level than in the "action-level" group ($p < 0.001$). However, it significantly decreases with training, and in both test tasks in this group, SS is weakly expressed ($p > 0.001$). In the second group the severity of SS was initially lower, but no dynamics were observed during training. SS was strongly pronounced in this group in the spatial test task. Thus, movement training in VR at the leading level of space prevents the development of SS.

VIRTUAL-059 | SHIELDING CHIPS REDUCE EFFECTS ON EEG BRAIN ACTIVITY, IMMUNE FUNCTIONS, AND MITOCHONDRIAL BIOENERGETICS INDUCED BY ELECTROMAGNETIC RADIATION IN THE 5G RANGE

Diana Henz
Stiftung für Gesundheit und Umwelt

Descriptors: EEG, immune response, mitochondrial bioenergetics
Literature shows that electromagnetic fields (EMFs) emitted by mobile phones cause changes in EEG brain activity. In previous studies, we showed that shielding chips applied in mobile phones reduced effects of EMFs on brain activity. In the present study, the effects of shielding chips on brain activity, immune functions, and mitochondrial activity were investigated when subjects were exposed to EMFs in the 5G range. Subjects were exposed to EMFs emitted by a smartphone (Apple iPhone 12) call for 30 minutes. We tested three experimental conditions in a randomized double blind design: (1) smartphone (shielding chip; Gabriel-Tech, Germany), (2) smartphone without chip, (3) control condition. High-density EEG was recorded from 256 electrodes before, during, and after each experimental condition. Blood samples to assess immune functions and mitochondrial bioenergetics were taken before and after each experimental condition. EEG data revealed increases in the beta and gamma bands in frontal, temporal, occipital, and limbic areas with increases in interleukin-1 beta and TNF-alpha, and decreases in mitochondrial spare respiratory capacity when subjects were exposed to the smartphone without application of a shielding chip. EEG beta and gamma activity decreased as well as interleukin-1 beta with increased mitochondrial spare respiratory capacity when the shielding chip was applied. Interrelations of brain activity, immune response, and mitochondrial bioenergetics are discussed within a model of neuroinflammation as a contributing factor to a variety of neuropsychiatric disorders.

VIRTUAL-060 | LATE BREAKING METHODOLOGICAL ADVANCES IN MACHINE LEARNING APPROACHES TO DECODING COGNITIVE TASKS IN NEUROIMAGING DATA

Corey Richier, Kyle Baacke, Sarah Olshan, Wendy Heller
University of Illinois, Urbana-Champaign

Descriptors: fMRI, Machine Learning, Decoding
The high-dimensionality and multicollinearity of neuroimaging data creates challenges for various analytic and modeling approaches. In predictive modeling, feature selection (FS) or dimensionality reduction (DR) methods are often employed to address this problem. FS methods reduce the number of features, whereas DR methods transform existing variables into fewer variables that capture, to a significant degree, the original data's variance. In the present analysis, we compare decoding accuracy of cognitive tasks in multiple datasets using various FS and DR methods. We used nine FS/DR methods to reduce the input space generated by functional connectivity values from parcellated t-fMRI sessions in two publicly available datasets (HCP1200 and UCLA LA5c Study). We then used classifier models to decode tasks from the resulting input feature sets. The cross-validation accuracy of the resulting models was then used to evaluate their efficacy. All methods demonstrated greater than chance accuracy in task decoding. DR methods outperformed FS methods. Linear Discriminant Analysis (LDA) was found to have the highest decoding accuracy (>94%). Future research should explore LDA's effectiveness across modalities of neuroimaging. These results showcase a tradeoff between accuracy and interpretability, in which certain methods may decode exceptionally well, but have input variables that are harder to interpret. The discrepancy between accuracy in FS and DR methods could suggest that the ensemble of features may be more important to decoding accuracy than individual features.

VIRTUAL-061 | LATE BREAKING INDIVIDUAL EYE MOVEMENT STRATEGIES IN HOLISTIC FACE PROCESSING

Anna Pichugina, Galina Menshikova
Lomonosov Moscow State University

Descriptors: facial perception, holistic processing, eye movements
The issue of the contribution of holistic and analytic mechanisms to the process of facial perception is actively discussed in modern scientific literature. Various experimental paradigms have been developed to study these

mechanisms. One such experimental paradigm is based on the face inversion effect. Recording of eye movements in the perception of inverted faces in different studies has shown conflicting results. The aim of our work was to study individual strategies of eye movements in the task of assessing the attractiveness of faces upon presentation of them in the upright and inverted orientation. 57 people participated in the experiment. Results show that a decrease in the influence of holistic processing during face inversion leads to a significant change in the fixation duration and the amplitude of saccades, as well as to a change in the distribution of the dwell in the AOIs (eyes, nose, bridge of nose and lips). Based on differences in eye movements, two groups of participants were identified: with a static strategy and with a dynamic strategy. We found specific for each of the groups changes in the dwell in AOIs, depending on the orientation of the stimulus. This pattern indicates the need to take into account individual eye movement strategies when studying holistic and analytic processing in facial perception.

VIRTUAL-062 | LATE BREAKING
HEART RATE VARIABILITY IN MOTHERS AND THEIR 12-MONTH-OLD INFANTS: CONSIDERATION OF RELIABILITY AND INTERGENERATIONAL ASSOCIATIONS

Paul Fitzgerald[1], Kaylin Hill[2], Wei Neo[1], Carolyn McCormick[1], Dan Foti[1], Bridgette Kelleher[1]
[1]Purdue University, [2]Vanderbilt University

Descriptors: heart rate variability, autonomic nervous system, mother-infant dyads

Heart rate variability (HRV) is a critical physiological indicator of autonomic nervous system functioning, and is associated with responsivity to the environment as well as sociable approach behaviors. While HRV has been studied extensively in adults, and to some degree in children and infants, less is known about intergenerational transmission of HRV in mother–infant dyads. Understanding more about HRV in these dyads may lend insight into caregiver–infant social processes that shape development, particularly in the first year of life. Here we measured resting HRV for 3 minutes using electrocardiogram (ECG) in 35 mothers and their 12-month-old infants, measured in the infant and mother separately. We found that both mothers and infants showed a high degree of split-half reliability within the 3-minute measurement, both for respiratory sinus arrhythmia (RSA; which reflects parasympathetic nervous system activity) and for low frequency HRV (LF; a proxy for sympathetic activity; mother RSA rSB = 0.88; mother LF = 0.84; infant RSA = 0.84; infant LF = 0.82). RSA and LF were positively correlated in mothers (r = 0.45, p = 0.011) and in infants (r = 0.47, p = 0.004). RSA was positively correlated between mothers and infants (r = 0.32, p = 0.081), as was LF (r = 0.39, p = 0.034). These data suggest that HRV can be measured reliably with ECG in mother–infant dyads, and that trait-like measures of parasympathetic and sympathetic signaling are inter-related, providing support for further investigation of HRV in caregiver–infant social processes.

VIRTUAL-063 | LATE BREAKING
FASTING MODIFIES QUANTITATIVE EEG MEASURES AND SLOWS COGNITIVE PROCESSING SPEED

Adrián Ávila-Garibay, Hugo Vélez-Pérez, Geisa Gallardo-Moreno, Andrés González-Garrido
University of Guadalajara

Descriptors: Working memory, qEEG, Fasting

Fasting is a common practice among different population segments, and it has been demonstrated that it can affect attentional processes. However, the effects of fasting on quantitative measures of electroencephalographic activity (qEEG) are unclear. We aimed to evaluate the impact of a relatively prolonged fasting condition (18 hours) on behavioral performance and qEEG during the performance of a complex n-back task. Twenty-nine healthy individuals were evaluated during fasting and regular breakfast while distinguishing target and no-target stimuli in n-back tasks with three memory load levels. Artifact-free epochs of EEG data were processed to obtain the main qEEG measures through a fast Fourier transform. Behavioral responses showed a significant decrease in the number of correct responses and slower reaction times when responding to non-target trials during fasting. In addition, the memory load had a significant effect on behavioral performance. The power of theta was significantly higher during the 2-back task compared to the 0-back. Even though fasting did not considerably vary the EEG power of any of the studied frequency bands, there was a significant fasting-related increase in the higher theta power over the frontal areas, probably reflecting transient changes in cognitive control mechanisms.

**VIRTUAL-064 | LATE BREAKING
EXPERIENTIAL, EXPRESSIVE, AND
PHYSIOLOGICAL EFFECTS OF POSITIVE AND
NEGATIVE EMOTION REGULATION GOALS
WHILE REAPPRAISING DISGUSTING STIMULI**

Alexander Bruckhaus[1], Sylvia Kreibig[2],
Andrea Samson[3,4], James Gross[2]
[1]University of Southern California, [2]Stanford University,
[3]UniDistance Suisse, [4]University of Fribourg

Descriptors: emotion regulation, peripheral physiology, affect systems

We examined whether positive and negative emotion regulation (ER) goals while cognitively reappraising disgusting stimuli differentially engage positive (PA) and negative affect (NA) systems. Forty-eight women watched 20-30 s disgusting film clips. They were instructed to either respond naturally (no ER goal) or emphasize the film clips′ positive (positive ER goal) or negative (negative ER goal) aspects. We measured PA and NA system activity on experiential, expressive, and physiological response channels through self-reported amusement and disgust, electromyography of zygomaticus major (ZM) and corrugator supercilii (CS), and autonomic nervous system reactivity from respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP). Compared to baseline, no ER goal increased self-reported amusement and disgust, CS reactivity, and RSA and shortened PEP. Compared to no and negative ER goals, a positive ER goal increased self-reported amusement, decreased self-reported disgust, decreased CS reactivity, and lengthened PEP. Compared to no and positive ER goals, a negative ER goal decreased self-reported amusement, ZM reactivity, and RSA and increased self-reported disgust and CS reactivity. Positive and negative ER goals while reappraising disgusting stimuli differentially engaged PA and NA systems: The positive ER goal engaged reciprocal experiential PA–NA system activation and expressive and physiological NA system withdrawal; the negative ER goal engaged reciprocal experiential and expressive NA–PA system activation and physiological PA system withdrawal.

**VIRTUAL-065 | LATE BREAKING
DOES THE RECOGNITION POTENTIAL
DISPLAY THE FREQUENCY BY REGULARITY
INTERACTION?**

Mariah McLaren, Joseph Dien, Donald Bolger
University of Maryland, College Park

Descriptors: ERP, reading, phonology

The Recognition Potential or RP provides a window into the reading process and can potentially shed light on disorders like dyslexia. The RP presents as a left-lateralized negativity that peaks at 200-250 msec and is more negative toward words than non-words (Rudell, 1991). It seems to reflect an early stage of word recognition processing (Martín-Loeches, 2007); however, without the use of supraliminal masking at an SOA of 250 msec, the lexical effect is not visible (Iglesias et al., 2004). Despite the extensive research on RPs, it is unknown what aspect of the reading process it reflects. In a prior study (Dien et al., 2013), ERP and fMRI data showed a Recognition Potential at about 200 msec that had its origin in the posterior inferior temporal gyrus. Based on the location and the latency, they hypothesized that the RP might reflect phonological encoding. Therefore, the current study aims to see if it reflects the well-known frequency by regularity effect (Paap et al., 1991). Sixty-eight channel EEG data were collected from a total of thirty-two neurotypical undergraduate students in the masked lexical decision task, which was modeled after the 2013 study. We conducted a two-step PCA on the data and obtained a significant word by frequency effect (p=0.038) but no three-way interaction with regularity (p=0.92). The N170 did not show an effect of either frequency or regularity. We discuss what these results suggest about the process reflected by the RP and thus reading models in general.

**VIRTUAL-066 | LATE BREAKING
USING VIRTUAL REALITY TO EXAMINE
PATTERNS OF PHYSIOLOGICAL ACTIVATION
ASSOCIATED WITH EXPERIENCING 'AWE'**

Lauren Pritchard, Chris Maymon, Gina Grimshaw
Victoria University of Wellington

Descriptors: physiology, awe, positive emotion

Awe is a complex emotion shown to improve psychological well-being by influencing the perception of time, space, and the self (Rudd et al., 2012). However, awe is challenging to induce in a sterile lab environment, and thus, little is known about how awe manifests changes in the autonomic nervous system (ANS). One recent study found

evidence suggesting that awe activates both the parasympathetic and sympathetic branches of the ANS (Chirico et al., 2017). The present study harnesses the immersive nature of Virtual Reality to situate participants in vast and implausible worlds, drawn from previous research (e.g., high above a mountain range, beneath an ocean reef, and floating in outer space). Each 'awe inducing' scenario was separated by an emotionally-neutral control scenario. While in each environment, we recorded physiological activity (heart rate, electrodermal activity) and verbal report of participants' emotional experiences. Participants reported higher levels of awe in the 'awe inducing' scenarios relative to the control scenarios. Preliminary physiological analyses suggest that awe activates the parasympathetic ANS, evidenced by a significant decrease in heart rate. Furthermore, we found no significant difference in electrodermal activity. These findings suggest that awe activates the parasympathetic ANS rather than the sympathetic ANS.

VIRTUAL-067 | CARDIAC INTEROCEPTIVE ABILITY MODERATES THE EFFECT OF SNS BUT NOT PNS REACTIVITY ON SOCIAL JUDGMENT DURING STRESS

Mallory Feldman[1], Urvi Patel[1], Jennifer MacCormack[2], Adrienne Bonar[1], Kristen Lindquist[1]
[1]University of North Carolina, Chapel Hill, [2]University of Pittsburgh

Descriptors: Interoception, Physiology, Social Perception
People constantly make judgments about those around them —inferring whether others are kind or cruel. These judgments can be adaptive (facilitating empathy/action planning). Yet inaccurate judgments can derail social interactions— even causing people to lose their friends or livelihoods. Social judgments are not only informed by target characteristics, but also by culture, context, and within-perceiver factors like the physiological state of the body. Prior research suggests that sensitivity towards physiological states (i.e., interoceptive sensitivity) may reduce affective misattribution during social judgment. We explored whether differences in sympathetic nervous system (SNS; proxied by pre-ejection period) and parasympathetic nervous system (PNS; proxied by HF-heart rate variability) reactivity would predict more negative social judgments – specifically for subjects who were less interoceptively sensitive. Participants ($N = 161$) completed the Trier Social Stress Test before two impassive interviewers.

We acquired SNS and PNS reactivity throughout. Participants then rated their interviews on several traits (helpful, polite, professional, apathetic, judgmental, aggressive). Interoceptive ability was measured using the Heartbeat Detection Task. We found that poor heartbeat detectors rated their interviewers more negatively when experiencing high levels of SNS (not PNS) reactivity. Furthermore, these changes were driven by decreases in positive (not negative) trait ratings. Being aware of one's internal state may be one pathway to more accurate, adaptive social interactions.

VIRTUAL-068 | COMPARING HEART RATE ANALYTICAL METHODS TO EXAMINE THERAPEUTIC ENGAGEMENT DURING IMAGINAL PROLONGED EXPOSURE THERAPY FOR PTSD: A MULTI-CASE STUDY

Allison Altman[1,2], Alexandra Cowden Hindash[3,4], Julia Levitan[5], Sabra Inslicht[3,4]
[1]University of California, Berkeley, [2]VA Palo Alto Health Care System, [3]San Francisco VA Medical Center, [4]University of California, San Francisco, [5]Washington University, St. Louis

Descriptors: PTSD, Physiological reactivity, Prolonged exposure therapy
As mobile health technologies proliferate, their use during exposure-based therapies has the potential to illuminate treatment mechanisms. The primary purpose of this article to is illustrate three approaches to using continuously collected physiological data during prolonged exposure therapy in patients with posttraumatic stress disorder to examine physiological markers of treatment response. Utilizing data from three non-Hispanic White male Veterans, photoplethysmogram measured HR during clinic-based prolonged exposure therapy sessions is analyzed to assess three potential therapeutic mechanisms: 1. emotional engagement is examined via correlation analysis between self-reported distress ratings and objectively measured peak heart rate in the minute prior to distress ratings; 2. initial emotion activation is examined through time to peak change in heart rate and self-reported distress; and 3. extinction processes within and between therapy sessions are examined via multilevel modeling using heart rate over time throughout imaginal

exposure procedures across sessions. Example analysis and results for each case in each analytical approach are presented. The implications of the analysis and the results for each case are discussed, in addition to the benefits and limitations of each approach. Mobile health technologies may provide a new avenue towards unveiling treatment mechanisms in psychotherapy. Use of standardized analytical approaches will enable cross study comparison and understanding, and will ultimately lead to increased treatment response.

VIRTUAL-069 | DISSOCIABLE SIGNATURES OF DYNAMIC AUTONOMIC ACTIVITY DURING EVOKED EMOTIONS AND REST

Lorenzo Pasquini[1], Fatemeh Noohi[1], Christina Veziris[1], Eena Kosik[1], Alex Lee[1], Jesse Brown[1], Sarah Holley[2], Bruce Miller[1], Manish Saggar[3], William Seeley[1], Virginia Sturm[1]
[1]University of California, San Francisco, [2]San Francisco State University, [3]Stanford University

Descriptors: Autonomic nervous system, Dynamic system, emotions

The outflow of the autonomic nervous system (ANS) is continuous and dynamic. How—and whether—the ANS produces physiological patterns during emotions remains a topic of significant debate. Here, we searched for ANS patterns in second-by-second, multichannel physiological recordings in 45 healthy older adults during a video-based emotional reactivity task and a resting period. Dimensionality reduction of the continuous physiological data during the emotional reactivity task revealed five principal components. Unsupervised clustering algorithms applied to the principal components' time series data uncovered five distinct ANS states that differentiated among the emotion-inducing trials. These states emerged and dissipated over time, with each instance lasting several seconds on average. ANS states with a similar functional organization were also detectable in the resting period but were of smaller magnitude. Our results suggest that, amidst its continuous outflow, the ANS produces dynamic constellations of physiological activity during emotions and at rest.

VIRTUAL-070 | CARDIOVASCULAR PAIN REGULATION AND THE BUFFERING EFFECT OF SOCIAL SUPPORT IN INDIVIDUALS WITH CHRONIC PAIN

Marie Neubert[1], Maria Kleinstäuber[2], Eric Garland[3]
[1]University of Siegen, [2]Utah State University, [3]University of Utah

Descriptors: chronic pain, cardiovascular changes, social support

Background: Chronic pain leads to alterations in the cardiac system such as higher blood pressure and reduced heart rate. Previous findings also suggest that patients with chronic pain show impaired cardiovascular regulation in response to acute pain. So far, meta-analytic findings indicate that social support during acute pain stimulation decreases pain intensity and physiological arousal in healthy individuals. In this study, we aim to investigate cardiovascular regulation in response to acute pain and the buffering effect of social support in individuals with chronic pain compared to healthy individuals. Methods: We included 85 individuals with chronic pain and 82 healthy participants. Participants were assigned to either the experimental group (social support) or the control group (no support) using stratified randomization. Social support was given by a confederate. Acute pain was induced using the cold pressor task. Blood pressure, heart rate, and heart rate variability were measured during rest and in response to acute pain. Results: Individuals with chronic pain exhibited higher blood pressure, increased heart rate, and reduced heart rate variability during rest compared to healthy individuals. Contrary to previous findings, healthy individuals in the social support group showed a higher heart rate in response to acute pain than healthy individuals in the no support group. Discussion: Group differences and moderating factors will be discussed. A better understanding of the cardiovascular changes associated with chronic pain could help improve patients' treatment.

VIRTUAL-071 | LATE BREAKING A MULTILEVEL EXAMINATION OF RESPIRATORY SINUS ARRYTHMIA AND AGGRESSIVE BEHAVIOR THROUGHOUT AN INTERPERSONAL CONFLICT

Donald Godfrey, Darian Reynero, Elizabeth Walla, Julia Babcock

University of Houston

Descriptors: Respiratory Sinus Arrhythmia, Couples, Conflict

Although theoretical models suggest that dys-regulation of the parasympathetic nervous system (PNS) plays a role in interpersonal aggression, past research on aggression and PNS activity has focused primarily on between person associations, limiting the inferences that can be made regarding within-person processes. The current study was developed to examine both within and between person associations between aggression and PNS activity among intimate partner dyads (N = 43) with a history of interpersonal aggression throughout a conflict discussion task. During the task, PNS activity (indexed via Respiratory Sinus Arrhythmia; RSA) and aggressive behavior (coded from affect) were measured in thirty second intervals. Using multi-level modeling for repeated measure dyadic data, we found that men and women's RSA increased linearly throughout the conflict discussion, and women with more aggression partners had stronger increases in RSA than women with less aggressive partners. Increases in aggressive behavior during one interval of the conflict was predictive of increases in RSA during the consecutive interval. Women experienced decreases in RSA thirty seconds following their partners' increase in aggression. Results suggest that aggression may act as a maladaptive autonomic regulation process in which individuals experience reinforcement for aggression through PNS activation. Women with aggressive partners may blunt physiological activity during interpersonal interactions, via PNS activation, to protect against chronic stress responses to aggressive behavior from their partner.

VIRTUAL-072 | TIME FREQUENCY ANALYSIS REVEALS THETA-RELATED SALIENCE AND DELTA-RELATED VALENCE EFFECTS TO APPETITIVE AND AVERSIVE OUTCOMES

Heather Webber[1], James Cavanagh[2], Geoffrey Potts[3]
[1]*University of Texas Health Science Center, Houston,*
[2]*University of New Mexico,* [3]*University of South Florida*

Descriptors: RewP, delta, theta

The Reward Positivity (RewP) is an event-related potential (ERP) that is widely thought to represent a signed reward prediction error (RPE). Previously, we employed a design that administered unpredicted/predicted appetitive (money) and aversive (noise burst) outcomes. RewP amplitudes were larger to unpredicted delivered outcomes compared to withheld outcomes - regardless of valence, consistent with a salience prediction error (SPE). Increasing evidence suggests the RewP is affected by overlapping components elicited from different cognitive demands (e.g., feedback modality-expectation interactions). Here we performed a secondary time-frequency analysis on these data to leverage the ability of temporal filters to dissociate overlapping processes. Theory predicts that frontal theta power should be affected by unexpectedness (SPE), whereas reward receipt should affect delta power (RPE). There was an interaction between prediction and delivery [$F(1,49) = 6.07$, $p = .017$], where FCz theta was enhanced to unpredicted delivered compared to withheld outcomes, regardless of valence (SPE). There was an interaction between valence and delivery [$F(1,49) = 4.20$, $p = .046$], where CPz delta power was enhanced when an aversive outcome was avoided or when an appetitive outcome was delivered (RPE). In conclusion, by utilizing temporal filters, we uncovered theory-consistent salience and valence effects which were not observed when only looking at ERPs. These results contribute to the growing knowledge on how scalp topography can be produced by dissociable underlying neural processes.

VIRTUAL-073 | UNDERSTANDING THE EFFECTS OF EFFORT AND EXPECTANCY ON THE P300

Jessica Simon, Nicholas Santopetro, Greg Hajcak
Florida State University

Descriptors: P300, effort, expectations

Existing literature reveals a link between effort expenditure and the significance of reward attainment. Recent research from our group found that greater effort expenditure results in a larger P300 to reward-based effort-completion cues. In these studies, however, more effortful trials are characterized by reward feedback that is more unpredictable in its timing, which may influence the effort P300 effect. In this study, 44 subjects completed a novel effort-reward task with 3 trial types: effort with countdown, effort with no countdown, and waiting (no countdown). All trial types were low or high in effort/ wait time. On each trial, a number indicated the amount of effort (i.e., button presses) or duration of waiting required for reward. On countdown trials, the amount of effort decreased with button presses to make the timing of the

effort-completion cue predictable. A 2 (Effort amount/Duration) x 3 (Trial Type) rmANOVA revealed a main effect of effort amount/duration, such that the P300 was larger following more than less effort and waiting. There was also an effect of trial type, reflected by a reduced P300 following countdown versus no-countdown effort conditions, and a smaller P300 for waiting versus both effort conditions. Critically, an interaction emerged between effort amount/duration and trial type, such that the P300 was only potentiated by high levels of effort when there was no countdown. The current study replicated the impact of effort expenditure on the P300 and suggests that this effect is only observed when the timing of rewards is more unpredictable.

VIRTUAL-074 | THREAT GENERALIZATION OVER VISUAL OUTGROUP INDIVIDUALS AND MISPERCEIVED FACIAL SIMILARITY

Niclas Willscheid, Florian Bublatzky
Central Institute of Mental Health

Descriptors: threat generalization, outgroup homogeneity, prejudices and stereotypes

Generalizations over different persons (i.e., prejudices and stereotypes) are based on perceived similarity between unique individuals and often directed towards visual outgroups (other racial groups). The initial perception of unfamiliar outgroup individuals tends to be accompanied by the recognition of visual category, and outgroup faces are often misperceived as looking more alike than ingroup faces. On the neural level, we examined whether threat association generalizes more across visual out- than ingroup faces, and whether this is linked with lower distinguishment between facial identities. Forty light-skinned German participants perceived twelve sequences of light- and dark-skinned faces and prior to each sequence, one in- or outgroup face was instructed as threat-of-shock cue. The sequences consisted of 40 consecutive adaptor-target pairs of visual in- or outgroup faces. To examine identity-sensitive repetition suppression as an indicator for neural face distinguishment, adaptor and target depicted either the same face or two different faces. Results show stronger threat response (more pronounced LPP amplitudes) to out- than ingroup safety faces after a face of the same visual group was instructed as threat-of-shock cue. At the same time, identity-sensitive N170 repetition suppression was present for visual in- but not outgroup faces. Due to perceived visual similarity between outgroup individuals, associations such as threat may generalize stronger from one individual to others, contributing to the buildup of prejudices and stereotypes.

VIRTUAL-075 | COMPARING PHYSIOLOGICAL STRESS ANALYSIS APPROACHES: MEAN ESTIMATE COMPARISONS VERSUS TRAJECTORY ANALYSIS

Kyle Rawn, Peggy Keller
University of Kentucky

Descriptors: biological stress responding, multilevel modeling, autonomic reactivity

Much research is focused on assessing individual differences in autonomic stress responding. However, little research explores how to best model these data. The common approach assesses differences between baseline mean activity and stressor mean activity, but assessing within-task stress patterns (trajectory analysis) more closely aligns with theory and physiological functioning. To compare these approaches, this proposal is a secondary data analysis of two studies, one using skin conductance level (SCL) with 177 college students, and another using respiratory sinus arrhythmia (RSA) with 346 parents. Participants completed questionnaires assessing demographics and variables of interest (coping, intimate partner violence exposure, problem drinking, and depression). SCL and RSA were recorded during a baseline period, a mirror-tracing task, a memory recall task, and for parents during a problem-solving task with their child. Analyses used linear regression for the mean-comparison approach and within-task multilevel modeling for the trajectory approach. Both approaches found significant changes in activity during stress, but only trajectory analysis detected relations between these changes and variables of interest. For example, higher coping flexibility was associated with lower increases and more stable response patterns of SCL during a memory recall task. Results show the advantages of a trajectory approach over the mean comparison approach: it illuminates stress response patterns and meaningful within-task fluctuations that are related to psychological variables.

VIRTUAL-076 | DIMINISHED "PREPARATORY" CARDIOVASCULAR RESPONSES TO UPCOMING EMOTIONAL STIMULI CONTRIBUTE TO INCREASED DISINHIBITION IN FRONTOTEMPORAL LOBAR DEGENERATION SYNDROMES

Kuan-Hua Chen[1], Alice Hua[1,2], Gianina Toller[2], Sandy Lwi[1], Marcela Otero[1,3,4], Claudia Haase[5], Katherine Rankin[2], Howard Rosen[2], Bruce Miller[2], Robert Levenson[1]
[1]University of California, [2]University of California, San Francisco, [3]Stanford University School of Medicine, [4]Veterans Affairs Palo Alto Health Care System, [5]Northwestern University

Descriptors: Emotion, Dementia, Behavioral Symptoms

Frontotemporal lobar degeneration (FTLD) encompasses a group of neurological conditions characterized by profound behavioral symptoms including apathy and disinhibition. In healthy individuals, increased cardiovascular responses to upcoming emotional stimuli support the increases in somatic activity needed to approach or withdraw salient emotional stimuli. We hypothesized that diminished "preparatory" cardiovascular responses to an upcoming emotional event contribute to behavioral symptoms of increased apathy and disinhibition in FTLD. Participants include 194 individuals with FTLD and 56 individuals with Alzheimer's disease (AD). Preparatory cardiovascular responses were quantified as decreases in interbeat interval (i.e., heart rate increases) from baseline to an "instruction period," during which participants were told to watch an upcoming emotional film but not provided information about the film's valence. Apathy and disinhibition in patients were evaluated via caregiver reports. We found that individuals with FTLD had more disinhibition and apathy than those with AD. Further, group differences in disinhibition (but not apathy) were mediated by individuals with FTLD having smaller preparatory cardiovascular responses (indirect effect = 0.07, accounting for 9.11% of the total effect, $p < .05$). We believe that diminished preparatory cardiovascular responses in FTLD result in the person having insufficient metabolic support for the somatic activity that is critically involved in the behavioral adjustments associated with inhibition.

VIRTUAL-077 | DEVELOPMENTAL CHANGES OF THE TOPOGRAPHICAL N170 DURING SPATIAL PROCESSING OF REWARDS IN NEUROTYPICAL CHILDREN AND PEDIATRIC CANCER SURVIVORS

Mei-Heng Lin[1], Sally Cole[2], Peter Cole[1,3], Miriam Rosenberg-Lee[1], Nicole Lalta[1], Travis Baker[1]
[1]Rutgers University, Newark, [2]Florida State University, [3]Rutgers Cancer Institute of New Jersey

Descriptors: Topographical N170, Spatial Processing, Pediatric Cancer Survivors

The topographical N170 (NT170) recorded over the right parietal site is sensitive to the spatial location of rewards. The latency effect of the NT170 is observed in adults, whereby its peak latency occurs earlier for rightward outcomes compared to leftward ones. However, the development of the NT170 and its latency effect in children remains unclear. Here, we explored the developmental changes of the NT170 in 50 neurotypical children aged 6-17 years using the T-maze task. We also examined whether the NT170 is implicated in pediatric cancer survivors whose brain functions have been reported to be compromised by chemotherapy. Two repeated-measures ANOVAs with age group [three groups: 6-8 years; 9-12 years; and 13-17 years] and direction [left and right] as predictors were conducted on the NT170 latency and amplitude, respectively. Results showed a significant main effect of age group on the NT170 latency and amplitude ($ps < .001$). Post hoc analyses showed that the NT170 latency and amplitude decrease with age groups. We also found a significant main effect of direction on the NT170 latency ($p < .001$) such that the latency of NT170 occurred faster for outcomes in the right alley compared to the left alley. Finally, our preliminary results showed that pediatric cancer survivors ($n = 5$) were trending toward a smaller latency effect compared to age-matched peers ($p = .08$). Taken together, this study demonstrated the developmental changes and the latency effect of the NT170 in neurotypical children and showed that the NT170 may be implicated in pediatric cancer survivors.

VIRTUAL-078 | REDUCTIONS IN CHILDHOOD DOORS-LOCKED P300 AMPLITUDE PREDICTS INCREASED RISK FOR DEPRESSIVE DISORDERS DURING ADOLESCENCE

Nicholas Santopetro[1], Christopher Brush[1], Brady Nelson[2], Greg Hajcak[1], Daniel Klein[2]
[1]Florida State University, [2]Stony Brook University

Descriptors: EEG/ERP, Depression, Prospective
Adults experiencing depression exhibit reductions in P300 amplitude when elicited from various experimental tasks including oddball and flanker tasks. More recently, this line of research has been extended to the doors gambling task in which a large sample of clinically depressed adults displayed reductions in the P300 component elicited from the door stimuli (doors P300) compared to healthy controls. The present study sought to further extend this finding to child and adolescent samples by investigating the associations between doors P300 amplitude measured at a baseline assessment with lifetime depression diagnostic data from both a baseline and a six-year follow-up assessment in a sample of 410 children. Baseline doors P300 amplitude was not associated to baseline lifetime depression diagnostic status; however, the number of children that met for a lifetime depressive disorder at the baseline visit was extremely low ($n = 8$). Findings did indicate that adolescents with a lifetime depression diagnoses at follow-up ($n = 48$) exhibited reductions in baseline (childhood) doors P300 amplitude compared to adolescents with no history of depression at follow-up ($n = 362$). Moreover, deficits in baseline doors P300 was significantly associated with follow-up lifetime depression diagnostic status in a logistic regression over and above baseline lifetime depression diagnostic status, age, and sex. In sum, results suggest that blunted doors P300 during childhood may have utility as a potential neural marker of risk for developing future depressive disorders.

VIRTUAL-079 | THE SPECIFIC REACTIVITY OF FACIAL SKIN BLOOD FLOW WHEN OBSERVING OTHERS' EMOTIONAL FACES

Naoki Ishikawa[1], Masato Asahina[2], Satoshi Umeda[1]
[1]Keio University, [2]Kanazawa Medical University

Descriptors: Facial skin blood flow, Angry, Embarrassment
Recently, facial skin blood flow (SkBF) has been growing attention as an emotional index. Although previous studies focused on the facial SkBF of people experiencing emotions, such as anger or embarrassment, facial SkBF in observers who perceive the person with emotion is poorly understood. The goal of the present study was to examine the facial SkBF changes in the observers and the detailed dynamics by measuring continuous blood pressure and heart rate. Healthy participants ($n = 29$) observed the 5-s videos, consisting of emotional expressions (neutral, angry, or embarrassed) and facial color changes (reddening or not). We measured facial SkBF, mean arterial pressure, and heart rate for autonomic responses during the experiment. Physiologically, observing anger and embarrassed faces induced a significant decrease in facial SkBF but no effect of facial expression or color changes on the other physiological indices. In addition, the facial vascular conductance index, an indicator of facial blood vessel variability, indicated that the decrease in facial SkBF while observing emotional faces was explained by the contraction of facial blood vessels. The decrease in facial SkBF may reflect the function that prevents the synchrony between people with intense emotion and observers by being in opposite directions in terms of facial SkBF, and calms the observers. Our results clarified the unique and rapid reactivity in facial SkBF while observing others' emotions and lead to clinical application by further demonstration of the emotional regulation function of facial SkBF in observers.

VIRTUAL-080 | EMOTIONAL SALIENCE OF POSITIVE AND NEGATIVE ASPECTS OF CANNABIS USE IN CANNABIS USE DISORDER: THE DEVELOPMENT OF A NOVEL SELF-REFERENTIAL PROCESSING TASK USING THE LATE POSITIVE POTENTIAL

Brandon Schermitzler, Richard Macatee
Auburn University

Descriptors: Cannabis, LPP, ERP
Cannabis Use Disorder (CUD) is becoming increasingly prevalent in the U.S., yet treatment-seeking remains low, suggesting that cannabis-related problems may be less emotionally salient to users than perceived benefits. In the current study, non-treatment seeking individuals with DSM-5 severe CUD (N = 42) completed a novel self-referential passive listening task that played 5 s-long statements referring to personalized positive and negative aspects of their cannabis use and neutral statements about their shower habits, followed by 5 s of silence. The late positive potential (LPP), a slow wave that begins approximately 400 ms after

stimulus onset, was used as a measure of the statements' emotional salience. The LPP was quantified as the mean amplitude from 5–10s post-stimulus onset to capture sustained emotional salience of the statements. Data from 7 participants were excluded due to artifacts. Contrary to hypotheses, the LPP to negative statements did not differ from neutral statements, but the LPP to positive statements was significantly larger than neutral and negative statements, $F(2,68) = 3.40$, $p = .039$, Eta squared = .09. No significant associations were observed between any LPP condition and clinical insight or motivation to change, two treatment-seeking related variables. These results suggest an increased level of self-relevance of the perceived benefits compared to negative effects of cannabis use in those with severe CUD not seeking treatment. Future versions of this task will include revisions to improve task engagement and explore its validity in prediction of CUD course.

VIRTUAL-081 | USE OF ADVANCED DIFFUSION WEIGHTED IMAGING TECHNIQUES TO MEASURE NEUROINFLAMMATION: A RANDOMIZED CROSSOVER STUDY

Julia Plank[1], Catherine Morgan[1], Frederick Sundram[1], Nicholas Hoeh[1], Flavio Dell'Acqua[2], Suresh Muthukumaraswamy[1], Joanne Lin[1]
[1]University of Auckland, [2]King's College London

Descriptors: Neuroinflammation, MRI, Psychiatric disorders
Psychiatric disorders affect a significant proportion of individuals globally and are associated with reduced quality of life, yet their pathophysiological mechanisms are not fully elucidated. Recent studies support the pathogenic role of neuroinflammation; however, there are no accepted methods that can reliably and non-invasively measure these inflammatory processes in living patients. We examined the potential of advanced diffusion-weighted imaging (DWI) techniques to detect low-level neuroinflammation. DWI techniques included diffusion tensor imaging (DTI), diffusion kurtosis imaging (DKI), and neurite orientation density and dispersion imaging (NODDI). Typhoid vaccine induced inflammation in 20 healthy volunteers in a double-blind, placebo-controlled, crossover study. Magnetic resonance imaging (MRI) scans optimized for DWI were conducted before and 3h after vaccine/placebo administration. Mood was assessed at hourly intervals using the Profile of Mood States. Differences in post-treatment white matter microstructure were examined using voxel-wise and region-of-interest analyses. Mood scores were assessed for correlations with diffusion metrics. Increases in mean and axial kurtosis were observed in several brain regions post-vaccine consistent with an inflammatory response. Brain regions affected by typhoid vaccine include regions implicated in major depressive disorder. Correlations between diffusion metrics and mood subscales were observed. Future studies may investigate DKI for detection of neuroinflammation in psychiatric disorders.

VIRTUAL-082 | PSYCHOMETRIC PROPERTIES OF REWARD-RELATED EVENT-RELATED POTENTIALS IN OLDER ADULTS

Lauren Keith[1], C.J. Brush[1], Greg Hajcak[1], Dimitris Kiosses[2], Natalie Sachs-Ericsson[1]
[1]Florida State University, [2]Weill-Cornell Institute of Geriatric Psychiatry

Descriptors: Event-Related Potentials, Reward Positivity, Older Adults
Reward-related ERPs, such as the reward positivity (RewP), feedback negativity (FN), and RewP difference score (ΔRewP), have been studied to understand relationships between reward processing and individual difference variables (e.g., depression) across populations, though mainly children and young adults. There is a paucity of research examining reward-related ERPs and their psychometric properties in older adults. The present study assessed the internal consistency of reward-related ERPs in 41 participants (60–92 years; 60.9% female) who completed a simple gambling task at an initial laboratory visit; 17 participants completed the same task approximately 3-months later to compute test–retest reliability. At baseline, Spearman-Brown corrected split-half internal consistency was excellent for the RewP and FN parent waveforms (rs of .95 and .91), but much more modest for ΔRewP ($r = .38$). At follow-up, internal consistency was similar: RewP = .90; FN = .97; and ΔRewP = .36. From baseline to follow-up, test–retest reliability was good for RewP ($r = .75$) and FN ($r = .79$), but much lower for ΔRewP ($r = .15$). Each ERP demonstrated stability and did not significantly change across visits (all ts < 0.96, ps > .355). The present study extends previous work on psychometric properties of ERPs to indicate that reward-related ERPs elicited by a simple gambling task demonstrate adequate internal consistency and stability and can be used to probe individual differences in older adults.

VIRTUAL-083 | THE ROLE OF THE MEDIAL PREFRONTAL CORTEX IN SELF-DECEPTION AND AFFECT: A TRANSCRANIAL MAGNETIC STIMULATION STUDY

Nathira Ahmad, Claudia Siertzputowski, Samantha Zorns, Matthew Pardillo, Adriana LaVarco, Julian Keenan
Montclair State University

Descriptors: self-awareness, affect, transcranial magnetic stimulation

The Medial Prefrontal Cortex (MPFC) plays a key role in cognitive functions including social monitoring, decision making, planning, and abstract reasoning. Previous research suggests that the MPFC is also involved in self-referential processing. Furthermore, the MPFC has been tied to MDD (Major Depressive Disorder) with the finding that patients with MDD have lower activity in the MPFC. We have previously found that decreased MPFC activity also leads to less self-enhancement. We therefore hypothesize that the MPFC may serve as an anti-depression mechanism and buffer allowing for increased self-enhancement. Ten healthy participants were given inhibitory TMS and self-enhancement and mood were measured. It was found that MPFC disruption led to a decrease in affect and self-deception. These data suggest an antidepressant role for self-deception.

VIRTUAL-084 | TRANSCRANIAL MAGNETIC STIMULATION AND EVENT RELATED POTENTIALS INDICATE INCREASED SELF-AWARENESS MAY INFLUENCE DEEP LEARNING

Julian Keenan, Ilse Wambacq, Mika Munakata, Ashuwin Vaidya
Montclair State University

Descriptors: self-awareness, deep learning, transcranial magnetic stimulation

Making connections between concepts, particularly those that are complex or abstract, presents many challenges to learners. Math concepts are particularly difficult to comprehend for students at both the primary and secondary level. Here we test the notion that increasing self-awareness may increase the ability to make connections between math and everyday concepts. Participants were given math pairs that were either related or not while ERPs were recorded. It was found that a significant Medial Prefrontal Cortex MPFC and right PFC was found when concepts were connected. TMS delivered the MPFC which increased self-awareness also increased the ability to successfully make connections. Control regions and Sham TMS had no such influence. These preliminary data may indicate that priming an individual's self-awareness may improve mathematical learning.

Poster Session 3

Friday, September 30, 2022

3–002 | HOW DO ADOLESCENTS ADJUST TO THEIR EVER-CHANGING ENVIRONMENT? EVIDENCE FROM EVENT-RELATED POTENTIALS DURING A REVERSAL LEARNING PARADIGM

Corinna Lorenz[1,2], Jutta Kray[1]
[1]Saarland University, [2]University of Wuppertal

Descriptors: Reversal Learning, Error Processing, Adolescence

It has been suggested that adolescents are specifically adapted to novel and ever-changing environments. To investigate the behavioral and neural flexibility of pre- to late adolescents (9–18 years), we applied a deterministic reversal learning (RL) task while measuring EEG. During RL, adolescents learn stimulus–response associations. After a learning period, these associations switch, meaning that choices that have previously been associated with positive outcomes now result in losses. As such, the main advantage of RL tasks is that they allow to investigate reactions to new and unexpected outcomes of behavior. In a preliminary analysis, we tested 17-year-olds' ($N = 22$) behavioral and neural reactions to outcomes that differ in valence (positive/negative) and expectancy (switch/no switch). To dissociate effects of feedback valence from effects of domain, the paradigm was framed in terms of gains and losses. On average, adolescents reached a rate of 80% correct choices within 3–4 trials after a switch. The Feedback-related negativity (FRN) depicted the processing of negative feedback and violations of expectancy while the P3b was highest following unexpected positive outcomes. Surprisingly, whether outcomes were presented as gains or losses had only a marginal impact on reaction times but not on ERPs. The results suggest unexpected gains to be salient cues that might guide adolescents' behavior. The findings will be discussed in terms of their implications for understanding developmental differences in reward and punishment learning.

3–004 | VARIABILITY IN ATTENTION PREPARATION EXPLAINS WORKING MEMORY FAILURES IN ADHD

Sarah Karalunas[1], Jason Dude[1], Lauren Shiro[1], Brittany Alperin[2], McKenzie Figuracion[1]
[1]Purdue University, [2]Lawrence University

Descriptors: working memory, ADHD, attention

A variety of cognitive impairments occur in attention-deficit/hyperactivity disorder (ADHD) yet vast within-group heterogeneity exists, and it is unclear whether impairments are distinct or share a common cause. We use a multi-method approach to test relationships between working memory and attentional variability. Using a whole-report change detection task, we examined trial-by-trial fluctuations in working memory in 211 youth ages 11–17 (104 with ADHD). 64-channel EEG recorded during the task was used to derive posterior alpha and frontal midline theta power during pre-stimulus fixation and retention for high (HPT) and low performance trials (LPT). Lower overall accuracy in the ADHD group was related to more LPTs at high working memory loads (group*load $p < .001$) and increases in LPTs over time (group*time $p < .001$). Person-centered effects indicated ~70% of youth performed consistent with a graded attentional control model; 10% performed consistent with a frank attention lapse model instead. On HPTs, both groups showed similar pre-stimulus alpha suppression. On LPTs, ADHD youth showed no pre-stimulus alpha suppression; non-ADHD youth showed earlier pre-stimulus alpha suppression on LPTs than HPTs (time*group*trial type $p = .015$). There were no effects for frontal midline theta. Working memory impairments may be explained via an impairment in graded attentional control for many (but not all) individuals with ADHD. Working memory failures in ADHD may result from inadequate attention preparation, whereas mis-timed attention preparation may explain failures for non-ADHD youth.

3–005 | RELATIONSHIPS BETWEEN IMPULSIVITY AND FRONTAL ASYMMETRY DURING MOTIVATIONAL CONFLICT

Micayla Lacey[1], Christopher Wendel[1], Philip Gable[2]
[1]The University of Alabama, [2]University of Delaware

Descriptors: Motivation, Impulsivity, Approach-Avoidance Conflict

Motivational drives have been implicated in asymmetric activation of the prefrontal cortex. While much prior work

has focused on relationships between frontal asymmetry and approach and avoidance motivation, recently, some work has suggested that motivational conflict may be associated with increased relative right frontal activity. Prior research has also found associations between impulsivity and increased relative left frontal asymmetry, a biomarker of approach motivation. It is still unclear, however, how impulsivity may be related to frontal asymmetry during instances of motivational conflict. The current study sought to examine how trait impulsivity influenced frontal asymmetry under instances of motivational conflict. A secondary data analysis of 63 participants investigated relationships between impulsivity and frontal asymmetry across approach-avoidance conflict and avoidance only motivational states. Results indicated that participants high in some facets of impulsivity exhibited greater relative left frontal asymmetry during instances of motivational conflict. These results suggest that individuals high in impulsivity may exhibit different physiological patterns of cortical activity during motivational conflict than their peers.

3–006 | UNCOVERING COVERED EXPRESSIONS: NEW EVIDENCE ON EMOTIONAL MIMICRY DURING THE COVID-19 PANDEMIC

Till Kastendieck, Nele Dippel, Ursula Hess, Julia Asbrand
Humboldt-Universität zu Berlin

Descriptors: Emotional Mimicry, Emotion Perception, Face Masks

During the COVID-19 pandemic, an abundance of studies has looked at the effects of face masks on emotion perception. However, so far, only one study (Kastendieck, Zillmer, & Hess, 2021) has looked at the role that face masks play for emotional mimicry. To address this scarcity, we conducted an online experiment ($N = 200$, German sample) via facial activity recognition technology as an alternative to electromyography. We assessed subjective ratings and facial expressions (mimicry) in response to masked and unmasked faces. We could replicate our previous evidence that face masks may hinder perceived emotion intensity in response to happy and sad targets. We now also included anger stimuli and failed to find significant effects of face masks in the overall stimulus set but varying effects when considering adult and child stimuli. We could find again that perceivers felt less interpersonal closeness when happy targets wore masks. When considering the full set of facial stimuli, we could replicate our previous findings that masks may indeed restrict facial mimicry of happy expressions. However, showing both adult and children targets in a within-design may stimulate contrast effects in that the mask vs no mask differences are less pronounced when adults and more pronounced when children are considered. There were no mask effects on facial activity in response to sadness and anger expression. Overall, these results suggest that facial mimicry may not only depend to some degree on the face masks common during the pandemic but also on who wears them.

3–007 | MEMORY FOR VOICES. ASSESSING NEURAL CORRELATES AND INDIVIDUAL DIFFERENCES

Romi Zäske[1,2], Stefan Schweinberger[2]
[1]Jena University Hospital, [2]Friedrich Schiller University Jena

Descriptors: voice recognition, speech, IRT

The ability to recognize others by their voice ranges from phonagnosia to super-recognition. To understand the neural mechanisms and individual differences underlying voice memory, we conducted a series of studies using recognition memory paradigms. Following few exposures to brief sentences, previously unfamiliar voices were recognized among novel voices, suggesting the rapid acquisition of voice representations. In the EEG, learned compared to novel voices elicited a suppression in beta-band oscillations from ~300 ms independent of speech content, indicating the detection of learned speaker identities across novel utterances (study I). In fMRI, explicit voice recognition independent of speech content recruited both voice-sensitive cortex areas of the right superior temporal gyrus and extra-temporal areas (study II). In terms of individual differences, we observed higher recognition performance for young vs. older adults (study III), and a general recognition advantage for old (vs. young) adult voices. Finally, to standardize the assessment of such differences, we developed the Jena Voice Learning and Memory Test (JVLMT), a novel and freely available research tool, suited to screen for phonagnosia and super-recognition abilities within ~22 min. This standardized and validated listening test is based on item response theory (IRT) and is applicable across languages due to the use of pseudo-sentences.

3–008 | SIGNALING UNPAIRED UNCONDITIONAL STIMULI DURING EXTINCTION DOES NOT REDUCE THEIR EFFECT TO STRENGTHEN EXTINCTION LEARNING

Ottmar Lipp[1], Luke Ney[1], Camilla Luck[2], Allison Waters[3], Michelle Craske[4]

[1]Queensland University of Technology, [2]Curtin University, [3]Griffith University, [4]University of California

Descriptors: Fear conditioning, electrodermal responses, return of fear

Presenting unpaired unconditional stimuli (US) during extinction reduces return of fear as indexed by renewal and extinction re-tests and slows re-acquisition. The present study investigated whether this is mediated by fear conditioning to the context and inhibitory conditioning to the conditional stimulus (CS) that had been paired with the US during acquisition (CS+) when this stimulus is presented without the US during extinction. Using an ABA renewal paradigm that trained extinction in a context different from acquisition and test, participants (N = 120) either received no USs (Standard), five unpaired US presentations (Unpaired) or five presentations of the US preceded by a novel CS (Paired) during extinction training. Extinction was followed by tests for renewal and re-acquisition. Replicating previous results, renewal of electrodermal conditional responses was observed in group Standard, but not in group Unpaired and re-acquisition was slower in group Unpaired than in group Standard. Signaling the additional USs, and thus reducing context conditioning and eliminating the possibility for inhibitory conditioning to the CS+, did not reduce their effect in that renewal was absent and re-acquisition slow in group Paired. Presenting unpaired USs during extinction training strengthens extinction learning, but the mechanism underlying this remains unclear.

3–010 | WHO KNOWS DIGITAL ADDICTS CAN (SOMEHOW) BE DIGITALLY SMARTER: AN ERP STUDY OF NUMERICAL STROOP TASK

Qiduo Lin[1], Bing Li[1], Hoi Yan Mak[1], Ovid J.L. Tzeng[1,2], Chih-Mao Huang[3], Hsu-Wen Huang[1]

[1]City University of Hong Kong, [2]National Taiwan Normal University, [3]National Yang Ming Chiao Tung University

Descriptors: Numerical Stroop Task, Internet Addition, Cognitive Control

Extending from the development of digital technology, being hyperconnected of Internet has become a prevalent issue and found to be responsible for certain changes in cognitive control. To further investigate these changes, our study used ERPs to provide a direct, temporally precise view of brain activity on numerical Stroop task, in which numerical and physical values were varied under task-relevant and -irrelevant conditions. Screened by Revised Chen Internet Addiction Scale (CIAS-R), 21 Internet addicts (IA) and 19 normal (control) students were recruited. For behavioral results, IA group showed faster reaction times but two groups showed no difference in accuracy. For ERP results, only IA group showed that Congruent elicited a smaller N200 than Neutral (a facilitation effect). On the late positive component (LPC), IA group showed both facilitation effect (more positive LPC of Congruent than Neutral) and interference effect (more positive LPC of Neutral than Incongruent), yet control group displayed only interference effect. The facilitation effect of LPC on CP3 and P3 was also positively correlated with the CIAS-R score. Overall, the findings imply that IA group avails of the task-irrelevant information to facilitate both early-stage perception and response organization. Though previous studies consider addition as a risk factor for cognitive impairment, our study contrasts this understanding by revealing the ability of information integration in digital addict individuals, which might be due to their volitional rich experience and long exposure to digital content.

3–011 | THE EFFECTS OF GOSSIP ON AUTONOMIC ACTIVITY BETWEEN FRIENDS

Konrad Rudnicki, Karolien Poels, Charlotte De Backer

University of Antwerp

Descriptors: gossip, social interactions, friendship

Since the milestone works of evolutionary psychologist Robin Dunbar (1993), gossip has been considered a key mechanism for human bond formation. This has been explained via a variety of social factors – in particular stress relief (Waddington & Fletcher, 2005). However, there were virtually no studies addressing the psychophysiological signature of gossip showing that gossip is stress-relieving. To fix that issue, we performed an experiment (n = 66, Mage = 21.01 SDage = 1.64, 83% females) in which dyads of friends individually experienced a stressor (The Cold Pressor Test - Schwabe et al., 2008) and then interacted together. The participants

in the gossip condition were given vignettes describing controversial events and asked to discuss if similar things happened to their friends. In the control condition participants were given pictures of common items and asked to discuss creative uses for them. Electrodermal activity (EDA) and heart rate were continuously measured during the interactions. The results showed that Phasic EDA and High-Frequency Heart Rate Variability rise during the interactions. As hypothesized, for both measures the rise was significantly higher in the gossip condition. Furthermore, in the gossip condition phasic EDA was higher in individuals who prior to experiment reported higher Tendency to Gossip (r = .33) and positive Attitude Towards Gossip (r = .45). These results provide strong evidence that gossip has a different psychophysiological signature than other social interactions, facilitating positive arousal and sociability.

3–012 | EMPIRICAL TESTING OF AN ALLOSTASIS-BASED MODEL OF NEUROFEEDBACK TRAINING: A RE-ANALYSIS

Arash Mirifar[1,2], Andreas Keil[3], Felix Ehrlenspiel[1]
[1]Technische Universität München, [2]Leibniz Universität Hannover, [3]University of Florida

Descriptors: Neurofeedback Training, Allostasis, Self-regulation

We previously examined the effects of neurofeedback training (NFT) of Beta band components (decrease of Theta/Beta ratio [TBR] vs. increase of Sensory Motor Rhythm [SMR], 12–15 Hz) on athletes' attention performance and reaction times (RTs), using general linear models. Employing homeostasis and control theory, the traditional framework used to characterize NFT, it was concluded that NFT did not modify the targeted brain responses nor did it improve performance. This conclusion, however, reflects the hypotheses based on the traditional framework. Here we examine the same data under a theoretical framework based on allostasis, which describes NFT as an adaptive process in the service of anticipating and coping with changing contingencies. We hypothesize that anticipatory neural self-regulation induced by NFT prompts an interaction between task demands and neural states, including those not targeted by the NFT. This is expected when an allostatically changing neural process is not targeted by the NFT, but facilitates the targeted behavioral state, for example heightened alertness. This hypothesis was tested using discriminant analyses on performance data from the prior study. At pre-test, the NFT and control groups could not be discriminated.

By contrast, RTs obtained at post-test discriminated the groups robustly. These effects were mirrored in unspecific (untrained) changes in EEG spectral power, in different feedback groups. The results support allostatic mechanisms of NFT in which functional changes outside the targeted neural response may mediate behavioral changes.

3–013 | TRAIT OPENNESS TO EXPERIENCE IN OLDER ADULTS IS ASSOCIATED WITH HIGHER MEMORY BRAIN-NETWORK INTEGRITY AND SUCCESSFUL VISUAL MEMORY ENCODING

Christopher Stolz[1], Ariane Bulla[1], Joram Soch[2,3], Björn Schott[1,2,4], Anni Richter[1]
[1]Leibniz Institute for Neurobiology (LIN), [2]German Center for Neurodegenerative Diseases (DZNE), [3]Bernstein Center for Computational Neuroscience (BCCN), [4]University Medical Center Göttingen

Descriptors: trait openness to experience, visual memory encoding, aging

An often-reported result in research on aging is a decline in episodic memory performance in older vs. young adults. While recent studies focusing on age-related personality effects suggest that particularly the Big Five personality trait openness to experience is related to better memory performance in older adults, the associated brain processes are still largely unknown. To investigate this, here 352 participants (143 older adults, 50–80 years old; 209 young adults, 18–35 years old) performed a visual memory encoding task during a functional magnetic resonance imaging (fMRI) session. To quantify the levels of brain memory network activity, a single-value score (SAME; Similarity of Activations during Memory Encoding) was calculated for memory and novelty contrasts, reflecting the respective deviation of every participant from prototypical fMRI activity patterns of young adults. Trait openness to experience was assessed using the NEO Five Factor Inventory. Replicating previous studies, older vs. young adults showed a lower memory performance and a higher deviation of fMRI activity patterns. Importantly, high trait openness to experience in older adults was related to better memory performance, and this relationship was mediated by higher SAME-memory scores. This indicates that older adults scoring high on trait openness to experience show a higher memory brain-network integrity which is directly related to better memory encoding performance. Overall, the present results suggest that trait openness to experience might be a protective factor in memory-related brain aging.

3–014 | STRATEGIC RESCHEDULING OF ERROR MONITORING IN DUAL-TASKING

Peter Löschner, Robert Steinhauser, Marco Steinhauser
Catholic University of Eichstätt-Ingolstadt

Descriptors: error detection, dual-tasking
Detecting errors in our own behavior is crucial for efficient task performance, and this is even more important when multiple tasks are executed simultaneously because interference makes dual-tasking particularly error-prone. We have recently shown that, under dual-tasking, an electrophysiological marker of error evaluation (the error positivity, Pe) is reduced immediately after the error but reappears at the end of a dual-task trial. We attributed this to a rescheduling mechanism that defers error evaluation to a point in time where interference is less pronounced. In the present study, we asked whether this mechanism is truly strategic by investigating whether rescheduling can also be observed when a second task is only expected but does not occur. To this end, we compared a single-task environment with a task environment in which single-task trials are intermixed with occasional and unpredictable dual-task trials. Within this unpredictable task environment, dual-task trials featured the previously found reduced Pe. Crucially, we also observed a reduced Pe when the second task was only expected but did not actually occur. Based on these results, we conclude that the reduction of immediate error evaluation in dual-tasking is not a reactive mechanism elicited by dual-task interference, but a proactive strategy based on expectations.

3–015 | ALTERED BRAIN-HEART INTERPLAY DURING THE ELABORATION OF NEGATIVE VALENCED IMAGES IN SUBTHRESHOLD DEPRESSION

Francesca Mura[1], Vincenzo Catrambone[2], Gaetano Valenza[2], Claudio Gentili[1], Elisabetta Patron[1]
[1]University of Padua, [2]University of Pisa

Descriptors: Depression, Brain-Heart Interplay, Emotion
Subthreshold depression, defined as experiencing depressive symptoms while not meeting diagnostic criteria for depression, is linked with emotional and cognitive disturbances including altered emotional stimuli elaboration. Recently, a composite index reflecting the associations between the autonomic and central nervous systems was proposed as an index of emotional stimuli elaboration in depression. Following studies linking altered Brain–Heart Interplay (BHI) to mood disorders, we analyzed functional directional BHI during passive viewing of emotional pictures using 32-channel electroencephalographic and Heart Rate Variability series in 12 individuals with subthreshold depression and 31 healthy controls. Time-varying power spectra were inputs to a recently proposed computational model. Results show that heart-to-brain interplay significantly decreases in subthreshold depression compared to controls, specifically when viewing negative valenced images (non-parametric Mann–Whitney test, statistical correction for multiple comparisons employing cluster analysis). These results support the hypothesis that sympathovagal activity plays a causal role in initiating the emotional response, in which ascending modulations from vagal activity precede neural dynamics and correlate with subjective arousal. Thus, the subsequent dynamic interplay between the central and autonomic nervous systems sustains emotional processing. These findings are relevant for understanding the psychophysiological mechanisms underlying altered emotional stimuli elaboration associated with depressive symptoms.

3–016 | DIFFERENCES IN ELECTROPHYSIOLOGICAL CORRELATES OF DISTANCE-TO-NORM AND FAMILIARITY BETWEEN HIGH AND LOW PERFORMERS IN FACE RECOGNITION

Anna Schroeger[1,2], Linda Ficco[1,3], Stella Faerber[1,4], Jürgen Kaufmann[1], Stefan Schweinberger[1,3]
[1]Friedrich Schiller University Jena, [2]Justus Liebig University Giessen, [3]Max-Planck Institute for the Science of Human History, [4]Infinite Potential Institute LLC

Descriptors: Face perception, individual differences, multidimensional face-space
An influential and intensively researched model on face perception is Valentine's norm-based multidimensional face-space model (nMDFS). Selective responses of event-related potentials (ERPs) to variations in distance-to-norm (P200) and familiarity (N250) supported some important predictions based on this model (Wuttke & Schweinberger,

2019). Despite growing evidence on interindividual differences in face perception skills at a behavioral level, only little research has focused on their electrophysiological correlates. Here, we tested for differences between high and low performers in face recognition tests in the effect of distance-to-norm in the P200 and the effect of familiarity in the N250. Additionally, we tested for differences between these performance groups in face processing, object recognition, low-level vision (acuity and contrast sensitivity) and autistic traits (AQ). We replicated both the P200 distance-to-norm and the N250 familiarity effect. Importantly, we found evidence for reduced responses in low compared to high performers of face recognition, especially in terms of smaller distance-to-norm effects in the P200. In summary, these findings suggest the contribution of early norm-based face coding to individual face recognition skills, and indicate that ERPs can offer a promising route to understanding individual differences in face perception and their neurocognitive correlates.

3–017 | EFFICACY AND SUSTAINABILITY OF A ONE-WEEK ERROR SENSITIVITY TRAINING ON THE ERROR-RELATED NEGATIVITY

Kai Härpfer, Franziska Kausche, Anja Riesel
University of Hamburg

Descriptors: error sensitivity, ERN, intervention
Overactive error monitoring, as reflected by an elevated error-related negativity (ERN), has been identified as a neural risk marker for anxiety and obsessive–compulsive disorders. Thus, the ERN represents an interesting target of mechanism-oriented interventions. In this pre-registered study, we investigated the efficacy of an error sensitivity training on neural indicators (ERN) and self-report measures (error sensitivity) in a German student sample. Our one-week online training was adapted from a previous study and consisted of three sessions including homework. Participants were randomized to an intervention or a passive control group and data were collected before the training (T0), one week after (T1), and at a follow-up assessment (FU). Preliminary results of the EEG sample ($n = 33$) revealed no significant effect of the training on the ERN, but the targeted sample size ($n = 80$) has not yet been reached. However, self-reported error sensitivity ($n = 139$) was significantly reduced at T1 in the intervention but not in the control group. This effect was still apparent over the course of five to ten weeks at the FU ($n = 61$). In conclusion, our training represents a sustainably effective and efficient intervention to reduce self-reported error sensitivity, but it seems to have no impact on the ERN. However, results must be interpreted in the light of the small sample size in the EEG sample. Overall, our training holds great potential to contribute to a reduced risk for anxiety and obsessive–compulsive disorders, but the final effects on the ERN are yet to investigate.

3–018 | IDENTIFYING THE SOURCE OF THE REWARD POSITIVITY: TWO PATIENT STUDIES INVOLVING CORTICAL LESIONS AND INTRACRANIAL RECORDING

Joyce Oerlemans[1,2], Ricardo Alejandro[1],
Dimitri Hemelsoet[2], Alfred Meurs[1,2], Paul Boon[1,2],
Veerle De Herdt[1,2], Clay Holroyd[1]
[1]University of Ghent, [2]University Hospital Ghent

Descriptors: Reward Positivity, ERP, Anterior Cingulate Cortex
The reward positivity (RewP) is an ERP component occurring 250-350ms after reward feedback presentation with a frontocentral scalp distribution. Although indirect evidence suggests the RewP is produced in anterior cingulate cortex (ACC), this inference remains inconclusive because of the inverse problem. Here we aim to identify the neural source of the RewP in two studies involving patient populations. In the first study, scalp and intracranial EEG were recorded from patients with epilepsy while they performed a task known to elicit the RewP (T-maze task). Two epilepsy patients had electrodes located on the ACC. For subject 1, the RewP peaked 353ms post-feedback at $-4.3\mu V$ with a frontal scalp distribution. Subject 2 did not show a clear peak on scalp EEG. Average values of the intracranial EEG were plotted onto the intracranial electrodes. One patient with a grid on ACC showed RewP on scalp EEG. In the second study, the impact of frontal cortex lesions on RewP was investigated in patients with stroke in the frontal lobe while they conducted the T-maze task. 25 stroke patients have been recruited. One had right ACC lesions; RewP peaked 365ms post-feedback at $-5.5\mu V$ with a right posterior scalp distribution. The grand average of the other 24 patients peaked at 273ms post-feedback at $-2.1\mu V$, with a left centro-parietal scalp distribution. Preliminary evidence suggests that unilateral lesions in ACC do not impair the RewP, although scalp distribution is more posterior than expected.

3–019 | DYNAMIC CHANGES IN HEART RATE VARIABILITY UNDER THREAT

Joe Cornes[1], Christopher Maymon[1], Kealagh Robinson[2], Jeremy Meier[3], Andre Botes[1], Gina Grimshaw[1]
[1]Victoria University of Wellington, [2]Curtin University, [3]University of Melbourne

Descriptors: Emotion, Autonomic, HRV

How an organism responds to the fluctuating metabolic demands imposed by the environment – that is, self-regulates – is crucial to its success. Several theorists argue that this self-regulation depends on the connection between brain and heart via *cardiac vagal control*. The efficiency/integrity of this brain–heart link is reflected in certain measures of heart-rate variability (HRV). Although trait-like HRV measured under resting conditions is often linked to the ability to flexibly regulate emotions, we are yet to fully understand the dynamic changes in cardiac vagal control that occur *during* emotional challenge (i.e., reactivity and recovery), or the factors that modulate this response. We conducted three studies analysing continuous HRV recorded before, during and after exposure to a social stressor (Study 1) or a VR plank-walking simulation (Studies 2 and 3). In Study 3, we also manipulated the use of emotion regulation strategies via explicit instructions. Across studies, HRV decreased during emotional challenge, and recovered to baseline levels following the challenge. The pattern of reactivity and recovery varied across individuals but did not differ based on history of self-injurious behaviour (Study 1), nor did it differ across instructed emotion regulation conditions (Study 3). Higher resting HRV predicted greater reductions during social stress (Study 1), but this relationship was not replicated in the plank-walk scenario (Study 2 and 3). Findings are discussed in terms of the relative roles of trait-like and dynamic cardiac vagal control in emotion regulation.

3–020 | CAPTURING THE DYNAMICS: THE STATISTICAL CHALLENGES OF DYADIC PHYSIOLOGICAL SYNCHRONY

Fabiola Diana[1], Julia Folz[1], Elio Sjak-Shie[1], Ruud Hortensius[2], Mariska Kret[1]
[1]Leiden University, [2]Utrecht University

Descriptors: Dyadic Interaction, Physiological synchrony, Windowed Lagged Cross Correlation

Recent research has shown the advantages of physiological synchrony for cooperative success and group cohesion. It is challenging to statistically capture these paired physiological dynamics. We propose the use of Window Lagged Cross-Correlation (WLCC) analysis, allowing the arbitrary choice of window size (*wSize*), window increment (*wInc*), maximum lag (*τMax*), and lag increment (*τInc*). However, the literature lacks clear guidelines to select those parameters. Here, we aim to 1) find the best set of parameters for different signals, whilst keeping the balance between the biological nature of the physiological signals and an optimal temporal resolution determined by the WLCC; 2) investigate to what extent the choice of parameters is affecting the sensitivity of WLCC in detecting differences between conditions. Dyads of strangers ($n = 26$, 13 dyads) played a Trust Game while they did or did not see each other and we simultaneously assessed EDA, ECG, facial EMG, pupil dilation, and skin temperature. For each signal, we selected two sets of parameters, *large* and *small*, and computed the synchrony strength. Our results show that different combinations of parameters did not influence the sensitivity of WLCC to capture differences between conditions, except for EDA where large parameters were more informative. However, parameter choice had a significant large effect on the estimated synchrony strength for all the signals except zygomaticus EMG and EDA. This suggests that, despite selecting parameters within the biological boundaries, the estimated synchrony changes remarkably.

3–021 | DISSECTING THE TEMPORAL DYNAMICS OF MOTIVATIONAL AND CONSUMMATORY REWARD PROCESSING DEFICITS IN DEPRESSION

Colin Bowyer, C.J. Brush, Christopher Patrick, Greg Hajcak
Florida State University

Descriptors: Reward Processing, Depression, Effort Expenditure

Substantial evidence exists for depression-related alterations in coding the opportunity-cost of effort expenditure for rewards, comprising increased perceived cost of effort expenditure and reduced valuation of subsequent rewards. The underlying neurobiology governing these systems has been extensively explored; however, little research has examined the temporal dynamics of these processes in depression. Therefore, the current study employed a novel ERP paradigm, the effort doors task, to evaluate these deficits at discrete temporal substages of reward processing in 34 MDD subjects and 32 healthy controls (HCs). Distinct substages of reward processing were indexed via

the following ERPs: effort cost evaluation, reward anticipation, reward valuation, and reward salience valuation. Behavioral indices of motivation were examined, including subjects' reaction time to effort presentation and response set shifting. Results demonstrated that effort expenditure increased subjects' motivation as evidenced by increased likelihood of behavior modification following feedback, and faster reaction time to reward choice. Further, ERP analyses revealed that, relative to HCs, MDD subjects displayed reduced motivational arousal to effort presentation, reduced anticipation of rewards, and reduced valuation of rewards following high effort expenditure. Collectively, results from this study help to elucidate the role of distinct components of reward processing in major depression and encourage use of the effort doors task in future research.

3–022 | ASSOCIATIVE LEARNING EFFECTS AND THE VISUAL HIERARCHY: WHERE ARE THEY NOW?

Maeve Boylan, Andreas Keil
University of Florida

Descriptors: associative learning, ssVEP, aversive conditioning

Research spanning both human and animal models has shown effects of adaptive change within the primary visual cortex. For example, associative learning effects have demonstrated systematic alterations of visuocortical response. Models of attention have shown the role of selective attention is demonstrated not in primary visual tissue, but in higher order processing areas along the visual stream. Thus, alternative hypotheses exist stating that associative learning (i) always involves changes in V1, regardless of the feature dimension manipulated, or (ii) selectively involves the tissue most sensitive to the feature dimension relevant for learning. In the present studies ($n = 21$, $n = 26$), we used the steady-state potential technique and a classical conditioning paradigm in which one exemplar of three stimulus sets was selectively paired with an aversive outcome: oriented Gabor patches, dot motion kinematograms, and faces. Source estimation and topographical Bayesian linear models were utilized to examine the effects of aversive conditioning across the three feature dimensions. Converging results indicate that associative learning effects involve feature-specific brain regions: calcarine cortex for orientation, mid-occipital gyrus for visual motion, and temporal cortex for faces. Thus, adaptive changes along the visual hierarchy occur in areas most sensitive to the critical stimulus dimension.

3–023 | META-ANALYSIS OF FRONTAL EEG ASYMMETRY DURING EMOTIONAL PICTURE AND FILM VIEWING

Katie Garrison[1], Brandon Schmeichel[2],
Cassandra Baldwin[2], Eddie Harmon-Jones[3]
[1]*University of Alabama,* [2]*Texas A&M University,* [3]*The University of New South Wales*

Descriptors: Frontal EEG Asymmetry, Approach and Avoidance Motivation, Meta-analysis

Decades of electroencephalographic (EEG) research have attempted to link greater relative left frontal asymmetry (FA) to approach motivation and positive affect, and greater relative right FA to avoidance motivation and negative affect. A previous meta-analysis by our team observed small relationships between resting FA and approach/avoidance traits. The current research is a meta-analysis of FA during states of emotion and motivation, wherein the effect on FA is expected to be more robust. One of the most common ways to elicit emotional or motivational states in the lab is through pictures and films. We conducted a meta-analysis of studies that measured FA while participants viewed emotional pictures or films in order to estimate the degree of FA during states of approach motivation/positive affect and avoidance motivation/negative affect. The meta-analysis included over 50 studies. Results will provide the best estimate yet of FA during emotional and motivational states.

3–024 | THE INFLUENCE OF EXPOSURE TO DIFFERENT DOSAGES OF NATURE ON REWARD PROCESSING

Amy McDonnell, Sara LoTemplio, David Strayer
University of Utah

Descriptors: applied psychophysiology, environmental psychology, reward positivity

Attention Restoration Theory posits that urban environments place high demand on our attentional resources due to many stimuli competing for our attention. Nature, in turn, places less demand on our attentional systems, allowing them to rest and recuperate. Prior research has found effects of exposure to natural stimuli on various EEG metrics related to attention. The current study explored the reward positivity—an ERP component related to reward processing that is observed about 300 ms after feedback of a monetary reward or loss–and how it changes in response to nature or urban exposure. We compared two groups of participants who were exposed to different "dosages" of nature–either a 5-day immersive camping

trip ($N = 62$) or 10-minutes of either nature or urban imagery ($N = 45$). All participants completed a doors task three times over the course of three weeks, with the nature manipulation (the camping trip or the viewing of images) occurring at their second testing session. We found that the RewP amplitude decreases during immersion in nature but not in response to images of nature. There was no difference in RewP amplitude between viewing nature and urban images. Test–retest reliability (ICC) analyses demonstrated that the RewP had good reliability across the three testing sessions. We believe the pattern of data is indicative of a decreased reliance on external reward to motivate attentional control during nature immersion. We conclude that there is a unique effect of immersion in nature on reward processing that cannot be replicated by simply viewing images of nature.

3–025 | DETECTING STRESS USING HEART RATE AND NEURAL ACTIVITY: TOWARDS INDIVIDUALIZED WORKPLACE STRESS REDUCTION TECHNIQUES

Kunjoon Byun[1,2], Colin West[3], Kevin Mazurek[1,2]
[1]Well Living Lab, [2]Delos Living LLC, [3]Mayo Clinic

Descriptors: Trier Social Stress Test, Heart Rate Variability, Working Memory Performance

Relaxation rooms have become a popular strategy to help mitigate workplace stress. However, few studies have examined how physiological and cognitive measures relate to improvements in perceived stress, which might explain why relaxation rooms are effective. Here, 20 healthy adults participated in a 3-hour experiment where they performed the Trier Social Stress Test (TSST) with a 30-minute baseline and two 20-minute recovery phases in a MindBreaks™ relaxation room. Participants completed working memory assessments (OSPAN, SSPAN) and surveys (dynamic stress scale, DSS; state–trait anxiety inventory, STAI) between each phase to assess changes from stress. Each participant wore wearable devices to measure heart rate (HR), heart rate variability (HRV), and neural activity (electroencephalography, EEG). Across participants, HR, DSS, and STAI increased during stress and recovered to baseline by the first recovery phase ($p < .001$ for all). Temporal analysis of HRV (RMSSD, pNN50) showed significant decreases during stress that returned to baseline by the first recovery phase ($p < .001$ for all). Frequency analysis of HRV (LF, HF) showed decreases during stress that returned to baseline by the first recovery phase

($p = .064$, $p = .001$, respectfully). EEG power increased during stress and returned to baseline by the second recovery phase. Interestingly, working memory unit scores showed no effect due to stress ($p > .5$). Thus, incorporating physiological measures as an indicator of stress into workplace stress reduction strategies could lead to more effective intervention outcomes.

3–026 | NEITHER REAPPRAISAL NOR SUPPRESSION STRATEGIES EFFECTIVELY REGULATE FEAR RESPONSES TO HEIGHT EXPOSURE IN VIRTUAL REALITY

Christopher Maymon, Joe Cornes, Andre Botes, Anna Markovitz, Nicholas Heyworth, Matthew Crawford, Gina Grimshaw
Victoria University of Wellington

Descriptors: Emotion Regulation, Virtual Reality

The ability to exert control over our emotions is an adaptive skill for which humans have developed countless strategies. However, research to date has reported inconsistent effects of different regulation strategies on subjective, physiological, and behavioural components of emotional responses (see meta-analyses by Webb et al., 2012; Zaehringer et al., 2020). Some of this variability stems from the use of study designs that may not induce authentic (and intense) emotional experiences. In this pre-registered study, we increased the ecological validity of fear induction in the lab by exposing participants to extreme heights in virtual reality. Participants were instructed to walk to the end of a virtual plank (appearing to extend high above a city street) while using either reappraisal or suppression strategies. In the control condition, participants were given no instruction about their emotions. All participants experienced marked increases in subjective fear, heart rate, and skin conductance, and an associated drop in HRV, during the plank-walk. Neither

strategy buffered the effect of height exposure on fear responses. However, groups showed subtle differences in the time-course of the emotional response, with heart rate peaking and plateauing early in the suppression condition, but continuing to rise throughout the walk in both reappraisal and control conditions. Findings suggest that neither strategy is particularly effective in the face of intense emotional challenge, and highlight the value of virtual reality for capturing authentic emotional responses in real time.

3–027 | RESTING STATE NETWORK FUNCTIONAL CONNECTIVITY IN THE DYING BRAIN USING EEG

Elizabeth Blundon[1], Romayne Gallagher[1,2], Lawrence Ward[1]
[1]University of British Columbia, [2]Providence Health Care

Descriptors: Consciousness, Default Mode Network, Electrophysiology

Objective: The purpose of this study was to characterize electrophysiological (EEG) functional connectivity within the default mode network (DMN) and task-positive network (TPN) among a small group of hospice patients at the end of life. Participants/Method: Resting state EEG was compared between young, healthy participants, and hospice patients, both when the latter were responsive and again when they became unresponsive during the last hours of life. Results: The prevalence of activation and connectivity within the default mode network was similar across all participant groups. Regions within the default mode network were more tightly connected than those within task positive network for all participant groups. By contrast, the number of functional connections within default mode network was greater than within the task positive network among controls and responsive hospice patients, but not among unresponsive hospice patients. Conclusions: Some unresponsive patients may have the functional architecture to support internally-oriented thought at the end of life. Resting state default mode and task positive network anticorrelations may be present among some unresponsive hospice patients.

3–028 | NONINVASIVE EXCITATORY STIMULATION OF THE VENTROMEDIAL PREFRONTAL CORTEX INCREASES POSITIVE SELF-REFERENCING OF EMOTIONAL ADJECTIVES

Alejandro Espino-Payá[1], Thomas Kroker[1], Sabine Prantner[2], M. Carmen Pastor[2], Johanna Kißler[3], Markus Junghöfer[1]
[1]University of Münster, [2]University Jaume I, [3]University of Bielefeld

Descriptors: Self-referencing, vmPFC, tDCS

Self-reference is reflected in all aspects of our lives. Positive and negative attributes that define us as individuals are also the ones that make us empathize with others. The vmPFC has been identified as the core region underlying self-referencing and perception of others. We aimed to investigate the effects that vmPFC stimulation by transcranial direct current stimulation (tDCS) could causally modulate self-reference and reference to others by positive and negative adjectives in healthy adults. On the behavioural level, excitatory vmPFC stimulation induced a significantly more positive self-evaluation and a more negative evaluation of others while inhibitory stimulation resulted in the inverse pattern. Magnetoencephalographic correlates supported these findings, showing stronger/reduced neural processing of self-referenced positive/negative adjectives after excitatory stimulation and the opposite pattern after inhibitory stimulation in temporal and parietal regions of the left hemisphere. These results open new possibilities for clinical applications and research into the effects of brain stimulation in pathologies with altered self-perception or empathy, such as major depression or body dysmorphia.

3–029 | ASSOCIATIONS BETWEEN PHYSICAL ACTIVITY, SEDENTARY BEHAVIOR, AND THE P300 DURING ADOLESCENCE

C.J. Brush, Nicholas Santopetro, Alexander Kallen, Kreshnik Burani, Alissa Winkler, Greg Hajcak
Florida State University

Descriptors: Adolescence, P300, Physical Inactivity

Low levels of physical activity and excessive sedentary behavior are related to poor mental health outcomes in youth. Furthermore, previous work has shown associations between low levels of physical activity, excessive sedentary behavior, and worse neurocognitive functioning; however, it is unclear whether low levels of physical activity and excessive sedentary behavior have similar or

differential effects on neurocognitive functioning. The aim of the current study was to examine associations between moderate-to-vigorous physical activity (MVPA), sedentary time (ST), and the P300 in adolescence. To accomplish this, 40 participants ($n = 25$ male; age range = 12–16 years) wore an accelerometer for approximately one week to quantify daily MVPA and ST before visiting the laboratory to complete a flankers task to elicit the P300. Results indicated that reduced MVPA was associated with smaller P300s on compatible and incompatible trials; increased ST was correlated with a smaller P300 on incompatible trials. Despite MVPA and ST accounting for shared variance in the compatible P300, increased ST was uniquely associated with a smaller incompatible P300, over and above MVPA. This effect held even after covarying for age, sex, and BMI. These findings indicate that sedentary behavior may be more strongly associated with alterations in neurocognitive functioning, especially on tasks requiring increased attentional engagement. Future research should examine whether interventions designed to reduce sedentary behavior also impact neurocognitive functioning.

3–030 | RELIABILITY OF CORTICAL SIGNAL PROCESSING IS DRIVEN BY GLUTAMATE MATURATION AND SUPPORTS WORKING MEMORY DEVELOPMENT

Shane McKeon, Finnegan Calabro, Maria Perica, Beatriz Luna
University of Pittsburgh

Descriptors: Working Memory, Developmental, Electrophysiology
Postmortem animal & human models indicate changes in excitatory (E, via glutamate; Glu) and inhibitory (I, via GABA) neurotransmitters (NTs) through adolescence suggestive of critical period plasticity supporting cognitive development. E/I balance would enhance cortical SNR as spontaneous, asynchronous firing shifts to evoked synchronous firing. How NT indices of age-related changes in E/I balance support enhanced SNR in humans, is not known. We acquired EEG during auditory steady state (SS) and memory guided saccade (MGS) tasks, and 7T MRSI at rest from 148 subjects (10-30yo, 77 F). Evoked activity was quantified as the mean-squared amplitude from the auditory SS task in the 50-200 ms following onset of the auditory cue, and spontaneous activity was measured as the average standard deviation of activity per trial. We used linear mixed-effects models to compare EEG measures to MRSI-derived measures of PFC GABA & Glu and to MGS data. Age-related decreases were found in performance variability in the MGS task. The difference between evoked and spontaneous frontal EEG increased with age, driven by decreases in spontaneous activity, consistent with increased cortical SNR. Increased SNR was associated with the deviation of Glu levels from their age-adjusted mean in both the MPFC and DLPFC in adolescents. Finally, higher SNR was associated with less variable responses on the MGS task. These findings provide evidence that SNR is enhanced in conjunction with increases in E/I balance supporting a model for critical period plasticity through adolescence supporting cognitive maturation.

3–031 | ATTENTIONAL PRECURSORS OF DISTRACTOR ERRORS PREDICT ERROR-RELATED BRAIN ACTIVITY

Martin Maier, Marco Steinhauser
Catholic University of Eichstätt-Ingolstadt

Descriptors: Error monitoring, Attention
Recent studies showed that the error-related negativity (Ne/ERN), an electrophysiological correlate of error monitoring in choice tasks, is increased for errors due to pressing a button associated with distractors (distractor errors) as compared to errors due to pressing a button not associated with the stimulus at all (nondistractor errors). Such error type evaluation could be possible because the error monitoring system registers error precursors that are predictive of specific error types, such as failures of selective attention. Here, we aimed at isolating such error precursors and testing whether they predict the size of the Ne/ERN. We presented small target letters in one hemifield concurrently with large distractor letters in the opposite hemifield and identified distractor errors and nondistractor errors. Already at the time of the stimulus, posterior alpha asymmetry was enhanced for distractor errors indicating increased attention to the distractors. This error precursor was particularly pronounced on those distractor errors that later elicited large Ne/ERN amplitudes. Our results thus provide support for the idea that error type evaluation at the time of the response is based on monitoring error-type specific error precursors.

3–032 | BASELINE PARASYMPATHETIC FUNCTIONING IS ASSOCIATED WITH VACCINE-INDUCED CHANGES IN SOCIAL ATTENTION AND MOTIVATION

Kelly Faig[1], Greg Norman[2]
[1]Hamilton College, [2]The University of Chicago

Descriptors: Parasympathetic nervous system, Vaccine, Social Motivation

Increased immune activation is associated with motivational changes like cognitive impairment, negative mood, and altered social behaviors including ingroup preference and outgroup avoidance. These changes have been suggested to conserve energy for the immune system during infection and minimize exposure to additional pathogens. The parasympathetic nervous system (PNS) facilitates homeostatic changes in affective, cognitive, and social processes as a function of immune status. Higher baseline PNS activity is associated with improved immune outcomes and the use of effective regulatory strategies across contexts. The present research examined whether baseline PNS cardiac activity was associated with adaptive changes in social motivation and attentional processes following an influenza vaccine compared to placebo. Social motivation was assessed via self-report. Attentional bias to social words (i.e., positive, negative, outgroup) was measured with an emotional Stroop task. Individuals with higher baseline PNS activity reported higher social motivation and showed greater attentional bias to outgroup-associated words following the vaccine compared to the placebo. Further, those with higher baseline PNS activity showed decreased attentional bias to both positive and negative social words across vaccine and placebo trials. These findings suggest that individuals with higher baseline PNS functioning may show adaptive social changes during activation of the immune system, while those with lower baseline PNS functioning may be more sensitive to social stimuli across contexts.

3–033 | STEADY-STATE VISUAL EVOKED POTENTIALS IN COLOR-SELECTIVE ATTENTION TO MID-COMPLEX PATTERNS

Christian Panitz[1,2], Christopher Gundlach[1], Andreas Keil[2], Matthias Müller[1]
[1]University of Leipzig, [2]University of Florida

Descriptors: feature-selective attention, color-selective attention, ssVEP

Visual attention to distinct feature dimensions (e.g., color or shape) has been linked to different, specialized visuocortical areas. For example, late regions in the ventral visual stream (e.g., V4) have been suggested as central in attention to color. The specific role of these regions in modulating neural gain for attended features is however unknown. This is partly owed to the fact that previous paradigms used low-complex stimuli, like monochromatic geometric shapes. To address the issue of region-specificity while heightening ecological validity, we validated and tested a set of mixed-color, naturalistic picture elements for use in steady-state visual evoked potential (ssVEP) studies. In Study 1, we compared ssVEP amplitudes to foveally presented pictures across different driving frequencies and different functions of luminance modulation (square vs sine wave). Across two laboratories, results converged, showing higher ssVEP amplitudes for lower frequencies and, specifically for those lower frequencies, higher amplitudes for square vs sine wave modulation. In Study 2, participants counted transient target events in one of two spatially overlapping, randomly moving picture arrays (color vs grayscale pictures). Ongoing analyses showed frequency-specific, late increases in ssVEP amplitude to attended pictures (both color and grayscale). Future work will combine the ssVEP measures with fMRI to investigate the specific role of ventral stream regions in modulating neural gain during color-selective attention.

3–034 | THE EFFECT OF VIBRATION THERAPY ON NEUROELECTRIC AND BEHAVIORAL INDICES OF INHIBITION IN CHILDREN WITH ADHD

Lauren Bullard, Colt Coffman, Abigail Brooks, Bailey Honeycutt, Matthew Pontifex
Michigan State University

Descriptors: Attention Deficit Hyperactivity Disorder, Heart Rate Variability, EEG

Using vibrational therapy, the Apollo System has been previously demonstrated to promote greater balance of the autonomic nervous system. Given the importance of the autonomic nervous system for modulating levels of physiological arousal and in-turn regulating aspects of attention and self-regulation; a therapeutic approach to promote better balance of this system may be particularly beneficial for populations such as children with Attention Deficit Hyperactivity Disorder (ADHD). Therefore, using a double-blind randomized sham-controlled design, this study examined the extent to which the Apollo System is effective in reducing ADHD-related symptomatology. Participants aged 8 to 17 years old (44.7% female,

Mage = 11.5 years) with previous ADHD diagnosis were randomly assigned either an Apollo System device which uses vibrational therapy to promote greater parasympathetic tone or a sham device; and then were instructed to use the device in addition to their current ADHD treatment for a period of 8 weeks. Prior to and following the intervention period, ADHD symptomatology was assessed using the ADHD-V rating scale; additionally, neuroelectric and behavioral indices of response inhibition and interference control were collected. Utilizing a multilevel model approach, analysis suggests that vibrational therapy using the Apollo System as an adjunct to existing ADHD treatment may help reduce symptomatology associated with ADHD and enhance aspects of inhibition and attention.

3–036 | INVESTIGATING ELECTROPHYSIOLOGICAL CORRELATES OF PREDICTION UPDATING IN A TWO-DAY READING STUDY

Ryan Hubbard, Kara Federmeier
University of Illinois, Urbana-Champaign

Descriptors: Comprehension, Prediction, ERPs
During language comprehension, people can use context information to generate predictions about upcoming words. Violations of these predictions result in unique neural responses depending on their nature: A late frontal positivity is elicited to unexpected but plausible words, whereas implausible words elicit a posterior positivity. The frontal effect may reflect updating of the discourse model to integrate the unexpected word, potentially reshaping future predictions, whereas the posterior response may reflect a failure of integration. To test downstream consequences of these effects, we recorded EEG in a 2-day sentence reading paradigm. On Day 1, participants read sentences that ended with an expected, unexpected but plausible, or anomalous word. On Day 2, participants read these sentences again; however, half of the sentences had the same ending as the first day, whereas in the other half the ending was switched (expected to unexpected, or unexpected to expected). For both types of prediction violations, the repeated ending elicited a smaller N400 response on Day 2, suggesting some facilitation for the unexpected word. In contrast, for switched endings, expected endings that were previously unexpected but plausible elicited a frontal negativity, which was not observed for previously anomalous endings. This negativity resembled responses that have been linked to ambiguity resolution or reinterpretation, suggesting participants had shifted their predictions to include the unexpected but plausible ending,

but did not shift their predictions following an anomalous ending.

3–037 | REPLACING HIGH-PASS FILTERS WITH BLINK-IDENTIFIED ROBUST DETRENDING: PUT A BIRD ON IT!

Ryan Hubbard, Kara Federmeier
University of Illinois, Urbana-Champaign

Descriptors: ERPs, Filters, Detrending
In cognitive neuroscientific studies measuring ERPs, high-pass filters are often applied in the pre-processing of EEG data to remove low frequency drifts. These filters are generally applied to the entire time series prior to trial-related segmentation to avoid edge artifacts; however, we show that filtering eyeblinks (and other types of waveform features) can create ringing artifacts that affect data in the epoch windows. We offer an alternative solution to high-pass filtering that removes low frequency drifts without producing artifacts; namely, Blink-Identified Robust Detrending (BIRD). Standard robust detrending fits a polynomial to the EEG data while excluding outliers, but is not always successful in identifying blink artifacts, leading to poor polynomial fits. BIRD improves upon standard robust detrending by first identifying time-points containing blinks in the EEG data and setting the weights for these time-points to zero. We apply BIRD to datasets investigating language and memory ERPs (N400s and LPCs) and demonstrate that statistical power to detect ERP effects is increased, but high-pass filter artifacts are not induced, by detrending. We also apply BIRD to simulated ERPs embedded into data containing blinks to compare the effects of BIRD and high-pass filtering artifacts on detecting ERP effects. Finally, we provide practical recommendations, as well as MATLAB code, to researchers that wish to replace high-pass filters with BIRD.

3–038 | RESTING STATE EEG FUNCTIONAL CONNECTIVITY IN NONVERBAL LEARNING DISABILITY (NVLD)

Ambra Coccaro, Maria Di Bono, Rachele Lievore, Camilla Orefice, Irene Mammarella, Mario Liotti
University of Padova

Descriptors: NonVerbal Disability, EEG functional Connectivity, Machine Learning
NVLD is a neurodevelopmental disorder characterized by deficits in visual–spatial processing but not in reading

or verbal ability. A better understanding of its neural correlates may provide evidence for recognizing NVLD as a discrete disorder. We studied EEG resting state functional connectivity (rsFC) in 16 NLVD (12.36 ± 1.9 ys) and 16 typically developing (TD: 13.23 ± 1.8 ys) children. The clinical group was then tested in a series of behavioral tasks. Coherence measures were extracted to identify differences in rsFC between the two groups at the source level in the ventral attentional network (VAN) and the dorsal attentional network (DAN), and to derive graph metrics. We then applied a machine-learning approach to investigate whether behavioral performance could be predicted from rsFC maps. Finally we employed graph theory nodal measures to study the contribution of each node of the DAN and VAN in discriminating between NLVD and TD groups. Results: For the DAN, left hemisphere *alpha* rsFC was predictive of WM and TOM performance, and bilateral *Beta* rsFC was predictive of VSWM performance. For the VAN, left hemisphere theta, alpha and beta rsFCs predicted VSWM and WM performance. Graph analysis within the DAN showed that in the *alpha* band there was a difference between groups at the level of a right inferior parietal node (both *Degree* and *Strength* greater in the clinical group). Graph analysis within the VAN showed that in the *gamma* band there were group differences in two right temporal nodes (both *Clustering coefficient* and *Local Efficiency* smaller in the clinical group).

3–039 | EFFECTS OF MINDFULNESS PRACTICE ON SYMPATHETIC NERVOUS RESPONSE IN GRADUATE STUDENTS

Megan Chang, Megan Karburn, Alexandra Kautz, Elaine Lau, Maiko Ibay, Sarah Hagen, Stephanie Geneza
San Jose State University

Descriptors: Electrodermal activity, Graduate students, stress responses

PURPOSE: Graduate students are at-risk for experiencing increased levels of stress and are at higher risk for anxiety and depression. Research showed that mindfulness practice protects against stress, anxiety, depression (Kernan et al., 2011). The purpose of this study is to investigate the effects of mindfulness practice on sympathetic nervous system (SNS) responses. METHOD: Electrodermal activity was used to measure SNS through a continuous recording of skin conductance levels (SCL). The lab protocol begins with a 5-minute resting period followed by a 15-minute Trier Social Stress Test (TSST, Kirschbaum et al., 1993) and then a 15-minute mindfulness practice. Anxiety was measured by the Adult Manifest Anxiety

Scale (Reynolds et al., 2003), while depression was measured by the Center for Epidemiologic Studies Depression Scale (Radcloff, 1977). RESULTS: Among all 15 participants, the SCL was significantly increased from the baseline during the TSST period and decreased significantly during mindfulness practice. The SCL during the recovery phase was significantly higher than the baseline. Individual with higher anxiety and depression levels remain at high skin conductance levels compared to those without anxiety and depression. CONCLUSION: Results suggest that mindfulness-based practice may be beneficial to decreased stress measured by SCL, but a 15-min MBSR practice is not sufficient to return to the baseline. Results also support the feasibility to use the lab protocol for future research.

3–041 | CHARACTERIZING THE TEMPORAL DYNAMICS OF VISUOCORTICAL AVERSIVE GENERALIZATION LEARNING WITH SOCIAL CUES

Jourdan Pouliot, Richard Ward, Faith Gilbert, Skylar McIlvanie, Payton Chiasson, Andreas Keil
University of Florida

Descriptors: Generalization Learning, Social Anxiety, Facial Perception

Generalization learning following aversive social experiences may contribute to the causal nexus of social anxiety. Prior research has shown that participants generalize autonomic fear responses from a facial stimulus (CS+) paired with an aversive noise (US) to unpaired faces that are similar in visual features. This study ($n = 36$) investigated steady-state visual evoked potentials (ssVEPs) evoked by seven morphed facial stimuli, with only one face (i.e., CS+) being paired with a loud noise serving as unconditioned stimulus. Hypotheses were derived from a computational model of generalization learning. We found that ssVEPs in early learning more closely followed a pattern reflective of overgeneralization compared to trials later in the experiment, specifically at occipital channels. In contrast, after additional learning trials a difference-of-Gaussian distribution emerged at parieto-occipital channels, consistent with lateral inhibitory interactions between similar facial representations. These results mirror previous findings of increased lateral inhibition in response to aversively conditioned facial stimuli. We extend past findings by demonstrating changes in electrophysiological responses across a stimulus gradient over time, suggesting initial conditioning of facial stimuli yields a generalized response pattern, while prolonged learning experiences yield sharpened-tuning of cortical responses to a CS+. An integrative model accounting for these effects is discussed.

3–042 | ELECTROPHYSIOLOGICAL RECORDING DURING REAL-WORLD GOAL-DIRECTED NAVIGATION USING AUGMENTED REALITY

Jaleesa Stringfellow, Mei-Heng Lin, Omer Liran, Travis Baker
Rutgers University

Descriptors: goal directed navigation, reward-based decision making, reward positivity

The ability to make adaptive decisions during goal-directed navigation is a fundamental and highly evolved behavior that requires continual coordination of perceptions, learning and memory processes, and the planning of behaviors. Although these mechanisms have been well studied in animal experiments, whether similar mechanisms exist in freely moving humans remains elusive. One key issue raised is the limitation inherent to traditional human neuroimaging—whilst rats and other nonhumans can be examined during free movement, human studies rarely achieve equivalent realism. To overcome this limitation, we developed a novel mobile EEG and Augmented Reality (AR) technique aimed to record brain activity and manipulate real-world environments in real-time during spatial navigation. AR is an interactive experience where the objects that reside in the real-world are "augmented" by computer-generated perceptual information across multiple sensory modalities using a special kind of optic glasses (Hololens2, Microsoft). In the present study, we recorded EEG in 20 subjects as they freely navigated an operant chamber with left and right goal locations (west vs east trajectories). In the time domain, reward feedback evoked both the reward positivity (RewP; valence effect) and the topographical N170 (spatial effect). Overall, this study provides the first evidence that combining mobile EEG with AR technology is possible during real-world navigation and provides a unique opportunity to move toward increasing ecological validity in human EEG studies of goal-directed navigation.

3–043 | SELF-REPORTED AND FACIAL EMG DIFFERENCES IN NEGATIVE EMOTIONAL EXPRESSION BY BLACK AND WHITE AMERICANS IN THE MIDLIFE IN THE UNITED STATES (MIDUS) STUDY

Anna Finley[1], Cassandra Baldwin[2], Carien van Reekum[3], Richard Davidson[1], Stacey Schaefer[1]
[1]University of Wisconsin, Madison, [2]Texas A&M University, [3]University of Reading

Descriptors: emotion, facial EMG, race

Black Americans report suppressing the expression of (negative) emotions more than White Americans, potentially to cope with and avoid racial stressors (Wilson & Gentzler, 2021). The current study examined differences between Black and White American's self-reports of trait expressive suppression, corrugator EMG activity during emotional image viewing, and valence and arousal ratings of the images ($n = 385$, 33.8% Black American, $M_{age} = 53.33$, $SD_{age} = 11.47$). Black participants report more expressive suppression, $t(260.95) = 3.18$, $p = 0.002$. A 2 (race) × 3 (image valence) RM ANOVA found that Black participants had less corrugator activity, $F(1, 383) = 6.73$, $p = 0.010$. Post-hoc t-tests found this racial difference was significant for negative and neutral images (p's < 0.03). Higher expressive suppression was related to less corrugator activity during negative images only, $r(383) = -0.24$, $p = 0.005$, and did not differ by race, $p > 0.40$. A subset of participants ($n = 108$) reported image valence and arousal ratings. A 2 (race) × 3 (image valence) RM ANOVA found a race × image interaction for self-reported valence, $F(2, 317) = 3.02$, $p = 0.050$, such that Black participants rated neutral images more negatively, $p = 0.034$. Results suggest Black Americans suppress the expression of negative emotions more than White Americans, rate unpleasant stimuli similarly, but do not exhibit similar facial EMG responses to the stimuli. Findings highlight the need to diversify emotion research and consider the social and cultural influences on emotional experience and expression.

3–044 | THREAT DIFFERENTIALLY AFFECTS ALERTING AND EXECUTIVE CONTROL NETWORKS: EVIDENCE FROM EVENT RELATED POTENTIALS DURING AN ATTENTION NETWORK TEST UNDER THREAT OF SHOCK

James Yancey[1,2], Danielle Jones[3], Keenan Roberts[3], Christopher Patrick[3]
[1]Rocky Mountain MIRECC (Salt Lake City VA),
[2]University of Utah School of Medicine, [3]Florida State University

Descriptors: attention, threat, event related potentials
Anxiety has been theoretically and empirically linked to abnormal attentional processing. Allocating attention is a complex process thought to reflect three distinct components: alerting, orienting, and executive control. These three components can be isolated in the cognitive laboratory with the Attention Network Test (ANT). The current study investigated the effect of an anxiety-inducing stressor (threat of shock) on neural processing of attentional cues during the ANT. Event-related potentials were collected in 64 participants during a version of the ANT under threat of shock. The ANT comprised flanker stimuli preceded by warning cues conveying either temporal (alerting network) or spatial–temporal (orienting network) information regarding target stimuli. The executive control network was indexed by comparing incongruent versus congruent flanker arrows. Trials were evenly divided across threat and safe conditions. Alerting cues elicited a robust negative potential ~100 ms post-cue onset at lateral parietal-occipital recording sites and was enhanced during threat blocks compared to safe. Orienting cues resulted in a larger negativity ~100 ms to flanker task stimuli but did not differ across threat and safe trials. Incongruent flanker stimuli requiring greater executive control resulted in reduced amplitude of the centroparietal P300, occurring 300-500 ms post-flanker. This reduction was larger for threat trials compared to safe.

3–045 | NETWORK ANALYSIS OF PHYSIOLOGICAL INDICATORS OF STRESS

Laura Hazlett, Samuel West, Nicholas Thomson, Roxann Roberson-Nay
Virginia Commonwealth University

Descriptors: Galvanic skin response, stress, methodology
Experimental inductions of stress have been used to study physiological responses to such experiences. The fear of experiencing pain elicited by physical sensations can amplify mild somatic sensations (e.g., dizziness) under conditions of stress, resulting in hyperarousal. We applied a psychometric network analysis regimen to explore the covariance structures among self-reported indicators of physiology under low and high stress conditions. Participants ($N = 571$) completed self-reports of physiological experiences during a Carbon Dioxide breathing task. We also measured objective physiological responding via galvanic skin response to identify which subjective indicator best accounted for GSR. Results of our regression analysis indicated that subjective reports of sweating were the single most important predictor of GSR during the CO_2 task. The CO_2 network demonstrated greater overall connectivity compared to pre-CO_2. Further, the subjective indicator most linked to GSR (sweating) was not connected to the pre-CO_2 network. These findings suggest that self-reports of physiology reflect distinct covariance structures under conditions of stress that may reflect the relationships among objective measures of physiology such as GSR and heart rate variability under high stress conditions. We also found that feelings of faintness were the most-central indicator in both networks regardless of network state. This may suggest that feelings of faintness are more easily recognized and reported on by respondents in relation to others subjective indicators (e.g., chest tightness).

3–046 | RELIABILITY OF EYE TRACKING BASED MEASURES OF ATTENTIONAL BIAS IN THE SCRAMBLED SENTENCE TASK

Dahlia Kassel, Caleb Coughtry-Carpenter, John Foley, Andrew Hauler, Siraj Lyons, Josh Carlson, Lin Fang
Northern Michigan University

Descriptors: attention bias, eye tracking, reliability
Preferentially attending to emotionally salient information within the environment is referred to as attentional bias and is thought to be an important component of adaptive behavior. The most commonly used method of assessing attentional bias is through reaction time-based measures, which have repeatedly been found to have low reliability. Eye-tracking offers a direct measure of overt attentional focus and may have higher reliability. Here, in a sample of university students (N = 19) we assessed the reliability of eye tracking measures (i.e., dwell time, fixation count, and first fixation) for positive and negative words in the scrambled sentence task. In this task, six words were presented on the screen in a single line. Each trial contains one emotionally negative and one emotional positive word. Participants were instructed to unscramble the sentence to form a grammatically correct

and meaningful statement using five of the six words as quickly as possible. Split-half reliability estimates (odd vs even trials) for dwell time, fixation count, and first fixation for positive words were acceptable ($r = .88$–$.92$). Similarly, the split-half reliability estimates of these measures were also acceptable for negative words ($r = .79$–$.97$). In short, various eye tracking indices of attentional focus on emotional positive and negative information in the sentence scramble task displayed acceptable internal consistency and therefore appropriate for assessing individual difference in attentional bias.

3–047 | IMPACT OF REDUCED DIMENSIONALITY INDEPENDENT COMPONENTS ANALYSIS ON EVENT-RELATED POTENTIAL DATA QUALITY

Victor Pokorny[1,2], Eric Rawls[2], Scott Sponheim[1,2]
[1]Minneapolis VA Health Care System, [2]University of Minnesota

Descriptors: Preprocessing, Principal Components Analysis, Scalability

ICA is a ubiquitous and effective tool for cleaning EEG. To reduce computation time, many analysis pipelines decrease EEG dimensionality prior to ICA. There have been reports of the deleterious effects of such reduced-dimensionality ICA (rdICA) on the dipolarity and reliability of independent components (ICs). A direct examination of the impact of artifact removal via rdICA on ERP data quality is needed. We analyzed 128 electrode recordings of 40 healthy subjects performing an active auditory oddball task. We preprocessed each subject's data under the following conditions: 1) ICA without dimension reduction; 2) ICA with only half (64) of the electrodes included; 3) ICA preceded by PCA retaining 99% of data variance; and 4) ICA preceded by PCA retaining 90% variance. We then compared ERP data quality (after automatic IC rejection using IClabel) by computing the standardized measurement error of the single-trial mean-amplitudes of the P3 component elicited by rare tones. We found no meaningful differences in SME for the full ICA as compared to the halved electrode ICA ($t[39] = -1.28$, $p = .1$), the ICA preceded by PCA retaining 99% variance ($t[39] = 2.20$, $p = .9$), or the PCA retaining 90% of the variance ($t(35) = 0.44$, $p = .67$; 4 individuals were excluded due to having a first PC accounting for >90% variance). The results suggest that judicious data reduction may not harm downstream ERP data quality. Our findings are part of a stage 2 registered report which investigates the effects of rdICA for other task paradigms, and components.

3–048 | TELL ME SOMETHING I DON'T KNOW: INFLUENCES OF WORLD KNOWLEDGE, CONTEXTUAL FIT, AND LINGUISTIC REGULARITY ON LANGUAGE COMPREHENSION

Emily Mech, Jon Willits, Kara Federmeier
University of Illinois, Urbana-Champaign

Descriptors: Knowledge, N400, Post-N400 Positivity
Language comprehenders can use context to rapidly activate concepts from semantic memory to understand an unfolding message. However, understanding any given message usually does not require activating all of a concept's features; knowing that carrots are orange is not necessary to understand that they can be eaten with hummus. Do comprehenders differentially activate features of concepts depending on what facet of knowledge is relevant in the current context? In an ongoing, pre-registered study, we are investigating how concept-feature strength, linguistic knowledge (measured as pointwise mutual information), and contextual fit dynamically influence language comprehension. We measured event-related potentials (ERPs) to concept-feature word pairs (e.g., carrot-orange) that were embedded in sentence contexts that biased what type of knowledge was useful for comprehension. Preliminary findings suggest that at the sentence-final feature words, the N400 was sensitive to the fit of the particular feature to its context, whereas post-N400 positivities remained sensitive to concept-feature strength even when the feature was irrelevant in context. This pattern of results suggests that although context can initially modulate conceptual activation, later processing may remain sensitive to contextually irrelevant features of concepts. Planned mixed-effects modeling will assess how cloze probability and linguistic knowledge, in addition to sentence context and concept-feature strength, modulate effects on the N400 and post-N400 positivities.

3–049 | OFFLINE CONSOLIDATION OF HUMAN FEAR MEMORY DOES NOT BENEFIT FROM SLEEP

Boris Kotchoubey[1], Yuri Pavlov[1,2], Nadezhda Pavlova[1,2], Susanne Diekelmann[1,3]

[1]University of Tuebingen, [2]Ural Federal University, [3]University Hospital Tübingen

Descriptors: conditioning, sleep, EEG
Consolidation of fear memories is known to play a role in the development of several pathological conditions such as phobia and panic disorder. The factors contributing to this post-acquisition consolidation are not well understood. Although sleep has a powerful effect on the consolidation and strengthening of declarative and procedural memories, its impact to the consolidation of fear memories remains an open question. In the present study, we analyzed the effects of time and sleep of fear-conditioned responses using highly sensitive electrophysiological measures. We assessed event-related brain potentials (ERP) in 18 healthy young individuals during fear conditioning before and after a 2-hour afternoon nap or a corresponding wake interval in a counterbalanced within-subject design. During conditioning, two equally neutral tones (designated as CS+ and CS-) were paired with a highly unpleasant sound, and a slightly pleasant sound, respectively. Fear responses were examined before the 2-hour interval during a habituation phase and an acquisition phase as well as after the interval during an extinction phase and a re-acquisition phase. A slow negative ERP deflection following CS (stimulus-preceding negativity) was significantly larger after CS+ than CS-. This differential fear response further increased after the interval during re-acquisition compared to the initial acquisition, indicating that fear memories were consolidated over time. However, this consolidating effect did not significantly differ between sleep and wakefulness conditions.
FUNDING: The study was supported by the German Research Society (Deutsche Forschungsgemeinschaft, DFG), grant KO-1753/13–4.

3–050 | THE EFFECTS OF CLINICAL ANXIETY ON MULTI-DIMENSIONAL NEUROPHYSIOLOGICAL MECHANISMS OF APPROACH PREPARATION AND MOTIVATION

Danielle Taylor, Christopher Sege, Lisa McTeague
Medical University of South Carolina

Descriptors: anxiety, heart rate, event-related potential
Research has evaluated the influence of anxiety on the neurophysiological indices of defensive engagement during escape, avoidance, and uncontrollable exposure to aversive contexts (Sege et al., 2018; Sege et al., under review). Startle reflexes are inhibited during avoidance, enhanced during escape, and further enhanced in uncontrollable anticipation, but clinical anxiety results in exaggerated startle during escape, and not avoidance preparation. Anticipatory cortical activity is not influenced by clinical levels of anxiety, suggesting a specific effect on activation of the fear system. To further evaluate defensive responding and cortical preparation, it is key to evaluate approach processes given overall inhibition is a mechanism of anxiety. Multi-dimensional neurophysiology was evaluated in a sample with clinical anxiety vs. healthy controls during anticipation of pleasant contexts that were uncontrollable, or that could be approached or extended. Multivariate analyses revealed no difference in skin conductance or startle ($ps > .05$). Heart rate acceleration was attenuated among patients with anxiety in the no control condition, and deceleration was attenuated with decreasing control, which was exacerbated by clinical anxiety. Cortical preparation was attenuated for healthy participants during no control, indicating healthy individuals demonstrate adaptive preparation for controllable pleasant exposure which is precipitated by reduced cardiac orienting. This indicates a specific anxious effect on emotional processes which do not influence cortical preparation.
FUNDING: This study was supported in part by the National Institute of Mental Health (NIMH; Grant # K23 MH123931-01A1) and through support from the Medical University of South Carolina.

3–051 | DISTINCT ERP MEASURES AS INDICATORS OF BROADER VERSUS NARROWER DIMENSIONS OF PSYCHOPATHOLOGY

Christopher Patrick[1], Keanan Joyner[2], Colin Bowyer[1], Pablo Ribes-Guardiola[3]
[1]Florida State University, [2]University of California, Berkely, [3]Jaume I University

Descriptors: ERP, Internalizing, Externalizing
A major challenge in efforts to link psychological disorders to neural systems, as a basis for biologically informed conceptions, is the issue of diagnostic comorbidity. Given substantial symptomatic overlap among different disorders, it is difficult to ascertain whether an observed relationship between a brain response measure and an individual diagnostic condition (e.g., depression, alcoholism) is specific to that condition, or indicative of some characteristic it shares with others. A potential means for addressing this challenge is provided by the Hierarchical Taxonomy of Psychopathology (HiTOP) model, a hierarchical-dimension system that characterizes disorders of many types in terms of lower-order (narrow)

dimensions reflecting more specific elements of each, and higher-order (broad) dimensions reflecting elements shared among them. Here, we used data from a sample of 667 adult participants to examine the specificity of relations of three ERP measures – Oddball-P3, Fear-Face N170 (Fear-N170), and Reward Positivity – in terms of the multi-level HiTOP framework. Analyses revealed that: (a) Oddball-P3 operated as an indicator of the broad externalizing dimension subsuming antagonistic-antisocial and substance-related problems, (b) Fear-N170 operated as a more specific indicator of the antagonistic subdimension of externalizing, and (c) RewP showed opposing relations with fear (+) and distress (−) subdimensions of internalizing problems. Implications for efforts to identify biomarkers of psychopathology and clarify their functional meaning will be discussed.

FUNDING: U.S. Army W911NF-14-1-0018.

3–052 | ESTIMATION OF COGNITIVE OVERLOAD STATE FROM PUPIL SIZE AND OSCILLATORY BRAIN ACTIVITY

Yuri Pavlov[1,2], Anastasia Gashkova[1], Dauren Kasanov[1], Alexander Kotyusov[1], Alexandra Kosachenko[1]
[1]Ural Federal University, [2]University of Tuebingen

Descriptors: working memory, EEG, cognitive overload
Objective methods for detection of cognitive overload are needed. In this study, we investigated how exceeding individual working memory capacity limit (digit span) affects psychophysiological indicators of working memory function such as frontal midline theta, posterior alpha, and pupil size. 137 participants were presented with a digit span task with serial presentation of the digits and serial recall while 64-channel EEG and pupillometry were recorded. Each trial consisted of sequences of visually presented digits. The sequence length was individually adjusted to either correspond to the digit span (at least 70% of the sequences correctly recalled in the right order, "span" condition) or to exceed the digit span by one digit ("overload" condition). Although, the overload condition was perceived as more challenging, as indicated by NASA-TLX subjective cognitive load ratings and behavioral accuracy, the psychophysiological indexes of cognitive load failed to distinguish between the conditions. Independently of the individual digit span the temporal dynamics of pupil size (reaching asymptote at 5-digit load), alpha suppression (reaching asymptote at 7-digit load), and theta enhancement (continuous increase till the end of the retention period) remained similar across individuals. We can conclude that cognitive overload state as indicated by behavioral outcomes lead to the saturation but not to an immediate drop or surge of physiological indexes of working memory load.

3–053 | ON THE EFFECT OF THE PSYCHOSOCIAL CONTEXT ON PLACEBOHYPOALGESIA - PSYCHOLOGISTS VS. PHYSICIANS

Philipp Reicherts, Katharina Lembke, Miriam Kunz
University of Augsburg

Descriptors: Placeboeffects, Pain, Psychosocial Context
Placebo effects on pain predominantly rely on positive treatment expectation and corresponding therapeutic experiences, however research on the influence of the psychosocial context, in which a sham treatment is administered, so far is very rare. Therefore, in the present study we investigated how the professional role of the experimenter might modulate the placebo response, comparing a physician vs. psychologist introducing an analgesic (sham) cream. Participants first underwent a placebo conditioning procedure, during which a placebo cream was paired with moderately painful heat pain stimuli, while highly painful stimuli were administered on skin patches, treated with a control cream. In the subsequent test phase, the procedure was repeated, however this time identical pain stimuli were administered on placebo and control patches. The placebo effect was determined as the difference in pain ratings of heat pain stimuli administered placebo and control patches during the test phase. Preliminary data analyses of pain ratings demonstrate successful placebo hypoalgesia. In general, pain was rated lower – despite similar pain thresholds and thus stimulus intensity in both groups – when participants were treated by a physician. Especially pain intensity ratings suggest more stable placebo responses across the test phase, when the alleged analgesic was introduced by a physician. The present findings demonstrate the relevance and capacity of psychosocial factors to modulate placebo hypoalgesia, which should be considered maximizing placebo effects.

FUNDING: This work was funded by the intramural research funding program of the Medical Faculty of the University of Augsburg.

3–054 | RECORDING EEG FROM HOME WITH NO TECHNICIAN ON SITE: THE DEVELOPMENT OF A NOVEL REMOTE, HOME-BASED EEG PROTOCOL FOR FAMILIES AFFECTED BY ANGELMAN SYNDROME

Kimberly Gálvez-Ortega, Roslyn Harold, Amanda Austin, Bridgette Kelleher, Dan Foti
Purdue University

Descriptors: Remote-EEG, Protocol Development, Protocol Satisfaction

Angelman syndrome (AS) is a rare neurogenetic syndrome characterized by motor impairment, intellectual disability, and seizures. Most treatments for AS provide support for motor delays and limited communication skills, fewer target core illness processes. Electroencephalography (EEG) is a method used by researchers to identify patterns of brain activity and assess the natural development of AS. Nevertheless, EEG presents challenges with toleration, geographic, and financial barriers for families affected by AS. Thus, we developed a remote, home-based EEG protocol (no technician on-site). In this poster, we will present visual aids and guided tutorials provided to families to facilitate the EEG setup and data on protocol satisfaction. Seven families (2 caregivers, child with AS, unaffected sibling) participated in 3 EEG assessments within a one-week period yielding 84 assessments. Six families completed the caregiver post-assessment, which reports comparisons to previous in-person EEGs, protocol satisfaction, and feedback. Post-assessments demonstrated 88% of caregivers rated their remote-EEG experience as moderately to much-better compared to previous in-person EEGs, 95% reported good-excellent satisfaction with the equipment quality/ease, 98% reported excellent satisfaction with their participation/support received, and 92% reported good-excellent satisfaction with the protocol's ability to capture child skills. Results suggest this remote-EEG protocol is a friendly and tolerable alternative to in-person EEGs that can increase accessibility for families affected by AS.

3–055 | RECONCEPTUALIZING THE REWARD POSITIVITY AS A TEMPORALLY INDEPENDENT AND ADDITIVE DELTA SPECTRAL FEATURE

Trevor Jackson[1], Darin Brown[2], James Cavanagh[1]
[1]University of New Mexico, [2]Pitzer College

Descriptors: Reward Positivity, Computational Modelling, ERP Methods

The reward positivity (RewP) is a feedback-locked ERP component dominated by delta-band activity and commonly computed by contrasting reward and punishment signals. However, this incorrectly assumes invariance in the punishment condition. Instead, we suggest that the RewP should be conceptualized as an additive, temporally independent delta feature that occurs over an obligatory multi-phasic motif. We leveraged feedback modality (sight vs. sound) to influence the latency of reward-specific activity relevant to the obligatory background ERP. In study 1 ($N = 24$), participants received separated modality feedback to establish that the RewP peaks earlier in auditory conditions. In study 2 ($N = 24$), participants received combined modality feedback to establish that auditory RewP latency is privileged over visual feedback. In study 3 ($N = 41$), participants received parametrically delayed auditory feedback to establish that the RewP can also be parametrically delayed. To better account for the variance specific to the RewP, two simulated half-cosine bursts in the delta range (one positive to model reward-related delta and one negative to model P3-related delta) were trained on a dataset ($N = 24$) with separated modality feedback and added to punishment signals to approximate the RewP; this was compared to a positive half-cosine model and a full-cosine model. The half-cosine model could best account for these parametric shifts in reward-related latency across each study, suggesting that the RewP is an independent brain response unrelated to punishment-sensitive obligatory background ERPs.

3–056 | FROZEN WITH FRIGHT? INHIBITORY CONTROL DURING A VIRTUAL PLANK-WALK

Gina Grimshaw, Jordan Schulde, Asha Strom, Christopher Maymon, Andre Botes, David Carmel
Victoria University of Wellington

Descriptors: Emotion, Virtual Reality, Inhibitory Control

Inhibitory control allows us to override habitual or prepotent responses so that we can achieve goals. The ability to "stop ourselves" is particularly important in threatening

situations, where our behaviours may be critical for survival. How might our fear affect our inhibitory control? Two hypotheses can be considered. On one hand, fear may recruit executive control to aid emotion regulation, reducing capacity for inhibitory control. Alternatively, fear may activate a defensive "freezing" response, facilitating inhibitory control. We tested these competing hypotheses in a preregistered study. Participants performed a test of inhibitory control – the go/nogo task – while standing on a virtual plank, first at street level (baseline), and then a second time on the plank suspended 80 stories above a city street (experimental group) or at street level (control group). Subjective and physiological measures (heart rate and skin conductance) confirmed that simulated height induced a strong fear response. Most participants in the control group showed improved inhibitory control (i.e., fewer false alarms) in the second part vs baseline, consistent with a practice effect. Participants in the experimental condition, however, showed highly variable responses: some showed better and others worse inhibitory control. Findings suggest that both hypotheses might be correct, but mediated by individual differences. The factors driving such differences are a worthwhile target for further investigation.

3–057 | MEASUREMENT PROPERTIES OF HEART RATE VARIABILITY IN VIRTUAL REALITY

Gabriela Revi[1], Sazedul Alam[2], Nilanjan Banerjee[2], Ryan Robucci[2], Scott Kerick[3], Derek Spangler[1]
[1]Pennsylvania State University, [2]University of Maryland Baltimore County, [3]CCDC US Army Research Laboratory

Descriptors: heart rate variability, virtual reality, test–retest reliability

Vagally mediated heart rate variability (vmHRV), an index of cardiac vagal activity, is a widely used correlate of emotion and cognitive performance. Recent studies have examined vmHRV in virtual reality (VR) to study more naturalistic processes without sacrificing experimental control. However, little is known about the test–retest reliability and convergent validity of vmHRV metrics in VR, calling into question their usage in virtual contexts. To this end, the present study tested the test–retest reliability and convergent validity of vmHRV metrics during a stressful VR shooting task. Participants ($n = 26$, $M_{age} = 25.27$y, $SD = 2.92$, 14 males) completed three daily, non-consecutive sessions of the task while ECG was assessed to calculate standard time-(e.g., RMSSD) and frequency-domain (e.g., HF-HRV) indices of vmHRV. Test–retest reliability was assessed via intraclass correlation, standard error of measurement, and coefficient of variation. Pearson correlations tested convergent validity. Results indicated that the absolute and relative reliabilities of vmHRV metrics were comparable to prior studies conducted in and out of lab (ICCs $=>.6$). VmHRV metrics displayed convergent validity commensurate with prior literature as well ($r =>.62$). The implications of findings are discussed in reference to future VR studies using cardiac vagal metrics.

3–058 | CONTROL, MOTIVATION, AND THE ADJUSTMENT OF RACE-BIASED RESPONDING

Paul Brancaleone[1], Roberto Cofresi[1], Tiffany Ito[2], Bruce Bartholow[1]
[1]University of Missouri, [2]University of Colorado, Boulder

Descriptors: Social Neuroscience

Tragic shootings of unarmed Black men by police have underscored the deadly consequences of race bias, the tendency to perceive Black Americans as more threatening than White Americans. Lab-based research documents that the tendency to misperceive innocuous objects as weapons when in the presence of Black persons is pervasive but varies according to individual differences in executive functioning (EF) abilities and motivations to control prejudiced responding (MCP). Here, we used data from a large study on the role of EF in implicit bias to test predictions derived from the Affect Alarm Model of control, which suggests bias control is a product of both the ability and motivation to exert control when bias is likely and when control has failed. A sample of 139 emerging adult ($M = 19.4$ yrs old) participants (Ps) completed a common lab-based race bias task while ERPs were recorded. EF was comprehensively assessed via performance on a suite of 9 EF tasks; MCP was measured using a standard questionnaire. Results showed that post-error adjustment in biased responding (RT difference between high- and low-conflict trials) was greatest among Ps high in EF and internal MCP. In addition, within-person trial-by-trial fluctuations in the size of the ERN, an ERP index of the motivational significance of control failures, predicted adjustment in biased responding mainly among Ps high in internal (vs external) MCP or high in EF. These findings support the primary tenets of the Affect Alarm Model and suggest that high internal MCP or high EF—or both—are needed to regulate biased responding.

3–059 | RESTING MULTISPECTRAL CONNECTIVITY DIFFERENCES ACROSS DEVELOPMENT

Nathan Petro[1], Christine Embury[1,2], Lauren Ott[1], Samantha Penhale[1], Maggie Rempe[1,3], Giorgia Picci[1], Yu-Ping Wang[4], Julia Stephen[5], Vince Calhoun[5,6], Gaelle Doucet[1], Tony Wilson[1,7]

[1]Boys Town National Research Hospital, [2]University of Nebraska, Omaha, [3]University of Nebraska Medical Center, [4]Tulane University, [5]Mind Research Network, [6]Georgia State University, [7]Creighton University

Descriptors: magnetoencephalography, phase-coherence, adolescence

Assessing brain connectivity during rest has become a widely used approach to determine changes in functional brain organization during development. Generally, this work has demonstrated that brain regions become more interconnected from childhood into adolescence. However, the majority of this work has been based on fMRI measures, whereas multispectral functional connectivity, as measured using M/EEG, is less well characterized. Spontaneous cortical activity was recorded using MEG from 108 typically developing youth (9–15 years-old; 55 female) during eyes-closed rest. MEG source images were computed and connectivity was estimated in the canonical delta, theta, alpha, beta, and gamma bands. Connectivity was estimated using the imaginary part of the phase coherence, which was computed between 200 brain regions defined by the Desikan-Killiany cortical atlas. Relationships with age and sex were assessed with permuted significance thresholds. Delta, theta, and alpha connectivity was stronger in older youths. These differences were most prominent in the alpha-band, with visual regions being primarily implicated. The age-related differences in resting multispectral connectivity are consistent with previous work where the brain becomes more integrated across development. Given that differences were most abundant in visual regions and within the alpha frequency band, the current results highlight integration of visual sensory regions with other brain networks across development.

3–060 | INTEGRATING EEG AND FMRI ESTIMATES OF ERROR MONITORING TO PREDICT FUTURE ANXIETY CHANGES AMONG BEHAVIORALLY INHIBITED ADOLESCENTS

Emilio Valadez[1], John Richards[2], Stefania Conte[2], Marco McSweeney[1], Enda Tan[1], George Buzzell[3], Anderson Winkler[4], Lucrezia Liuzzi[4], Daniel Pine[4], Nathan Fox[1]

[1]University of Maryland, College Park, [2]University of South Carolina, [3]Florida International University, [4]National Institute of Mental Health

Descriptors: multimodal neuroimaging, error monitoring, anxiety

The error-related negativity (ERN) is inconsistently associated with anxiety among adolescents. Recent work suggests these inconsistent findings may, in part, be due to moderation by early life temperament. Moreover, efforts to localize the source of the ERN reveal multiple neural generators, including the dorsal anterior cingulate cortex (dACC) and posterior cingulate cortex (PCC), which may further contribute to inconsistent findings. To assess differential impacts of early life temperament and individual neural generators on ERN-anxiety relations, the present study leveraged a multi-modal fMRI/ERP fusion approach to localize ERN sources. Adolescents with known history of behaviorally inhibited (BI) temperament completed a flanker task at age 13 years with EEG ($n = 123$), non-simultaneous fMRI ($n = 42$), or both ($n = 41$). Anxiety was assessed at age 13 and again at 15 years. Results revealed that larger fMRI-weighted ERN source estimates within the dACC at age 13 predicted increased anxiety by age 15, but only among youth with a history of high BI. The opposite pattern was observed among youth with a history of low BI or when examining fMRI-weighted ERN source estimates within the PCC. When examining EEG or fMRI separately, effects did not survive correction for multiple testing. Overall, results indicate that the differential impact of early life temperament and of unique ERN sources may explain inconsistent associations with anxiety. Furthermore, results suggest that integrating multimodal neuroimaging measures can improve prediction of clinical outcomes.

3–062 | A TRANSLATIONAL MODEL FOR REWARD LEARNING: THE TRANSLATIONAL BANDIT TASK (TBT) ELICITS ROBUST REWARD LEARNING BEHAVIOR AND ERP VALUE CODING IN HUMANS

Eric Rawls[1], Caroline Demro[1], Collin D. Teich[1], Angus W. MacDonald III[1], Scott R. Sponheim[1,2]
[1]University of Minnesota Twin Cities, [2]Minneapolis VA Healthcare System

Descriptors: reward, learning, value

For translational psychopathology research, we require tasks that tap into the same computational process across multiple species. We developed a Translational Bandit Task (TBT) that can be completed by humans, rodents, and non-human primates. In the TBT, three Gabor patterns (the three arms of the bandit) surround a central fixation. The reward probabilities of the three arms change slowly over time. We report that the TBT generates robust reward learning behavior and reward processing ERPs in human subjects. We acquired EEG data concurrently with 3 T fMRI while n = 10 subjects completed the TBT. We first demonstrated that single subjects exhibit significant reward learning on the TBT by calculating the lagged normalized mutual information between reward outcomes and switch behavior. All but one subject (n = 9) showed significant immediate (lag = 1) reward learning, and a subset (n = 5) of subjects showed significant multi-trial reward learning (p < .05, within-subject permutation test). Following removal of gradient and cardioballistic artifacts, EEG data were subjected to group independent component analysis, from which we identified a mediofrontal brain component for further analysis (69% of scalp ERP variance explained). The scalp back-projection of this component demonstrated a feedback-related negativity (FRN) peaking at 308 ms, which was more negative for losses than for wins ($p = .02$). Thus, we demonstrate that the TBT is a sensitive tool to recover human reward learning behavior and reward processing brain activity, even in the challenging MRI environment.

3–064 | FRONTAL MIDLINE THETA INDEXES SUCCESSFUL INHIBITORY CONTROL IN A STRESS-INDUCING GO/NOGO TASK AND IS ASSOCIATED WITH INDIVIDUAL DIFFERENCES IN TRAIT NEGATIVE EMOTIONALITY

Collin D. Teich[1], Craig A. Marquardt[2], Eric Rawls[1], Kara Stevens[1,2], Scott R. Sponheim[1,2], Melissa A. Polusny[1,2,3]
[1]University of Minnesota Twin Cities, [2]Minneapolis VA Health Care System, [3]Center for Care Delivery and Outcomes Research

Descriptors: resilience, frontal midline theta, negative emotionality

Inhibitory control, defined as the ability to stop one's impulses or goal-irrelevant responses to stimuli, is critical for healthy emotion regulation. Frontal midline theta (FMT) is sensitive to laboratory manipulations of cognitive control and individual differences in internalizing psychopathology, suggesting that FMT might index neural processes critical for successful emotion regulation. This connection may be particularly relevant for understanding resilience and the effects of adverse life events on psychopathology. The connection between FMT and traits that predict internalizing psychopathology following psychological stressors, like trait negative emotionality, are poorly understood. In the present study, we sought to identify the relationship between FMT elicited by a Go/No-Go task and negative emotionality (NEM) as measured by the Multidimensional Personality Questionnaire (MPQ). We collected EEG data from 108 National Guard recruits before they attended basic combat training. FMT was quantified by extracting time-frequency power from 3-8 Hz and 200-500 ms. We analyzed correct go and no-go trials across three blocks with modulated difficulty intended to induce stress. Repeated measures ANOVA revealed a potentiation of FMT for no-go compared to go across blocks. FMT predicted performance, NEM was associated with reduced FMT, and these relationships were strongest during the most stressful task block. These results suggest FMT may be a neural mechanism of relevance for understanding resilience capacity and the ability to buffer the effects of psychological stressors.

3–065 | NEURAL MEASURES OF ATTENTION SELECTION AND SUPPRESSION OF EMOTIONAL AND NON-EMOTIONAL STIMULI IN ANXIETY

Katherine McCain[1], Wendy Zhang[1,2], Megan Spence[1], Marisa Krauter[1], Emily Kappenman[1,2]
[1]*San Diego State University, [2]San Diego State University/ University of California, San Diego*

Descriptors: Trait anxiety, Attentional bias, Event-related potentials
Recent work using event-related potentials (ERPs) to separately measure two aspects of attentional control—attentional selection (indexed by the N2pc) and attentional suppression (indexed by the P_D)—has shown that these mechanisms may provide unique insights into anxiety. Specifically, anxiety was associated with increased attentional suppression, but not increased selection, of threatening stimuli (Kappenman et al., 2021). However, people with high anxiety showed increased attentional selection, but not increased suppression, of non-emotional distractors (Gaspar & McDonald, 2018). The present study addressed these opposing findings by examining selection and suppression of emotionally-neutral and threat-related distractors in the same individuals ($N = 60$). In session 1, participants completed a visual search task, in which they responded to a target stimulus (yellow circle) while ignoring a non-emotional distractor (red circle). In session 2, participants completed a dot-probe task with conditioned threats (colored shapes paired with electric shock). Results showed that attentional selection (N2pc) and suppression (P_D) ERPs were elicited in each task. However, increased attentional selection was not associated with anxiety in either task. By contrast, increased attentional suppression was associated with anxiety, but only in the context of threat-related stimuli. These results demonstrate the specific role of increased attentional suppression in the context of emotional stimuli in anxiety and help elucidate the complex relationship between attentional control and anxiety.

3–066 | CEREBROVASCULAR HEALTH IN AGING: OPTICAL MEASURES PREDICT STRUCTURAL DECLINE

Daniel Bowie, Kathy Low, Benjamin Zimmerman, Samantha Rubenstein, Gabriele Gratton, Monica Fabiani
University of Illinois, Urbana-Champaign

Descriptors: aging, optical arterial pulse measures (pulse-DOT), structural magnetic resonance imaging (sMRI)
The health of the cerebrovasculature gradually deteriorates during normal aging due to arteriosclerosis. During this process, the brain's arteries slowly stiffen and lose their elasticity, leading to decreases in the perfusion of oxygenated blood throughout the brain, which contributes to declines in brain structure, brain function, and ultimately, cognition, in aging. Here, in a relatively large sample ($N > 150$) consisting of individuals aged 18–85 years, we show that diffuse optical tomography measures of the cerebral arterial pulse (pulse-DOT), including the Pulse Relaxation Function (or PReFx), are negatively associated with age and predict declines in at least several markers of neuroanatomical integrity, including increased white matter lesion burden, decreased cortical volume, and decreased total gray matter volume. Our data also suggests that enhanced cardiorespiratory fitness (CRF) confers neuroprotective benefits, as evidenced by a positive relationship between estimates of CRF and cerebral arterial elasticity. This finding underlines the protective role that regular aerobic exercise plays in slowing age-related declines in brain structure and function, and, potentially, cognition.

3–067 | ABSOLUTE REDUCTION IN ELICITING STIMULUS INTENSITY AS A NEW INDEX OF STARTLE PPI

Andreas Behrje[1], Johannes Finke[2], Terry Blumenthal[3], Hartmut Schächinger[1]
[1]*University of Trier, [2]University of Siegen, [3]Wake Forest University*

Descriptors: Startle, Prepulse Inhibition
The human startle reflex and prepulse inhibition (PPI) are well established tools in psychophysiological research. However, it has been rarely investigated how startle stimulus intensity, with and without PPI, affects both the magnitude of the startle response and subjectively perceived intensity. PPI is usually specified in percentage of magnitude decrease. We aimed to present varying startle noise intensities to additionally indicate PPI in loss in dB. In the present study ($N = 22$), startle responses to acoustic stimuli were assessed via EMG at the m. orbicularis oculi. Assuming a linear relationship between startle magnitude and stimulus intensities in the range of 85, 95, or 105 dB, the influence of an auditory prepulse (60 dB, lead interval: 120 ms) was investigated. Additionally, participants were audiometrically checked and completed hyperacusis questionnaires. The presence of a prepulse before a 105 dB

startle stimulus resulted in an average magnitude equivalent to that of a startle response to an 83 dB (extrapolated) startle stimulus without prepulse presentation. PPI was also linked to attenuated subjective ratings of loudness and aversion of the startle stimulus. Individuals suffering from moderate hyperacusis showed lower audiogram scores and rated presented stimuli as more aversive. Discussion: Our data indicate the possibility of conceptualizing PPI either as a percent change (relative to control) or as absolute reduction in equivalent eliciting stimulus intensity (in decibels), with could serve as a methodical enhancement.

3–068 | INTERGENERATIONAL TRANSMISSION OF THE ERROR-RELATED NEGATIVITY AND ITS LINK WITH GENERALIZED ANXIETY IN A LARGE SAMPLE OF 12-YEAR-OLD CHILDREN

Lyndsey Chong[1], Daniel Klein[2], Ellen Kessel[3], Alexandria Meyer[1]
[1]Florida State University, [2]Stony Brook University, [3]Columbia University

Descriptors: error processing, familial transmission, anxiety
Generalized anxiety disorder (GAD) is a highly prevalent condition characterized by persistent and excessive worry and is often associated with psychiatric comorbidities and disability. GAD often aggregates in families, onsets in adolescence, and is associated chronic impairment across the lifespan. The neural response to errors (i.e., the error-related negativity or ERN) has been identified as a correlate and risk marker for anxiety. Previous work has shown that the ERN is heritable and is increased in individuals with GAD. However, few have investigated familial transmission of the ERN as a pathway of risk for GAD. The current study presents evidence from 475 parent–child dyads supporting the intergenerational transmission of the ERN in 12-year-old children. Results from this study also indicated that the relationship between child ERN and child GAD is particularly robust when the parent ERN is increased. In sum, parent ERN may play a role in the pathway towards GAD in childhood and could point towards novel interventions targeting the parent ERN for prevention and treatment of child GAD.

3–069 | SELF-ENHANCEMENT MOTIVATION ATTENUATES THE ERROR-RELATED NEGATIVITY

Esther Robins, James Butterworth, Chengli Huang, Constantine Sedikides, Nicholas Kelley
University of Southampton

Descriptors: self-enhancement, narcissism, error-related negativity
According to self-enhancement theory, individuals possess a drive to form and maintain positive views of the self. In service of this drive, people will maximize their successes (i.e., self-enhancement) and minimize their failures (i.e., self-protection). Little is known about how self-enhancement motivation influence responses to one of lives most common and challenging occurrences – errors. To the extent that people are driven to maintain positive self views, errors represent a direct threat to the self-enhancement motive. To test this hypothesis, we asked participants ($N = 52$) to complete speeded reaction time task (i.e., the Eriksen Flanker Task) while their brain activity was recorded using electroencephalography (EEG). Then we assessed two traits central to self-enhancement motivation – grandiose and vulnerable narcissism. Insofar as grandiose narcissism is characterized by elevated self-enhancement motivation and vulnerable narcissism by elevated self-protective motivation, they are well suited to investigate how self-enhancement shapes neural responses to errors. We observed that blunted error-related negativity (ERN) amplitudes on the flanker task were associated with elevated self-enhancement motivation (i.e., grandiose narcissism) but not self-protective motivation (i.e., vulnerable narcissism). These associations were unaffected by correlates of self-enhancement (e.g., self-esteem) or performance monitoring (e.g., anxiety). These results advance our understanding of the neurophysiological basis of self-enhancement motivation.

3–071 | CARDIAC SYMPATHETIC INDICES FOR MEASURING AUTONOMIC BALANCE: CHOOSING BETWEEN SYSTOLIC TIME INTERVALS

Patterson Aaron, Elan Donnellan, Kareem Isaac, Foster Marian, Jules Harrell
Howard University

Descriptors: ventricular ejection time, pre-ejection period, autonomic balance and regulation
Left ventricular ejection time (LVET) and pre-ejection period (PEP) have been used in formulas for cardiac

autonomic balance (CAB) and total cardiac autonomic regulation (CAR). Wiley et al, (2021) favored the use of LVET in these computations based on low correlations between LVET-based CAB (VCAB) and CAR (VCAR) measures. We studied CAB and CAR based on VET and PEP (PCAB and PCAR) indices of cardiac sympathetic activity. Respiratory sinus arrhythmia gauged cardiac parasympathetic activity. Measures in 48 college students were obtained at rest and during simple and choice reaction time tasks. VCAB and VCAR were correlated at rest and during reaction time (Pearson r range .301 to .373, $p < .05$). None of the correlations between PCAB and PCAR were significant across the measurement periods (r range .035 to .125). Additionally, correlations between the PEP- based and VET-based measures taken during the same period were significant (range $r = .495$ to .596, $p < .01$). VCAB and PCAB showed comparable strong relationships with cardia inter-beat intervals (r range .543 to .650, for PCAB; r range .418 to .676 for VCAB [p < .01]). The indices of CAB based on VET and PEP failed to correlate with the Heather Index of cardiac sympathetic input. These findings reveal modest correlations between measures CAB and CAR based on both systolic time intervals. They related similarly to the chronotropic index, inter-beat intervals. In contrast to earlier findings, the indices based on PEP measures revealed greater independence (lower correlations) between CAB and CAR.

3–072 | WHAT IF THE VARIABILITY OF SINGLE-TRIAL ERP MEASURES WITHIN A SESSION IS SYSTEMATIC INSTEAD OF RANDOM?

Kyle Wilhelm, Blythe LaGasse, William Gavin, Patricia Davies
Colorado State University

Descriptors: EEG, ERP, Single-Trial
Averaging multiple ERP segments attenuates the brain's response (signal) to a stimulus and is based on the false assumption that the ERP signal is invariant and hidden by background brain noise. Our Single Trial Peaks (STP) procedure measures amplitude and latency of multiple peaks in each segment using a two-stage process based on the peak latencies of the individual's averaged ERP. To assess the reliability and validity of this approach, we analyzed correct trial data from 70 adults performing two repetitions of a speeded visual flanker task and compared peak data (P1, N1, P2, N2, and P3) to single-trial averaged voltage in time windows (STW) and peaks of averaged ERPs.

Results indicated that the STP approach had overall higher split-half reliability (odd-even, $r = .70$–.96) and test–retest reliability ($r = .66$–.97) than the STW approach. The mean signal/noise ratio for the amplitude measures was similar for the STP and STW approaches, each having low measurement error, while the averaged ERPs had higher ratios and higher measurement error. The validity of the STP approach was evaluated via regression analyses where mean trial-level peak amplitude, *SD* of amplitude and *SD* of latency accounted for a significant amount of variance in corresponding peaks of the averaged ERPs ($R^2 = .73$–.95). Exploratory curve fitting analyses showed systematic changes in amplitude over trials, similar to changes in response time. These data support the validity of the STP approach, which provides researchers a valuable tool to investigate systematic changes of brain activity across trials.

3–073 | NEURAL CORRELATES OF MOTIVATED ATTENTIONAL PROCESSING IN MOTIVATIONAL CONFLICT

Emma Boyd[1], Timothy McCoy[1], Hilmar Zech[2], Philip Gable[1]
[1]University of Delaware, [2]Technische Universität Dresden

Descriptors: motivational conflict, approach-avoidance task, event-related potential
Making movements inconsistent with motivational tendencies causes momentary motivational conflict. The current study sought to examine neural correlates of momentary motivational conflict using a mobile approach-avoidance task. In the task, participants physically moved pictures of desserts and neutral objects towards or away from them while EEG was recorded. Motivational conflict occurred when participants had to move desserts away from them, and neutral items towards them. Reaction times were collected during the task using the mobile device accelerometer. As predicted, participants made faster responses to consistent movements (approach dessert pictures and avoid neutral objects), as compared to conflicting movements. Event-related potentials measuring motivated attentional capture were examined to pictures. P1 amplitudes were larger on conflicting trials than consistent trials. These findings reveal that neural correlates of motivated attentional processing reflect motivational conflict.

3–074 | CONCUSSION HISTORY IS ASSOCIATED WITH REDUCTIONS IN P3 AMPLITUDE AND INCREASED P3 LATENCY

Ryan Olson, Madalyn Sheridan, Cheyenne Godby, Payton Smith, Nicholas Magera
University of North Texas

Descriptors: Concussion, P3, N2

There are an estimated 3.8 million sport-related concussions in the United States each year. Despite the associated negative health outcomes, nearly 50% of concussions go unreported or undetected. Concussions are typically diagnosed and monitored through a series of field- and lab-based functional and neuropsychological tests. However, these approaches may not be sensitive enough to detect consequential functional changes in the brain and could be susceptible to individual variability. The primary purpose of this study was to examine the relationship between N2 and P3 event-related potential (ERP) responses (amplitude; latency), behavioral performance (accuracy; reaction time), and previous history of concussion. A secondary aim was to apply a two-step principal component analysis (PCA) to separate sources of variability within ERPs. Fifty-one participants (25 concussed; 26 non-concussed) between the ages of 18–36 years old completed 200 trials of the oddball paradigm while ERPs were recorded. Individuals reporting a history of concussion displayed lower mean P3 amplitude, $F(1,49) = 4.38$, $p = .042$, $\eta^2_p = .082$, and longer centroid P3 latency, $F(1,49) = 4.43$, $p = .04$, $\eta^2_p = .083$, compared to the non-concussed group. PCA decomposition confirmed P3 amplitude reductions in the concussed group, $F(1,49) = 4.72$, $p = .035$, $\eta^2_p = .088$. No significant differences in N2 responses, accuracy, or reaction time were identified (ps > .05). Findings suggest that concussions have long-term effects on the brain which may disrupt cognitive processes related to working memory and attention.

3–075 | RESPIRATORY SINUS ARRHYTHMIA AS A PREDICTOR OF DAILY EMOTION REGULATION

Mary Charleson, Kenneth Safley, Amy Mezulis
Seattle Pacific University

Descriptors: respiratory sinus arrhythmia, emotion regulation

Emotion regulation strategies may be categorized as adaptive or maladaptive, depending on their psychological impact. One's physiology may impact the use of emotion regulation strategies in response to stress. Respiratory sinus arrythmia (RSA) may provide a method for reliably measuring the degree to which nervous system activation corresponds with the use of emotion regulation strategies. The current study examined basal RSA and RSA reactivity in a stress induction task in 177 (85% female) undergraduates. We examined emotion regulation in response to challenging events through 42 ecological momentary assessments. We hypothesized moderate RSA reactivity in the presence of high basal RSA would predict use of adaptive strategies, and excessive or muted RSA reactivity and/or low basal RSA would predict use of maladaptive strategies. Results indicated joint effects of basal RSA and quadratic RSA reactivity for maladaptive strategies: rumination ($\beta = -0.006$ [0.002], $p < .001$) and suppression ($\beta = -0.010$ [0.002], $p < .001$). However, there was not a significant interaction between basal RSA and quadratic RSA reactivity for adaptive strategies: problem solving ($\beta = -0.001$ [0.002], $p = .543$) or cognitive reappraisal ($\beta = -0.009$ [0.005], $p = .056$). Further examination of the joint effects indicated the highest use of maladaptive strategies were found in individuals with high basal RSA and very low RSA reactivity. Thus, RSA may be a reliable predictor of an individual's tendency to use maladaptive emotion regulation strategies in response to daily stressful events.

3–076 | BOREDOM AND MOTIVATIONAL CONTROL: INSIGHTS FROM FRONTAL ASYMMETRY?

Micayla Lacey[1], Philip Gable[2]
[1]*The University of Alabama,* [2]*University of Delaware*

Descriptors: Motivation, Boredom, Frontal Asymmetry.

Recently, theorists have posited that boredom may be associated with motivational states, including motivational control processes. Little work, however, has examined this empirically, perhaps due to the difficulty of examining boredom. Prior research has suggested that motivational control may be associated with increased relative right frontal cortical activity. Examining frontal asymmetry during experiences of boredom may provide insight into the relationships between motivational control and boredom. In the current study, electroencephalography was measured as 70 participants completed a modified *n*-back task designed to induce varying levels of boredom. Results revealed that self-reported task engagement was associated with increased relative right frontal activity during the most boring section of the task, but not during sections of the task perceived to be less boring. This finding

suggests that engagement with the task during the boring condition required higher motivational control than engagement with the task during non-boring conditions.

3–078 | ELECTROPHYSIOLOGICAL EFFECTS OF VIBROTACTILE DISCRIMINATION TRAINING OF COMPLEX SOUNDS IN PARTICIPANTS WITH PROFOUND DEAFNESS

Vanessa Ruiz-Stovel, Andrés González-Garrido, Fabiola Gómez-Velázquez, Carlos Soto-Nava, Geisa Gallardo-Moreno
University of Guadalajara

Descriptors: profound deafness, vibrotactile discrimination, P300
Early auditory deprivation strongly impacts oral language development, as well as the perception of environmental sounds that play an important role in daily life. Hence, vibrotactile stimulation has been explored as an alternative method that allows sound perception and discrimination. Previous studies have demonstrated that profoundly deaf (PD) can learn to discriminate the frequency and temporal duration of pure-tones, but the discrimination of complex sounds has not been investigated. This study compares electrical brain activity in 17 PD participants and 17 normal-hearing (NH) controls, while they performed a Continuous Performance Task, before and after a brief training program. A portable device worn on the right index finger-tip delivered the stimuli consisting of 5 animal sounds (target: barking 20%; non-target: mooing, neighing, braying or trumpeting, 80%). Behavioral results showed PD significantly decreased false alarms and a hit rate ceiling effect in both groups. The P300 peak amplitude latencies revealed a group training effect. In the NH, changes in the amplitude and topographical distribution of the P3 waveform were more pronounced. Neural changes associated with vibrotactile complex sound discrimination training in PD were characterized by greater variability. In sum, results may be due to underlying neurodevelopmental differences and distinct cognitive strategies. Our findings set the basis for future research aiming to clarify the dynamic neural changes related to the training of vibrotactile discrimination of complex sounds and linguistic stimuli.

3–079 | VALIDATION OF A WIRELESS AND MOBILE EEG SYSTEM WITH MINIMAL ELECTRODE PREPARATION

Colt Coffman, Matthew Pontifex
Michigan State University

Descriptors: EEG, Validation, ERP
The aim of the present investigation was to validate the 8-channel wireless Unicorn Hybrid Black amplifier to determine if it provides comparable data to a traditional laboratory-based system when no electrode preparation is utilized (i.e., dry) or if a saline-based solution may be utilized to enhance signal quality. Electroencephalogram (EEG) activity was concurrently recorded in 13 college-aged adults (11 female) using both the Unicorn Hybrid Black amplifier and a Neuroscan SynAmpsRT amplifier while EEG frequency spectra and event-locked activity were assessed in response to an eyes closed task and an oddball task. Our analyses examined the correlation between data from each system for log power spectral activity and target-locked activity (oddball task) data in both the dry preparation condition and the saline preparation condition. Findings from the present investigation suggest that the Unicorn Hybrid Black provides valid measures for investigations of frequency spectra even with no conductive solution applied. However, the use of a saline solution for electrode preparation is preferable for valid assessments of event-related brain potentials. Accordingly, the Unicorn Hybrid Black provides a valid means of obtaining high-quality EEG measures comparable to a traditional wet-EEG approach. The mobility of the Unicorn Hybrid Black allows researchers to integrate well-established psychophysiological measures into school, clinical, and remote settings, as well as increase accessibility to special populations when it may be prohibitive to use a traditional wet-EEG approach.

3–080 | EEG AGE-RELATED CHANGES DURING FACIAL PROCESSING IN CHILDREN

Julieta Ramos-Loyo[1], Paola Olguín-Rodríguez[2,3], Sara Espinosa-Denenea[1], Luis Llamas-Alonso[1], Sergio Rivera-Tello[1], Markus Müller[3]
[1]University of Guadalajara, [2]National Autonomous University of Mexico, [3]Autonomous University of Morelos State

Descriptors: EEG, children, face processing
Functional brain development in children have been revealed by different methods used to analyzed brain

electrical activity (EEG). Some studies have been conducted both at rest and during cognitive task performance. However, few studies have addressed facial emotional processing in spite of its socioemotional relevance. The purpose of the present study was to evaluate EEG changes in the event related potentials (ERP), absolute power, the power spectrum slope and functional connectivity during face processing. We recorded the EEG of 3 groups of children (6, 8, and 10 years) while performing 2 odd-ball tasks. Children had to identify the sex in one of the tasks, and the happiness expression in the other one. Performance in both tasks improved and ERP latencies shortened with higher age. The power spectrum slope, as well as delta and theta absolute power decreased, while alpha band increased as age increased. In addition, the two older groups showed higher correlation values between regions associated with the attentional and face processing networks compared to the 6-year-olds. Moreover, correlation values increased during task performance. Present results suggest that face processing, like other cognitive processes, improves with higher age associated to maturational EEG changes that reflect faster processing, changes in brain activation and higher synchronization of related processing networks. These changes may be directly related to a higher efficiency of cognitive functioning with increasing age. FUNDING: CONACYT (CF-263377).

3–081 | THE IMPACT OF NARRATIVE AND EMOTIONAL INTENSITY ON SMOKERS′ RESPONSES TO ANTI-TOBACCO VIDEOS

Yen-I Lee[1], Di Mu[1], Ashley Churchill[2], Layne Russell[3], Ducan Prettyman[4], Paul Bolls[1]
[1]Washington State University, [2]NielsenIQ, [3]Unaffiliated, [4]Colorado Technical University

Descriptors: Attention, Emotion, Anti-Tobacco
This study is focused on investigating how smokers process anti-tobacco ads varying in narrative (strong/weak) and emotional intensity (low/moderate/high). High emotional intensity evokes defensive responses. This study advances that work by exploring how narrative might moderate responses to emotionally intense ads. A within-subjects 2 (Narrative) X 3 (Emotional Intensity) X 3 (Ad) repeated measures design was employed. Ads varied in length but were averaged into 24 data points across time per ad for analysis. Ads were blocked by Narrative X Emotional Intensity condition and blocks of ads were presented in random orders. Smokers ($N = 32$) were recruited to complete the study. Heart rate (cognitive resources allocated to encoding) and Skin conductance (arousal) were recorded during exposure to the 18 ads viewed. Participants completed a measure of probability (0–100) that the type of ads shown would make them consider quitting smoking immediately after each block of ads. There was a significant Narrative X Emotional Intensity X Time interaction on heart rate. At moderate intensity, ads with a weak narrative engaged more resources allocated to encoding than strong narrative ads. The opposite was true for high-intensity ads. There was a significant effect of ad condition on considering quitting smoking. High-intensity ads were most effective regardless of narrative. Low-intensity weak narrative ads were the least effective. It appears that strength of the narrative in anti-tobacco ads may change the effects of emotional intensity of the ad on responses.

3–082 | ALL AUDIENCES ARE NOT THE SAME: PSYCHOPHYSIOLOGICAL MEASURES ENHANCE TRAFFIC SAFETY VIDEO DEVELOPMENT FOR HIGH AND LOW SENSATION SEEKERS

Marcia Howell[1], Paul Bolls[2], Anthony Almond[3]
[1]Alaska Injury Prevention Center, [2]Washington State University, [3]MediaScience

Descriptors: Attention, Emotion, Traffic Safety
Deaths and injuries from traffic crashes are a worldwide health concern. Safe driving videos are used to improve driver safety. This study used psychophysiological measures to discern differences in the processing of graphic scenes in traffic safety videos between audiences with low and high levels of sensation seeking. Psycho-physiological measures included attention (heart-rate), arousal (skin conductance), and emotional intensity (corrugator). Based on their over-representation in traffic crashes, 75 males aged 20–30 were the recruited for this study. Participants were divided into those with low (n = 18) and high (n = 17) levels of sensation seeking. Neutral sensation seekers were excluded from this analysis (n = 40). Participants viewed crash scenes in two videos. One depicted a highly graphic crash scene, and the other led up to the crash scene but left the consequences to the audience's imagination. Results indicate that low sensation seekers experienced psychological reactance during the highly threatening graphic scene. In contrast, the high sensation seeking group paid attention throughout the highly graphic threatening scene. The video that left the crash consequences to the audience's imagination held the attention and arousal of those with low levels of sensation seeking. In contrast, the high sensation seeking group stopped paying attention and had minimal engagement in that video. The results of this current study also help support using psychophysiological

3–083 | COGNITIVE FUNCTION IN ADULTS WHO LIVED AND GREW UP IN AIR-POLLUTED ENVIRONMENT AND ROLE OF AUTONOMIC NERVOUS SYSTEM: THE 4HAIE STUDY

Vera Jandackova, Steriani Elavsky, Daniel Jandacka
University of Ostrava, Ostrava

Descriptors: Cognitive function, Air pollution, Autonomic nervous system

Air pollution is thought to be an environmental neurotoxin that may affect cellular and molecular events in the brain. Evidence about its impact on cognitive development remains inconclusive. We assessed whether exposure to air pollution throughout one's life, including childhood, is associated with cognition in adulthood and how this differs by age. We further examined the role of autonomic functioning. Data from the Czech study Healthy Aging in Industrial Environment (4HAIE) were used. Analysis included 379 adults aged 18–65 yrs who reported to have spent at least the first 10 yrs of their life in either a region with high or low air-pollution. Cognitive score was calculated as the sum of standardized scores from 5 tests of memory and executive function (RAVLT, Flanker, SetShift, Nback and 2Nback). Autonomic function was indexed by measures of 5 min supine heart rate variability (HRV). Multivariable regression revealed that on average, adults from polluted region had higher cognitive performance than those from control region. However, the interaction term between region and age showed that for every 1 yr increase in age, there was a lower cognitive score in those from polluted region, compared to those from the control region. The model accounted for sex, education, economic status, fitness level, fatique and noise during testing. We didn't observe any association of HRV with cognition or region. Our findings may suggest that the negative effect of air pollution becomes evident with the aging process and that autonomic dysfunction is less likely to be a potential mechanism.

3–084 | BEING OPEN BUT SHARP: OPENNESS TO EXPERIENCE ASSOCIATED WITH THE VARIATIONS OF THE ONLINE PROCESSING OF CATEGORY-BASED SEMANTIC RELATEDNESS

Bing Li[1], Qiduo Lin[1], Hoi Yan Mak[1], Ovid J. L. Tzeng[1,2], Chih-Mao Huang[3], Hsu-Wen Huang[1]
[1]City University of Hong Kong, [2]National Taiwan Normal University, [3]National Yang Ming Chiao Tung University

Descriptors: Openness, semantic processing, category
Openness as a personality trait describes the continuum of the need and curiosity for intellectual endeavors. With the behavioral manifestation of high openness as creativity and advanced verbal abilities, Openness is considered highly cognitive; more specifically, it implies potential variations in the underlying cognitive mechanisms of language information processing. To examine such implication, we observed how openness tunes the processing of categorical and semantic associative information with a membership verification task in an ERP experiment. Semantic relatedness is manipulated for category members and nonmembers, thus 4 conditions in category-target pairs in the prime paradigm: high-typicality (HT), low-typicality (LT), related-violation (RV), and non-related violation (NRV). High-openness (HO, Openness>28) and low-openness (LO) participants showed different patterns for ERP results but no difference at the behavioral level. Only HO showed condition main effect on frontal P2, indexing primary processing for basic-level features. On N400, contrasting patterns are observed: LT and RV grouped in HO, LT/RV/NRV grouped against HT in LO. Only HO showed significant difference on RV-NRV. Moreover, differences between related targets (HT, LT, RV) to non-related targets (NRV) are positively correlated with the Openness Score. These results may have associated higher openness with a more aware and sensitive cognitive style that pervades basic semantic processing. This finding extends the understanding of what Openness portrays and differentiates in the general population.

3–085 | EFFECTS OF SET SIZE ON THE ELECTROPHYSIOLOGICAL CORRELATES OF SINGLETON DETECTION

Daniel Tay, David McIntyre, John McDonald
Simon Fraser University

Descriptors: visual search, singleton detection mode, event-related potentials

Reaction-time studies have provided evidence for a singleton-detection strategy that is used to search for salient targets when there is no additional featural knowledge that would help guide attention. Despite this behavioural evidence, there have been few event-related potential (ERP) studies of singleton detection mode because it was reported early on that the ERP signature of attentional selection (the N2pc) is absent without feature guidance. Recently, however, it was discovered that a small and relatively late N2pc occurs in singleton detection mode along with a previously unreported component called the singleton detection positivity (SDP). Here we show that the timing and amplitudes of both components are influenced by the number of items in the display, as one might expect in a salience-based search mode. Specifically, the N2pc and SDP were larger when the set size was increased to make the singleton "pop out" more easily (Experiment 1). The SDP onset latency also depended on set size, whereas the N2pc appeared early for all set sizes, possibly due to carry-over effects from larger set-size trials to smaller set-size trials. In Experiment 2, EEG was recorded with a higher density electrode array to better characterize the scalp topography of the components and to estimate their neural sources. Regional sources near the ventral surface of extrastriate cortex in the occipital lobe explained over 96% of N2pc and SDP activity. These results indicate that searching in singleton detection mode selectively modulates processing within perceptual regions of visual cortex.

3–086 | ISOLATING THE ELECTROPHYSIOLOGICAL CORRELATES OF VISUALLY GUIDED ATTENTION ORIENTING IN HUMANS

John McDonald[1], Daniel Tay[1], David Prime[2], Steven Hillyard[3]
[1]Simon Fraser University, [2]Douglas College, [3]University of California, San Diego

Descriptors: covert orienting, attention, event related potentials (ERPs)
The study of visual attention orienting has been an important impetus for the field of cognitive neuroscience. Seminal reaction-time studies demonstrated that a suddenly appearing visual stimulus attracts attention involuntarily, but the neural processes associated with visually guided attention orienting have been difficult to isolate because they are intertwined with sensory processes that trigger the orienting. Here we isolated visually guided orienting activity from sensory activity using event-related potentials (ERPs). By recording ERPs to a lateral stimulus and comparing waveforms obtained under conditions of attention and inattention, we identified an early positive deflection over the ipsilateral visual cortex that was associated with the covert orienting of visual attention to the stimulus. The VOA was linked with behavioral measures of orienting, being significantly larger when the stimulus was detected rapidly than when it was detected more slowly, and its presence was independent of saccadic eye movements towards the targets. The VOA appears to be a specific neural index of the visually guided orienting of attention to a stimulus that appears abruptly in an otherwise uncluttered visual field. And while it bears resemblance to a well-known ERP component associated with attentional selection (the N2pc), it differs from that component in several aspects.

3-087 | LATE BREAKING
THE ROLE OF FAMILIARITY AND MEMORY RECOLLECTION IN DECREASING THE CONTINUED INFLUENCE EFFECT OF MISINFORMATION: AN ELECTROPHYSIOLOGICAL INVESTIGATION

Sean Guo, Danni Chen, Xiaoqing Hu
University of Hong Kong

Descriptors: Misinformation, Event-related Potentials, Memory Updating
Understanding and preventing the spread of misinformation has become a critical problem in modern society. The continued influence effect of misinformation (CIEM) occurs when exposure to misinformation results in an inaccurate reliance on misinformation even after refutation. This problem is exacerbated when misinformation plays a key causal role in an event. To combat this, there is robust evidence that providing an alternate cause to counter misinformation is more effective than refuting misinformation without providing an alternate cause. Two explanatory models have been debated between: the mental model posits that correct information replaces misinformation, whereas the activation model posits that misinformation and correct information coexist in memory. This study seeks to shed light on this debate by investigating the neurocognitive mechanism behind the CIEM using a novel misinformation paradigm and EEG recording. Participants (n = 44) first learn a series of events and their causes, some of which

are revealed to be misinformation. Then, they undergo a recognition test to differentiate misinformation from correct information. Electrophysiological results show that providing a correct explanation during encoding reduces familiarity and increases recollection of the event during re-exposure to the original misinformation, as evidenced by reduced frontal negativity (FN400) and enhanced late positive complex (LPC). Results suggest a modified mental model is likely: the replaced misinformation is less familiar but still serves as a memory cue for the original event.

3-088 | LATE BREAKING
SUPERIOR NEGATIVE LEARNING IN HEALTHY OLDER WOMEN WITH LARGER ERROR-RELATED NEGATIVITY AMPLITUDES DURING REINFORCEMENT LEARNING

Christian Otteman, Elizabeth Paitel, Kristy Nielson
Marquette University

Descriptors: Sex differences, Reinforcement learning, Error-related negativity

Reinforcement learning (RL) entails learning from feedback to choose favorable outcomes (positive learning) or avoid unfavorable outcomes (negative learning). The error-related negativity (ERN; conflict processing, error detection) is an event-related potential generated by the anterior cingulate cortex (ACC); it notably predicts negative RL. We hypothesized that the ERN in RL would index compensatory recruitment in healthy older adults, with better negative learning related to larger ERN during training. Healthy, cognitively intact elders (n=37, mage=80, 9 male) performed a probabilistic selection task, choosing one from a pair of differentially reinforced stimuli. All effectively learned within six training blocks. Testing paired the stimuli randomly, assessing ability to choose favorable and avoid unfavorable outcomes. Age was covaried. ERN amplitude across frontocentral electrodes during training was maximal at FCz, but at Cz, it correlated with avoiding unfavorable stimuli during testing (p=.007). Further, women had significantly larger ERNs (p=.001) and better negative learning than males (p=.04). More, women with better negative learning had a larger Cz training ERN than either men with better negative learning (p=.002) or women with poorer negative learning (p=.004). Thus, cognitively intact older adults can support RL performance by recruiting additional cortical resources specifically to process the avoidance of negative outcomes in ACC. This may be unique to older women, although the small sample (particularly males) warrants additional study.

3-090 | LATE BREAKING
INTRINSIC FUNCTIONAL CONNECTIVITY BETWEEN THE SALIENCE NETWORK AND LOCUS COERULEUS ASSOCIATED WITH ATTENTION PERFORMANCE

Joshua Neal, Inuk Song, Tae-Ho Lee
Virginia Polytechnic and State University

Descriptors: Attention, fMRI, Locus Coruleus

The LC is a brainstem region associated with broad physiological and neural arousal as part of the release of norepinephrine, but has increasingly been associated with multiple specific cognitive processes, including sustained attention, deficits in which are associated with multiple disorders. Neural Models of attention deficits to date have focused on dysfunctions in the Default Mode Network (DMN), the Fronto-Parietal Network (FPN), and the Salience Network, which have been associated with internal focus, processing of external stimuli, and task-switching respectively. Conflicting findings based on these regions suggest the possibility of upstream signaling leading to attention dysfunction, and previous findings suggest the LC may play this role. In this study, 584 individuals across the lifespan were examined for their resting-state functional connectivity (FC) and behavioral performance on an attention task. Analysis revealed significant clusters connected to the LC activity in the bilateral insula, ACC, and bilateral ventral striatum, regions associated with the Salience Network. Given previous findings that attention deficits may be caused by dysfunctions in network switching by the Salience Network, our findings here further suggest dysfunction in LC signaling to the Salience Network may interfere with attention.

3-091 | LATE BREAKING
WIN, LOSE OR DRAW: DISSOCIATION AND THE EXPERIENCE OF WIN CONDITIONS

Ellen Yates[1], Wendy D'Andrea[1], Greg Siegle[2]
[1]The New School for Social Research, [2]University of Pittsburgh

Descriptors: Dissociation, Reward Learning, fMRI

Dissociation is a symptom of trauma exposure and PTSD widely considered to be clinically significant. Recently, the overmodulation model has become increasingly popular, with evidence suggesting increased cortical regulation of emotion yields dissociative states. Meanwhile, in contrast with older characterizations, mounting evidence regarding the basal ganglia indicates a significantly more complex and integrative role of deep nuclei in habit formation and behavioral regulation. Taken together, these bodies of work suggest that the reward-based learning networks may have a more active role in modulating dissociation than previously thought. In a large transdiagnostic dataset of participants (N=172), fMRI of reward receipt yielded differing levels of BOLD reactivity in certain canonical networks–including the executive, emotion, pain, salience and sensation networks–when grouped by scores on the Dissociative Experiences Scale (DES). Using taxometric analyses and a p-value threshold of 0.05, biological correlates of dissociation were measured in participants at a score on the DES ten points lower than the previously determined threshold of clinical significance. Given that mechanistic correlates of dissociation were visible at lower levels of symptomatology than expected, these results suggest the potential utility of considering these lower levels in the clinical as well as research setting.

3-092 | LATE BREAKING
EFFECT OF SECOND LANGUAGE ACQUISITION AGE ON VISUAL WORD PROCESSING

Ricardo Barba-Medina, Fabiola Gómez-Velázquez, Andrés González-Garrido, Vanessa Ruiz-Stovel
University of Guadalajara

Descriptors: Visual word processing, Bilingualism, ERPs

A fundamental goal in neuroscience of language has been to understand the brain mechanisms that underlie our ability to read. In Mexico, a phenomenon that is becoming more frequent is the ability to read in two languages with different levels of orthographic transparency, Spanish (L1) and English (L2). We examined how the age of either early or late L2 acquisition affects visual word processing during a lexical decision task. We compared a group of 15 early bilinguals (EB) and 15 late bilinguals (LB). All were healthy right-handed young males, who solved a lexical decision task in both L1 and L2. The participants had to respond, if a word or pseudoword was presented on the screen. Simultaneously, an electrophysiological recording was performed to obtain Event-Related Potentials (ERPs). No significant behavioral group differences were found; however, we did observe a lexicality effect with a higher number of correct responses (CR) to words than to pseudowords and a greater number of CR to words in L1. A significant effect of lexicality in reaction time (RT) was also observed with longer RT to pseudowords than words, and a language effect, with higher RT for words and pseudowords in L1. In the ERPs, EB exhibited a higher amplitude positivity around 300 ms in the word condition in both L1 and L2. Despite similar behavioral performance, EB showed different fronto-parietal brain activity patterns suggesting that early bilingualism may facilitate the recruitment of greater attentional resources during word visual processing in either language.

3-093 | LATE BREAKING
SYMPATHETIC NERVOUS SYSTEM REACTIVITY DURING INTERPERSONAL CONFLICT AMONG WOMEN IN PARTNER VIOLENT RELATIONSHIPS: THE ROLE OF POSTTRAUMATIC STRESS DISORDER

Darian Reynero, Donald Godfrey, Julia Babcock
University of Houston

Descriptors: Post-Traumatic Stress Disorder (PTSD), Intimate Partner Violence (IPV)

More than half of female victims of Intimate Partner Violence (IPV) experience symptoms of posttraumatic stress disorder (PTSD). As symptoms of PTSD are characterized by changes in affective processing, those with heightened symptom severity may demonstrate dysregulated sympathetic nervous system (SNS) reactivity within the context of interpersonal conflict. The current study assessed couples (N = 44) with a history of male-to-female physical IPV. Women completed measures of PTSD symptom severity and participated in a conflict discussion with their partner, during which, SNS activity was measured via skin conductance level in thirty second intervals. Using multi-level growth modeling, we found that women's SNS activity demonstrated a curvilinear trajectory across the conflict with SNS activity increasing at the beginning, and then leveling off near the end of the discussion. PTSD symptom severity was correlated with linear changes in SNS activity, such that women with higher PTSD symptom severity experienced stronger initial increases during the conflict, relative to women with average

PTSD symptom severity. Women with no or few symptoms of PTSD did not experience significant linear changes in SNS activity during the conflict. Secondary analysis demonstrated that the association between PTSD severity and SNS reactivity was primarily related to reexperiencing of trauma symptoms and changes in arousal symptoms, but not related to avoidance symptoms. Results suggest that changes in SNS activity during conflict coincides with PTSD symptom severity among female victims of IPV.

3-094 | LATE BREAKING
COGNITIVE LOAD LEADS TO POORER SENSORY ENTRAINMENT

Brendan Huff, Jules Faunce, Bruce Friedman
Virginia Tech

Descriptors: Entrainment, attention, rhythm

The cognitive process of neural entrainment, in which neural oscillations synchronize with a given stimulus, may help improve selective attention. However, the specific conditions that determine the presence and strength of entrainment effects require further investigation. The present study investigated differences in entrainment based on level of engagement with the entrainment stimuli. In the active condition, participants tapped along to stimulus beats, whereas in the passive condition participants simply received the stimuli. Two critical measurements for observing entrainment effects are the amplitude and phase coherence of steady state evoked potentials (SSEPs). Results show that active conditions negatively impacted entertainment, both in SSEP amplitude ($\beta = 0.08$, $t(3038) = -8.872$, $p<.001$) and in SSEP phase coherence ($\beta = -0.05$, $t(3038) = -2.030$, $p= 0.042$). This result allows this study to reject the null hypothesis and suggest that there is a statistically significant difference between the strength of entrainment in the active and passive conditions, with active conditions (cognitive load) leading to weaker entrainment.

3-096 | LATE BREAKING
ENTRAINMENT ECHO POST-STIMULATION BENEFITS ATTENTIONAL PERFORMANCE

Brian Angus, Jules Alex Faunce, Bruce Friedman
Virginia Tech

Descriptors: Attention, Entrainment, Sensory

Neural entrainment, a process of synchronizing oscillations with rhythmic stimuli, may help cognitive functioning. There is an "echo" period where stimuli have ceased but the entrainment and related cognitive enhancements continue for several cycles. The present study examined whether the strength of entrainment during echo periods predicted attentional performance. 23 participants were exposed to auditory and visual stimulation while electroencephalogram was recorded. Entrainment was defined using the amplitude and phase coherence of steady state evoked potentials in 1.25 Hz. After the cessation of the stimuli, participants completed a Flanker task in order to assess if strong entrainment during these echo periods predicted attention or not. Entrainment amplitude, but not coherence, predicted better Flanker scores during post-stimulus periods ($\beta = -0.03$, $t(2115) = -2.45$, $p=0.014$; coherence $\beta = 0.01$, $t(2115) = 0.99$, $p=0.324$). This suggests an impact of entrainment echo on acute attentional performance, and that the measure of entrainment matters.

3-097 | LATE BREAKING
ASSOCIATION BETWEEN RESTING-STATE EEG MICROSTATES AND COGNITIVE PROCESSES DURING EARLY CHILDHOOD

Armen Bagdasarov, Michael Gaffrey
Duke University

Descriptors: Resting-State, Error-Related Negativity, Children

To understand the association between intrinsic activity and developing cognitive processes during early childhood, we assessed the relationship between EEG microstates during rest and a go/no-go task. Microstates represent transient periods of synchronized neural activity evolving dynamically over time. During rest, cognitive control-related networks have commonly generated a microstate with a frontocentral topography, canonically labeled microstate D. The error related negativity (ERN) is a response-locked negative deflection occurring after an error. Participants were 95, 4-to-8-year-old children. The proportion of global explained variance (GEV) accounted for by rest microstate D was calculated for each participant. Microstate analysis of go/no-go data identified a central negative topography -56-104ms relative to error (i.e., error microstate). The GEV of the error microstate and the ERN were calculated for each participant during this period. Linear regression analyses controlling for age and sex revealed that a more negative ERN predicted both higher error microstate GEV (R2=0.36, p<.001) and higher rest microstate D GEV (R2=0.30, p<.001), and that

higher error microstate GEV predicted higher rest microstate D GEV (R2=0.36, p<.001). Results further support microstate D's role in cognitive control and suggest that brain regions supporting error detection may contribute to the functional brain network(s) sources underlying microstate D. Longitudinal research is needed to elaborate the implications of these findings for understanding early cognitive development.

3-098 | LATE BREAKING
THE RELATIONSHIP AMONG MUSICAL TRAINING, PHYSICAL ACTIVITY, AND SENSORY ENTRAINMENT

Brian Angus, Jules Alex Faunce, Bruce Friedman
Virginia Tech

Descriptors: Entrainment, Physical Activity, Music
Musical training and physical activity are both associated with more fine-tuned timing of motor and electrophysiological responses. The interrelationship between these variables and cognitive functioning suggests an underlying mechanism of synchronization of neural oscillations to external stimuli (sensory entrainment). The present study investigated whether musical training and exercise were related to sensory entrainment (1.25Hz amplitude and phase coherence (PC) from electroencephalogram, or EEG) to auditory vs. visual stimulation. 23 participants, sorted into groups based on self-reported years of musical training (cutoff at 2 years) and weekly exercise (cutoff at 3 days per week), were exposed to auditory and visual stimulation while EEG was recorded. Amplitudes of 1.25Hz steady state evoked potentials were lower during visual than during auditory stimulation (β =-0.08, t(17)=-5.72, p<.001). Counter to expectation, high exercisers and musically trained people did not entrain better in general (for amplitude, β(exercise) =-0.29 , t(17)=-1.48, p=0.156; β(music) =0.04, t(17)=0.23, p=0.824; for PC, β(exercise) =.001¬¬¬, t(17)=0.01, p=0.996, β(music) =.04, t(17)=0.33, p=0.745). However, both musical experience and exercise moderated the effect of stimulus modality on entrainment amplitude, with musically trained people and high exercisers showing relatively better visual entrainment (β(exercise) =-.04, t(1174) =-2.87, p=.004; β(music) =-0.03, t(1174) =-2.02, p=.043). The results may illustrate that musical training and frequent exercise promote visual entrainment.

3-099 | LATE BREAKING
CHANGES IN RESTING STATE FUNCTIONAL CONNECTIVITY BEFORE AND AFTER COGNITIVE PROCESSING IN TYPE-1 DIABETES

José Gómez-Barba, Aurora Espinoza-Valdez, Geisa Gallardo-Moreno, Andrés González-Garrido
University of Guadalajara

Descriptors: Type 1 Diabetes, Resting-State, fMRI
Previous research on Type 1 Diabetes (T1D) suggests that the deleterious effects on cognitive processing may depend on different brain functional connectivity. We have reported that T1D patients show higher task-related connectivity indices than healthy controls since the initial stages of working memory (WM) processing. However, little is known of resting-state (RS) functional connectivity in these patients. Therefore, we aimed to compare global efficiency and cluster coefficient in the functional RS connectivity of 20 T1D-patients and their matched healthy controls before and after performing a WM task. During the first RS sequence (RS1) participants were scanned for 10 minutes with their eyes open. Then, they were scanned while performing a visuospatial WM task consisting of the serial presentation of 4 neutral or happy faces in different spatial positions, followed by a second series of 4 faces. Participants had to indicate whether the second series appeared in the reverse spatial order of the first one. After the task, a second RS sequence (RS2) was acquired. There were no between-group behavioral differences in the WM task. Still, our results confirm that T1DM modifies brain functional RS connectivity in terms of global efficiency and cluster coefficient in both RS1 and RS2. The different basal brain functional activation patterns observed between the groups suggest that the cognitive activity of patients with T1D could be affected by the preceding RS-connectivity, which could also be modifying the availability of resources for subsequent cognitive processing.

3-100 | LATE BREAKING
SENSORY ENTRAINMENT NOT AFFECTED BY ATTENTION DEFICIT OR STIMULANT USE

Sonia Warrior, Alex Faunce, Bruce Friedman
Virginia Tech

Descriptors: ADHD, Entrainment, Stimulant
Neural entrainment, or the synchronization of neural oscillations to repeated stimuli, is a phenomenon that occurs widely in nature. Neural entrainment can be measured by both amplitude and phase alignment of steady state

evoked potentials. Studying this phenomenon can provide insights on individual differences in learning and information processing. In this study, we explored the effect of attention deficit hyperactivity disorder symptom severity as well as stimulant use on neural entrainment in a sample of 23 undergraduates. Participants filled out the Adult ADHD Self Report Scale (ASRS), and reported use of caffeine and attention deficit medication in the past 8 hours. Electroencephalography was recorded while participants were exposed to repetitive rhythmic and nonrhythmic visual and auditory stimuli in 1.25 Hz. Neural entrainment was measured using intertrial phase coherence and frequency tagging of steady state evoked potentials in 1.25 Hz. It was found that neither stimulant use nor ADHD symptom severity impacted entrainment (for amplitude: β(stimulants) = 0.24, t(17)= 1.12, p= 0.238; β(ASRS) = 0.22, t(17)= 1.10 , p= 0.286; for ITPC, β(stimulants) = 0.21, t(17)= -1.73, p=0.102; β(ASRS) = -0.01, t(17)= -0.12, p=0.910). These results suggest that attention deficit symptoms and stimulant use do not impact sensory entrainment, which runs counter to prior research.

3-101 | LATE BREAKING
THE IMPACT OF NEURAL ENTRAINMENT METRIC ON THE RELATIONSHIP BETWEEN SENSORY ENTRAINMENT AND ATTENTION PERFORMANCE

Arthur Louie Deapera, Jules Alex Faunce, Bruce Friedman
Virginia Tech

Descriptors: Entrainment, Sensory, Flanker
Sensory entrainment describes the synchronization of neural oscillations to rhythmic sensory stimulation. Entrainment is related to attention. However, different measures of entrainment exist, and these measures may differ in the information that they provide about behavior. In the present study we investigated whether entrainment amplitude or phase coherence (PC) was a better predictor of attentional performance due to sensory entrainment stimulation. Electroencephalogram (EEG) measurements were recorded while participants were exposed to trains of repetitive visual and auditory stimuli. Before and after each train of stimuli, participants responded to Flanker test questions. The measures of entrainment were amplitude and PC of 1.25-Hz steady state evoked potentials. The results from the analysis indicate that either amplitude nor PC were associated with differences in the

Flanker effect (β(amplitude) = .0001, t(2889) = -0.36, p= .721; β(PC) = .007, t(2889) = 0.318, p= 0.751). The results suggest that entrainment may not directly affect attentional performance as measured by the Flanker test.

3-103 | LATE BREAKING
PRELIMINARY EVALUATION OF THE UTILITY OF AN APP-BASED SLOW BREATHING TOOL FOR ASSESSING INTERVENTION COMPLIANCE IN REAL WORLD SETTINGS

Neel Muzumdar, Venkatasai Jonna, Marsha Bates, Jennifer Buckman
Rutgers University

Descriptors: HRV Biofeedback, Resonance Breathing, RRI
Resonance breathing, an active element of heart rate variability biofeedback (HRVB), shows promise to protect against escalations in craving during outpatient treatment for substance use disorders (SUD). Yet, no studies have directly linked HRVB-induced physiological changes to proximal affective states. The advent of smartphone apps that pair breathing pacers with photoplethysmography (PPG) offer a chance for resonance breathing to be practiced on demand and grants insight into real-time physiological reactions to negative and stressful states outside the lab. As a first step, we evaluated whether PPG data could be used to assess compliance to a breathing intervention. This study used data from an 8-week randomized clinical trial (RCT) in which women in a SUD treatment program were asked to use an iPhone app (CameraHRV) preset with a breathing pacer timed to 0.1Hz (resonance) or 0.23Hz (sham) for 5min in the face of urges. The intervention period was bookended with lab sessions wherein research-grade ECG data were collected during paced breathing. Usable PPG data were available from 47 of 77 RCT participants (1204 total app uses). Their spectral characteristics were qualitatively compared to those obtained from the ECG. In the resonance breathing group, 238 of 497 uses (48%) exceeded 250s minimum. Of these, 74 uses (24%) generated the expected RRI spectral peak indicative of resonance breathing, though signal noise due to distractors was common. These preliminary analyses suggest that PPG may be used to assess compliance to breathing interventions in real-world contexts.

Index to Abstract Authors

PSYCHOPHYSIOLOGY SPR | WILEY

Index to Abstract Descriptors