47. Jahrestagung

Psychologie und Gehirn

16. - 18. Juni 2022

UNI FREIBURG

GENERAL INFORMATION

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The Psychologie und Gehirn (PuG) 2022 conference is organised in close collaboration with the Fachgruppe Biologische Psychologie und Neuropsychologie of the German Psychological Association (DGPs) and the Deutsche Gesellschaft für Psychophysiologie und ihre Anwendung (DGPA). We thank both speakers, Prof. Hartwigsen (DGPs) and Prof. Hewig (DGPA), for their support in the scientific committee.

Contact

Website: `https://pug2022.de`
E-Mail: info@pug2022.de

Acknowledgements

We want to express our thanks to all sponsors for their invaluable financial support. Furthermore, we are grateful for the support of our student assistants in the run-up to the conference and their continuous support during the days of the meeting, ensuring that every question gets answered and every problem gets solved.

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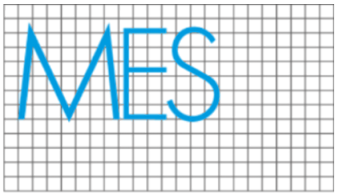
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Welcome to Freiburg


Liebe Kolleginnen und Kollegen,

wir freuen uns, Sie vom 16.-18. Juni 2022 zur 47. Jahrestagung „Psychologie und Gehirn“ an der Albert-Ludwigs-Universität in Freiburg willkommen zu heißen! Die gemeinsam mit der Fachgruppe Biologische Psychologie und Neuropsychologie der Deutschen Gesellschaft für Psychologie (DGPs) und der Deutschen Gesellschaft für Psychophysiologie und ihre Anwendung (DGPA) organisierte Tagung bietet ein breites Spektrum von den neurobiologischen Grundlagen des Verhaltens bis zur anwendungsorientierten psychologischen Forschung. Das diesjährige Tagungsprogramm bietet neben 36 wissenschaftlichen Symposien und zwei Postersessions mit 250 Posterbeiträgen drei hochkarätige Hauptvorträge mit Prof. Dr. Andreas Meyer-Lindenberg, Prof. Dr. John Cryan und Prof. Dr. Brigitte Röder.

Es freut uns besonders, dass wir – nach langer Ungewissheit – eine Tagung vor Ort ermöglichen können. Für viele bei der Tagung aktive junge Forschende ist dies die erste wissenschaftliche Tagung in Präsenz, und für so manch anderen die erste „echte“ Tagung seit Jahren.

Wir wünschen Ihnen vielfältige Gelegenheiten zu Austausch und Vernetzung und hoffen, dass Sie auch etwas Zeit finden, die südbadische Atmosphäre in der Stadt zu genießen.

Wir freuen uns, Sie so zahlreich in Freiburg begrüßen zu dürfen!

Markus Heinrichs und Monika Schönauer
für das gesamte Organisationsteam

Freiburg im Juni 2022

Dear Colleagues,

We are pleased to welcome you to the 47th Annual Meeting "Psychologie und Gehirn" at the Albert-Ludwigs-Universität in Freiburg from June 16-18, 2022! Organized jointly with the Fachgruppe Biologische Psychologie und Neuropsychologie of the German Psychological Association (DGPs) and the Deutschen Gesellschaft für Psychophysiologie und ihre Anwendung (DGPA), this conference offers a broad spectrum spanning the neurobiology of human behavior and its applications in psychology. In addition to more than thirty-five scientific symposia and two poster sessions with 250 poster presentations, we have three renowned keynote speakers: Prof. Dr. Andreas Meyer-Lindenberg, Prof. Dr. John Cryan and Prof. Dr. Brigitte Röder.

After a long period of uncertainty, we are particularly happy that our meeting can be held in person. For many of the attending young researchers, this will be their first in-person conference, and for many others, their first "real" meeting in years.

We wish you plenty of great opportunities for exchange and networking and we hope that you will also find some time to enjoy the great South Badonian atmosphere in the city.

It is our great pleasure to welcome so many of you in Freiburg!

Markus Heinrichs and Monika Schönauer
on behalf of the organizing team

Freiburg, June 2022

Contents

Program at a glance

DONNERSTAG | 16.06.2022

Symposia I 8:30 – 10:00	*KG I, HS 1098*	*S01* - Metacognitive Functions: Error Monitoring and Decision Confidence *CHAIR: Prof. Dr. Jutta Stahl | Prof. Dr. Stefan Bode*
	KG I, HS 1199	*S02* - Tomorrow's troubles, today's tools: Psycho-physiological predictors of stress responses in prospective longitudinal Studies *CHAIRS: Dr. Lara Puhlmann | Prof. Dr. Jens Prüssner*
	KG I, HS 1221	*S03* - What Virtual Reality can tell us about behavior and physiology in face-to-face social interactions *CHAIR: Dr. Lea Hildebrandt | Dr. Jonas Großekathöfer*
	KG I, HS 1015	*S04* - Individual differences in emotion regulation (choice): From neurobiological mechanisms to implications for well-being and clinical application *CHAIR: Dr. Anne Gärtner*
	KG I, HS 1010	*S05* - IGOR Symposium: Advances in Open and Reproducible Practices for Biological Psychology and Human Neuroscience *CHAIRS: Dr. Gordon Feld | Dr. Tina Lonsdorf*
	10:00 - 10:30 *Prometheushalle*	**Kaffeepause**
	10:30 - 10:45 *KG I, Aula* *HS 1010 (Stream)*	**Begrüßung und Tagungseröffnung**
	10:45 – 11:45 ***KG I, Aula*** ***HS 1010 (Stream)***	**Keynote | Prof. Dr. Andreas Meyer-Lindenberg** Zentralinstitut für Seelische Gesundheit, Mannheim
	11:45 – 13:00	**Mittagspause**
	12:00 – 13:00 *KG I, HS 1009*	**Roundtable IGOR**
Symposia II 13:00 – 14:30	*KG I, HS 1015*	*S06* - Electrophysiological Correlates of Cognitive Control *CHAIRS: Prof. Dr. Thomas König | Prof. Dr. Kyle Nash*
	KG I, HS 1098	*S07* - Updates on complementary memory systems in the brain *CHAIRS: Dr. Roland Benoit | Dr. Heidrun Schultz*
	KG I, HS 1221	*S08* - Behavioral and Psychological Effects of Sex Hormones *CHAIRS: Dr. Bernadette von Dawans | Dr. Frances Chen*
	KG I, HS 1199	*S09* - (Neuro)biologically informed psychotherapy: Approaches and developments *CHAIRS: Dr. Christian Paret | Prof. Dr. Peter Kirsch*
	KG I, HS 1010	*Poster-Blitz*
	14:30 – 16:00 *Prometheushalle*	**Kaffeepause**
	14:30 – 16:00 *UB Freiburg*	**Postersession**
Symposia III 16:00 – 17:30	*KG I, HS 1098*	*S10* - P300 and much more: A Tribute to Rolf Verleger *CHAIR: Prof. Dr. Edmund Wascher*
	KG I, HS 1010	*S11* - Recent advances in non-invasive brain stimulation *CHAIRS: Prof. Dr. Til Ole Bergmann | Dr. Gesa Hartwigsen*
	KG I, HS 1199	*S12* - Attentional dynamics in face perception and social interaction *CHAIRS: Prof. Dr. Gregor Domes | Prof. Dr. Matthias Gamer*
	KG I, HS 1221	*S13* - Einfluss traumatischer Kindheitserfahrungen auf soziale und emotionale Prozesse – eine transdiagnostische Perspektive *CHAIR: Dr. Katja Seitz | Prof. Dr. Christian Schmahl*
	KG I, HS 1015	*S14* - Biological targets of early childhood adversity -genetic, epigenetic and imaging findings *CHAIRS: Prof. Dr. Robert Kumsta |Dr. Miriam Schiele*
	17:45 – 19:00 *KG I, HS 1010*	**Mitgliederversammlung DGPA**
	19:00 – 20:15 *KG I, HS 1010*	**Mitgliederversammlung DGPs**

FREITAG | 17.06.2022

	8:00 - 8:30 *KG I, Aula*	**Interessensgruppen**
Symposia IV 8:30 – 10:00	*KG I, HS 1010*	*S15* - Psychological and Neural Underpinnings of Curiosity *CHAIR: Prof. Dr. Nico Bunzeck*
	KG I, HS 1098	*S16* - Acquiring and extinguishing fears: The modulating role of cognitive, biological, environmental and developmental factors *CHAIR: Dr. Valerie Jentsch*
	KG I, HS 1199	*S17* - Moderators of social connectedness: neurobiological mechanisms and clinical implications *CHAIRS: Dr. Dirk Scheele | Prof. Dr. Alexander Lischke*
	KG I, HS 1015	*S18* - Brain and behavioral plasticity in the context of early adversity -across the lifespan and generations *CHAIRS: Dr. Katharina Pittner | Dr. Nora Moog*
	10:00 - 10:30 *Prometheushalle*	**Kaffeepause**
Symposia V 10:30 – 12:00	*KG I, HS 1015*	*S19* - How Real is Virtual Reality? Evidence from Explicit, Implicit and Physiological Measures *CHAIR: Dr. Marius Rubo*
	KG I, HS 1010	*S20* - Deciphering the memory function of the sleeping brain *CHAIRS: Dr. Marit Petzka | Dr. Thomas Schreiner*
	KG I, HS 1098	*S21* - How oxytocin and sex hormones affect social cognition *CHAIRS: Prof. Dr. Katja Bertsch | Prof. Dr. Gregor Domes*
	KG I, HS 1199	*S22* - The Neurobiological foundations of psychotherapy for anxiety disorders *CHAIRS: Prof. Dr. Martin Herrmann | Prof. Dr. Ulrike Lueken*
	12:00 – 13:00 *KG I, HS 1009*	**Roundtable JuWis**
	12:00 – 13:00	**Mittagspause**
	13:00 – 14:00 *KG I, Aula*	**Preisverleihung**
	14:00 - 15:30 *Prometheushalle*	**Kaffeepause**
	14:00 – 15:30 *UB Freiburg*	**Postersession**
	15:30 – 16:30 *KG I, Aula HS 1010 (Stream)*	**Keynote | Prof. Dr. John F. Cryan** Department of Anatomy & Neuroscience, University College Cork
Symposia VI 16:30 – 18:00	*KG I, HS 1199*	*S23* - Personality Neuroscience: A walk through the garden of forking paths *CHAIRS: Prof. Dr. Anna-Lena Schubert | Dr. Kirsten Hilger*
	KG I, HS 1015	*S24* - Social learning: Learning from and about others *CHAIR: Prof. Dr. Grit Hein*
	KG I, HS 1010	*S25* - The social side of stress *CHAIRS: Prof. Dr. Katja Wingenfeld |Prof. Dr. Oliver T. Wolf*
	KG I, HS 1098	*S26* - The gut microbiome and mental health *CHAIR: Dr. Else Schneider*
	19:00 *Ballhaus*	**Gesellschaftsabend**

Samstag | 18.06.2022

Symposia VII 9:00 – 10:30	*KG I, HS 1010*	*S27* - Prediction in language: from sensation to semantics *CHAIR: Prof. Dr. Milena Rabovsky*
	KG I, HS 1199	*S28* - A Neuroscience Perspective on Prospective Memory Across the Lifespan *CHAIRS: Dr. Jessica Peter | Dr. Sebastian Horn*
	KG I, HS 1221	*S29* - The effects of social touch on emotion, cognition and health *CHAIRS: Dr. Monika Eckstein | Dr. Rebecca Böhme*
	KG I, HS 1098	*S30* - Risk and Resilience Factors for the Development of Neurodevelopmental Disorders *CHAIRS: Dr. Valerie Brandt | Dr. Dennis Golm*
	KG I, HS 1015	*S31* - Cardiac and brain parameters of self & other emotion processing and regulation *CHAIRS: Dr. Laura Kaltwasser | Dr. Simón Guendelman*
	10:30 - 10:45 *Prometheushalle*	**Kaffeepause**
	10:45 – 11:45 ***KG I, Aula*** ***HS 1010 (Stream)***	**Keynote | Prof. Dr. Brigitte Röder** Biologische und Neuropsychologie | Universität Hamburg
Symposia VIII 11:45 – 13:15	*KG I, HS 1010*	*S32* - Neurophysiological correlates of inter-individual differences: The role of situational variables *CHAIR: Dr. Katharina Paul*
	KG I, HS 1199	*S33* - The (un)familiar face: from neurobiology to psychophysiological mechanisms and clinical implications *CHAIRS: Dr. Mareike Bayer | Dr. Florian Bublatzky*
	KG I, HS 1015	*S34* - Digital Methods for Induction, Measurement and Reduction of Acute Psychosocial Stress *CHAIR: Prof. Dr. Hanna Drimalla*
	KG I, HS 1221	*S35* - Interozeptive Verarbeitung bei Psychopathologie: pharmakologische und neurophysiologische Konzeptualisierungen und Interventionen *CHAIRS: Prof. Dr. André Schulz | Prof. Dr. Katja Bertsch*
	KG I, HS 1098	*S36* - Prediction perspectives on perception *CHAIR: Prof. Dr. Nicole Wetzel*

Thursday | 16 June 2022

Keynote

Prof. Dr. Andreas Meyer-Lindenberg

Gehirn und Umwelt, Risiken und Resilienz

Thursday, 10:45 - 11:45 | KG I, Aula

Psychische Störungen sind häufig und schwerwiegend und sollten idealerweise präventiv angegangen werden. Bezogen auf die neurowissenschaftliche Forschung begründet das ein Interesse der Art und Weise, wie validierte Risiko- und Resilienzfaktoren auf das Gehirn einwirken. Dieser Ansatz soll im Kontext vom Umweltrisikofaktoren (z.B. Urbanizität) und Resilienzfaktoren (z.B. Naturerleben) vorgestellt werden. Es ergibt sich, dass Umweltrisiko- und resilienzfaktoren auf ein konvergentes Hirnsystem einwirken. In dessen Zentrum steht das perigenuale anteriore Zingulum in Verbindung mit limbischen Strukturen, die es reguliert (Amygdala, ventrales Striatum) und präfrontale Regionen, die wiederum das Zingulum regulieren. Aus diesen Befunden lassen sich therapeutische und in der Zukunft primärpräventive Ansätze ableiten. Dies soll am Beispiel der Stadtlebenswelt erläutert werden.

Andreas Meyer-Lindenberg, *in Deutschland seit 2007, ist Direktor des Zentralinstituts für Seelische Gesundheit, Mannheim, Ärztlicher Direktor der dortigen Klinik für Psychiatrie und Psychotherapie sowie Lehrstuhlinhaber für Psychiatrie und Psychotherapie an der Universität Heidelberg. Er ist Facharzt für Psychiatrie und Psychotherapie sowie für Neurologie. Bevor er 2007 die Position in Mannheim übernahm, war er zehn Jahre als Wissenschaftler am National Institute of Mental Health, Bethesda, USA, tätig. Er ist Autor von mehr als 480 referierten Artikeln und Buchkapiteln. Seit 2014 gehört er kontinuierlich zu den am meisten zitierten Wissenschaftlern der Welt (www.isihighlycited.com). Er ist federführender Herausgeber der neuen Zeitschrift der ECNP Neuroscience Applied, Herausgeber von Science Advances und Mitherausgeber einer Reihe anderer Zeitschriften. Die Forschungsinteressen von Professor Meyer-Lindenberg liegen in der Entwicklung von neuen Behandlungsmethoden für schwere psychische Störungen, insbesondere der Schizophrenie, durch Anwendung von multimodalem Neuroimaging, Genetik und sozialen Neurowissenschaften. Professor Meyer-Lindenberg erhielt eine Vielzahl von Auszeichnungen, unter anderem: Joel Elkes International Award for Clinical Research der ACNP (2006), A.E. Bennett Award der SfBP (2007), NARSAD Distinguished Investigator Award (2009), Kurt-Schneider-Wissenschaftspreis (2010), Hans-Jörg Weitbrecht-Preis für Klinische Neurowissenschaften (2011), ECNP Neuropsychopharmacology Award (2012), Prix ROGER DE SPOELBERCH (2014), CINP Lilly Neuroscience Clinical Research Award (2016).*

Symposia

Symposia I

S01 - Metacognitive Functions: Error Monitoring and Decision Confidence

Thursday, 8:30 - 10:00 | KG I, HS 1098

Session chair(s): **J. Stahl**[1], **S. Bode**[2] ([1] Universität zu Köln, Deutschland | [2] University of Melbourne, Australia)

The coordination of complex actions requires the processing of task-relevant information and the continuous accumulation of evidence regarding the decision's quality on a metacognitive level. The symposium will focus on determinants of decision confidence and error monitoring, two crucial metacognitive functions. The first talk introduces challenges of error processing when multiple tasks are performed at the same time. A series of EEG and behavioral studies will elucidate how error monitoring is affected by dual-tasking interference, and how the brain deals with interference to maintain efficient error processing. The second talk presents findings from perceptual decision tasks in which EEG was used to determine pre- and post-decisional neural correlates of decision confidence. It will be demonstrated that the certainty about response correctness is reflected in a pre-decisional frontal component (rather than the CPP), while confidence in error detection is associated with the post-decisional error positivity (Pe). The third talk delivers insights into behavioural adaptation. The study investigates the modulating impact of response monitoring activity on decision parameters of the subsequent trial (decision threshold and drift rate) by combining single-trial ERPs with post-response behaviour and drift-diffusion modelling. The last talk elucidates the antecedences and consequences of motor inhibition errors and interference suppression errors in a complex speeded choice task, and examines variations of these two error types with inhibition-related individual characteristics such as impulsivity, attentional-capacity, and working-memory capacity. A concluding panel discussion will address the question whether error monitoring and confidence processing are two sides of the same coin.

- **S01.1 - Error monitoring in dual-tasking**
  M. Steinhauser, *Catholic University of Eichstätt-Ingolstadt*
- **S01.2 - Electrophysiological correlates of decision confidence for correct and error responses**
  S. Bode, *The University of Melbourne, Australien*
- **S01.3 - Linking Neurophysiological Processes of Action Monitoring to Post-Response Speed-Accuracy Adjustments in a Neuro-Cognitive Diffusion Model**
  A. Mattes, *University of Cologne, Deutschland*
- **S01.4 - Motor Inhibition and Interference Suppression Linked to Individual Differences in Trait-Impulsivity, Selective-Attention and Working-Memory Capacity**
  E. Porth, *Universität zu Köln, Deutschland*

S02 - Tomorrow's troubles, today's tools: Psycho-physiological predictors of stress responses in prospective longitudinal studies

Thursday, 8:30 - 10:00 | KG I, HS 1199

Session chair(s): **L. Puhlmann**[1], **J. Pruessner**[2] ([1] Leibniz Institute for Resilience Research, Mainz, Germany & Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany | [2] Department of Psychology, University of Constance, Germany)

Recent developments in clinical and health psychology set an increasing focus on preventive approaches to mental health. Identifying individuals resilient to or at-risk for developing future neuropsychiatric disorders is essential to facilitate mental health maintenance. However, this task requires well-planned and elaborate study designs. In this symposium we examine how tracking of mental health responses to periods of severe stress during prospective longitudinal studies may provide a unique opportunity to identify mental health predictors. The contributions explore the potential of combining neurobiological and psychological information as both targets and means of prediction to maximize model accuracy. *Marina Giglberger* presents how neural responses to acute stress predict chronic stress perception in daily life over 13 months in an at-risk group of law students. *Bianca Kollmann* presents mental health trajectories during the first COVID-19 lockdown in Germany and work by Ahrens et al. that indicates prospective prediction of these trajectories through hair cortisol concentration and polygenic risk scores. *Jost Blasberg* shows that personality traits prospectively predict subjective and physiological stress load before and during the first lockdown period. *Lara Puhlmann* presents data indicating a dynamic relationship between psychosocial resilience factors and stressor reactivity during different phases of the pandemic. *Antje Riepenhausen* draws on data from the SOEP panel study and presents evidence for psychological risk and protective factors for changes in mental health during the COVID-19 pandemic. We aim to incite methodological and conceptual discussions relating to the nature of prospective prediction, context- and population-specific predictors, and the integration of psycho-physiological measures.

- **S02.1 - Neural responses to acute stress predict chronic stress perception in daily life over 13 months – Findings from the LawSTRESS project**
  M. Giglberger, *Institute of Psychology, University of Regensburg, Regensburg, Germany*
- **S02.2 - Differential mental health trajectories during the first COVID-19 related lockdown and their prediction through hair cortisol and polygenic risk scores**
  B. Kollmann, *Leibniz-Institut für Resilienzforschung*
- **S02.3 - Associations of personality traits, resilience and biological stress during the first wave of Covid-19**
  J. Blasberg, *Institut für Psychosoziale Medizin, Psychotherapie und Psychoonkologie, Universitätsklinikum Jena*
- **S02.4 - Investigating Prospective and Dynamic Associations between Psychosocial Resilience Factors and Stressor Reactivity during COVID-19**
  L. M. Puhlmann, *Leibniz Institute for Resilience Research, Mainz, Germany*
- **S02.5 - Psychological Risk and Protective Factors for Changes in Mental Health During COVID-19: Insights from a German Representative Panel Study**
  A. Riepenhausen, *Charité - Universitätsmedizin Berlin, Department for Psychiatry and Neurosciences | CCM, Research Division of Mind and Brain, Berlin, Germany*

S03 - What Virtual Reality can tell us about behavior and physiology in face-to-face social interactions

Thursday, 8:30 - 10:00 | KG I, HS 1221

Session chair(s): **L. Hildebrandt**[1], **J. Großekathöfer**[2] ([1] Julius-Maximilians-Universität Würzburg | [2] Universität Bielefeld)

How we perceive and interact with others crucially depends on us being immersed in our complex, dynamic environment - however, experimental psychological research largely uses static stimuli in the lab. This discrepancy between our everyday experiences and the predominant research method decreases the validity and generalizability of our findings, especially when researching interactive social situations. Virtual Reality (VR) offers high ecological validity while maintaining a high degree of experimental control, thereby enabling researchers to study socio-affective phenomena, such as how we perceive and react to others, in a dynamic, immersive, and controlled way.
This symposium will highlight different approaches of using VR to study social-affective phenomena, from basic social attention to interpersonal distance, emotional mimicry, to social threat. We will present a variety of data covering behavioral, eye-tracking, and physiological measures. First, *Jonas Großekathöfer* will present a comparison of social attention in real life and spherical videos, highlighting the importance of potential interactions. Second, *Robin Welsch* will discuss how social approach-avoidance processes can be studied in mixed reality. Third, *Leon Kroczek* will discuss the role of social reciprocity on behavior, physiology and experience in virtual interactions using a closed-loop paradigm. Finally, *Lea Hildebrandt* will address whether humans show different autonomic and behavioral defensive states when threatened by an attacker. Taken together, this symposium will illustrate how humans perceive, react to and interact in naturalistic environments. Thereby, we will highlight the promises (and pitfalls) of VR as a multi-faceted technique in the study of social interactive behavior.

- **S03.1 - A direct comparison of social attention in the light of potential face-to-face interactions in the laboratory and the real world**
  J. D. Großekathöfer, *Uni Bielefeld, Deutschland*
- **S03.2 - Proxemics and personality in mixed reality environments**
  R. Welsch, *LMU Munich*
- **S03.3 - How reciprocity shapes social interactions: Insights from Virtual Reality**
  L. Kroczek, *Department of Psychology, Clinical Psychology and Psychotherapy, Regensburg University*
- **S03.4 - Defensive states in response to a threatening attacker in an unconstrained virtual environment**
  L. Hildebrandt, *Universität Würzburg, Deutschland*

S04 - Individual differences in emotion regulation (choice): From neurobiological mechanisms to implications for well-being and clinical application

Thursday, 8:30 - 10:00 | KG I, HS 1015

Session chair(s): **A. Gärtner**[1] (TU Dresden)

Emotion regulation (ER) is an indispensable part of mental health and adaptive behavior. Furthermore, individual differences in the implementation of ER strategies have implications for affect, well-being, and clinical application. In the first talk, *Anne Gärtner* (Technische Universität Dresden) will investigate neural mechanisms in the temporal dynamics of ER via a distancing strategy across four different time intervals (during regulation, immediately after regulation, after 10 minutes, and after one week). A range of strategies can be used to regulate emotions, and people differ widely with respect to which strategies they tend to use in different contexts. These individual differences in the choice and implementation of ER strategies are the focus of the next three talks: Acute stress effects on cognitive ER outcomes and ER choice will be presented in the talk by *Katja Langer* (Ruhr University Bochum). Next, the influence of individual differences in subjective and physiological effort associated with different strategies on ER choice will be discussed in the talk by *Christoph Scheffel* (Technische Universität Dresden). The talk by *Ulrike Basten* (University of Koblenz–Landau) will focus on individual differences in ER choice, their association with regulation ability, and their role for resilience and well-being. Finally, the symposium will close with a translational perspective. *Lena Schindler-Gmelch* (Friedrich–Alexander Universität Erlangen–Nürnberg) will present her study on the predictive role of hair cortisol and ER for ambulatory assessed symptom fluctuation and regulation in posttraumatic stress disorder.

- **S04.1 - Temporal dynamics of emotion relation: Regulatory and post-regulatory effects of distancing**
  A. Gärtner, *Faculty of Psychology, Technische Universität Dresden, Dresden, Germany*
- **S04.2 - Effects of acute stress and cortisol on cognitive emotion regulation**
  K. Langer, *Department of Cognitive Psychology, Institute of Cognitive Neuroscience, Faculty of Psychology, Ruhr University Bochum, Germany*
- **S04.3 - Impact of subjective effort and personality traits on emotion regulation choice**
  C. Scheffel, *Professur für Differentielle und Persönlichkeitspsychologie, Technische Universität Dresden, Deutschland*
- **S04.4 - Individual Differences in Emotion Regulation Choice: Regulation Tendency is Associated with Capacity, Resilience, and Well-Being**
  U. Basten, *Universität Koblenz-Landau, Campus Landau, Deutschland*
- **S04.5 - SmartPTBS: Longitudinal assessment of posttraumatic stress disorder symptomatology and coping strategies - insights from ecological momentary and hair cortisol data**
  L. Schindler-Gmelch, *Department of Clinical Psychology and Psychotherapy, Friedrich-Alexander-Universität Erlangen-Nürnberg, Deutschland*

S05 - IGOR Symposium: Advances in Open and Reproducible Practices for Biological Psychology and Human Neuroscience

Thursday, 8:30 - 10:00 | KG I, HS 1010

Session chair(s): **G. Feld**[1,2], **T. Lonsdorf**[3] ([1] Zentralinstitut für Seelische Gesundheit, Universität Heidelberg | [2] Psychologisches Institut, Universität Heidelberg | [3] Universitätsklinikum Hamburg-Eppendorf)

This symposium, submitted by the Interest Group for Open and Reproducible Science (IGOR), showcases current developments aimed at improving replicability and accessibility of biopsychological research. First, *Helena Hartmann* will give first-hand insights from preregistering and subsequently publishing an fMRI-study. Her talk will focus on the experience of diving into a complex preregistration as well as on challenges and lessons learned during that process. However, biopsychological data, especially imaging data, are often highly multivariate, and explicit hypotheses are sometimes difficult to devise in advance for preregistration. *Steffen Gais* will therefore present an approach on MEG data that combines exploratory and confirmatory analyses into one study using machine learning. Along the same lines, in mass-univariate situations like in fMRI strict statistical thresholding provides only a very limited perspective on the present effects. *Martin Gerchen* will describe the implementation and application of equivalence, inferiority, and superiority tests for fMRI and discuss how these approaches can be used to gain deeper insight into effects and their relationships inside and outside of data sets, which could not be obtained by conventional null hypothesis significance testing. Lastly, open code can increase reproducibility and enhance trust in scientific results. In practice, there are many obstacles for scientists to re-run code and verify results or to perform their own analysis. *Philippe Jawinski* will present two solutions: a) the use of shareable project environments, and b) the provision of synthetic example data. These novel approaches have the potential to become standard practices of biopsychological inquiry in the near future.

- **S05.1 - Preregistering an fMRI study: First experiences and lessons learned**
  H. Hartmann, *Department for Cognition, Emotion, and Methods in Psychology, Faculty of Psychology, University of Vienna, Vienna, Austria*
- **S05.2 - Analyzing MEG Data with Machine Learning – Exploration and Confirmation**
  S. Gais, *Universität Tübingen, Deutschland*
- **S05.3 - Equivalence and inferiority/superiority tests in mass-univariate situations – the example of fMRI**
  M. F. Gerchen, *Zentralinstitut für Seelische Gesundheit, Mannheim, Deutschland*
- **S05.4 - Using shareable coding environments and synthetic datasets to increase reproducibility and facilitate collaboration**
  P. Jawinski, *Humboldt-Universität zu Berlin, Deutschland*

Symposia II

S06 - Electrophysiological Correlates of Cognitive Control

Thursday, 13:00 - 14:30 | KG I, HS 1015

Session chair(s): **T. König**[1], **K. Nash**[2] ([1] University Hospital of Psychiatry and Psychotherapy, Translational Research Center | [2] University of Alberta)

Cognitive control is vital to our ability to guide our thoughts and actions based on our own reasons and beliefs over time. To a certain extent, cognitive control can act independently of external circumstances, and is part of what makes us a unique individual. However, permanent control of one's own mental activity may stand in the way of an adaptive and creative orientation essential to coping with constantly changing experiences and environmental demands. This changing need for cognitive control naturally leads to inter- and intra-individual variance, which can be used to identify and more precisely describe the biological substrates and the functioning of this ability.
The symposium will bring together a number of electrophysiological studies, each dealing with different aspects of cognitive control, but using similar methodology to foster synergistic conclusions. In particular, all of the studies use microstate analysis, which allows for the identification of discrete functional states in spontaneous EEG and event related potentials (ERPs), and on which a course will be held at the PuG. Specifically, *Bastian Schiller* will speak about the stability of microstates in spontaneous EEG as a function of inter-individual variance in self-control. *Maria Stein* will present ERP findings where inhibitory control of salient stimuli was examined in patients with a history of alcohol abuse. *Kyle Nash* will demonstrate how microstate analyses can shed light on the puzzling relationship between anxiety and cognitive control. *Thomas König* will show how the natural transient loss of self-control during sleep onset is reflected in EEG microstates.

- **S06.1 - A self-controlled mind is reflected by stable mental processing**
  B. Schiller, *Laboratory for Biological and Personality Psychology, Albert-Ludwigs-University of Freiburg, Stefan-Meier-Straße 8, 79104 Freiburg, Germany*
- **S06.2 - Neurophysiology of alcohol-specific inhibitory control in alcohol use disorder**
  M. Stein, *Universität Bern, Institut für Psychologie, Schweiz*
- **S06.3 - Anxiety disrupts performance monitoring: Integrating behavioral, event-related potential, EEG microstate, and sLORETA evidence**
  K. Nash, *University of Alberta*
- **S06.4 - Ruhezustände des Gehirns im Zusammenhang mit traumähnlichen Erlebnissen beim Übergang zum Schlaf**
  T. König, *Universitätsklinik für Psychiatrie und Psychotherapie Bern, Universität Bern, Schweiz*

S07 - Updates on complementary memory systems in the brain

Thursday, 13:00 - 14:30 | KG I, HS 1098

Session chair(s): **R. Benoit**[1], **H. Schultz**[1] (Max Planck Institute for Human Cognitive and Brain Sciences)

The brain retains memories of our past at different levels of abstraction. A hippocampally-mediated system supports the rapid formation of detailed memories for specific events. The neocortex, by comparison, is thought to extract commonalities across multiple events over a longer time period. It thereby forms representations of more general knowledge of our environment. This symposium sheds further light on the complementary contributions of these memory systems. First, *Valentina Krenz* will demonstrate how memories are transformed over time from detailed representations in the hippocampus to semantic, gist-like representations in the posterior neocortex. *Antonia Lenders* will then report evidence from functional and diffusion-weighted MRI that repeated learning can accelerate the build-up of neocortical representations of naturalistic episodic material. Next, *Svenja Brodt* will argue that the two memory systems acquire memory representations in parallel early on in learning and that their relative contributions hinge on the particular encoding strategy. Finally, *Heidrun Schultz* will focus on the interactions between the two systems by examining how general knowledge encoded in the prefrontal cortex guides the retrieval of specific episodes. Together, the four presentations will thus provide a critical update on the complementary nature of hippocampal versus neocortical memory representations.

- **S07.1 - Unraveling the semantic nature of memory transformation over time**
  V. Krenz, *Department of Cognitive Psychology, Institute of Psychology, Universität Hamburg, Von-Melle-Park 5, 20146 Hamburg,Deutschland*
- **S07.2 - Rapid memory for complex episodic narratives in the parietal cortex**
  A. Lenders, *Albert-Ludwigs-Universität Freiburg, Deutschland*
- **S07.3 - Investigating the functional specialization of declarative memory subsystems**
  S. Brodt, *Eberhard Karls Universität Tübingen*
- **S07.4 - Facilitating episodic memory with pre-existing knowledge**
  H. Schultz, *Max-Planck-Institut für Kognitions- und Neurowissenschaften, Leipzig*

S08 - Behavioral and Psychological Effects of Sex Hormones

Thursday, 13:00 - 14:30 | KG I, HS 1221

Session chair(s): **B. v. Dawans**[1], **F. Chen**[2] ([1] Universität Trier, Deutschland | [2] University of British Columbia, Canada)

Sex hormones not only regulate human development but also influence cognitive and emotional processes, as well as sexual and social behaviors. In our symposium, we will showcase new research examining both endogenous (e.g. variations over the menstrual cycle or during pregnancy) and exogenous effects (e.g., estradiol, intranasal oxytocin application or hormonal contraceptives and hormonal intrauterine devices) of sex hormones. The studies use methods from psychoneuroendocrinology (application and measurement of hormones in blood or saliva, fMRI) in combination with behavioural paradigms in order to disentangle potential mechanisms of effects. *Zoé Bürger* (Tübingen) will present a study on the effects of oral contraceptives compared to hormonal intrauterine devices on stress reactivity. Her colleague *Melina Grahlow* (Tübingen) has investigated emotion regulation in pregnant women compared to nulliparous women receiving either estradiol or placebo in an fMRI design. How oxytocin administration modulates emotional learning during different cycle phases was investigated by *Ekatarina Schneider* (Heidelberg). In a group-based online study, *Julia Strojny* and colleagues investigated how menstrual cycle phase or hormonal contraception are related to theory of mind, empathy and social interaction. Finally, *Belinda Pletzer* (University of Salzburg, Austria) will close the symposium by presenting results from three large-scale behavioral menstrual cycle studies utilizing spatial and verbal tasks, which allow the assessment of variations in cognitive strategies rather than simple performance measures.

- **S08.1 - Effect of hormonal contraception on stress reactivity in women**
  Z. Bürger, *Department of Psychiatry and Psychotherapy, Tübingen Centre for Mental Health (TüCMH), Medical Faculty, University of Tübingen, Germany.*
- **S08.2 - Emotion regulation during pregnancy: A special role for estradiol?**
  M. Grahlow, *Department of Psychiatry and Psychotherapy, Innovative Neuroimaging, Tübingen Center for Mental Health (TüCMH), University of Tübingen, Tübingen, Germany*
- **S08.3 - Menstrual cycle phase, hormonal fluctuations, and emotional learning**
  E. Schneider, *Institute of Medical Psychology, Center for Psychosocial Medicine, Heidelberg University Hospital, Heidelberg, Germany*
- **S08.4 - The modulation of social behavior and cognition via menstrual cycle phase, sex hormones and oral contraceptives**
  B. v. Dawans, *Universität Trier, Deutschland*
- **S08.5 - Menstrual cycle dependent fluctuations in cognitive performance and strategies - effect size and inter-individual differences**
  B. Pletzer, *Paris-Lodron-Universität Salzburg, Österreich*

S09 - (Neuro)biologically informed psychotherapy: Approaches and developments

Thursday, 13:00 - 14:30 | KG I, HS 1199

Session chair(s): **C. Paret**[1], **P. Kirsch**[2] ([1] Zentralinstitut für Seelische Gesundheit, Deutschland | [2] Zentralinstitut für Seelische Gesundheit)

Biopsychological perspectives can inform the development of innovative psychotherapeutic intervention by defining (neuro)biological target mechanisms and by evaluating therapy outcome by means of biological parameters. This symposium will demonstrate research on the feasibility and proof-of-concept of novel biologically oriented, behavioral treatment approaches. After an introductory overview of the field by *Peter Kirsch*, the session will feature four approaches to leverage psychobiological mechanisms of clinical change. *Barbara Schmidt* will present data from a study, where participants received a hypnotic safety or neutral suggestion and then underwent a standardized acute stress situation where they could activate the hypnotic trigger. Autonomous, endocrine, and immune system parameters were compared between participants who received the safety versus neutral trigger. In the second presentation, *Stephanie Böhme* will present an innovative technical approach to assess affect-relevant bodily processes for the diagnosis and psychotherapy of depression. They induced depressive mood to participants and assessed depressed mood amelioration following affect expression training, verbal reappraisal, and the combination of the two. *Rosa Grützmann* investigated a 3-week executive control training on interference control and performance monitoring in obsessive-compulsive disorder. Following the treatment, they observed a reduction of response times and a normalization of the error-related negativity. Finally, *Christian Paret* will present a study where they administered fMRI-neurofeedback from the amygdala to patients with borderline personality disorder. The randomized controlled open-label trial investigated the effect of adjuvant neurofeedback treatment on top of Dialectical-Behavior Therapy (DBT), administered to patients who still presented substantial symptom severity halfway through a residential DBT program.

- **S09.1 - (Neuro)biologically informed psychotherapy: Approaches and developments**
  P. Kirsch, *Department of Clinical Psychology, Central Institute of Mental Health Mannheim, Medical Faculty Mannheim, Heidelberg University*
- **S09.2 - Feel safe when stressed - Impact of a hypnosis-based intervention on physiological and behavioral parameters during acute stress**
  B. Schmidt, *Universitätsklinikum Jena, Deutschland*
- **S09.3 - EmpkinS: Empatho-kinesthetic Sensory Systems for Biofeedback in Depression**
  S. Böhme, *Friedrich-Alexander-Universität Erlangen-Nürnberg, Deutschland*
- **S09.4 - Targeting the error-related negativity, a biomarker of overactive performance monitoring, as an add-on intervention in OCD treatment**
  R. L. Grützmann, *Humboldt-Universität zu Berlin, Deutschland*
- **S09.5 - FMRI Neurofeedback Treatment in Borderline Personality Disorder**
  C. Paret, *Zentralinstitut für Seelische Gesundheit, Deutschland*

Symposia III

S10 - P300 and much more: A Tribute to Rolf Verleger

Thursday, 16:00 - 17:30 | KG I, HS 1098

Session chair(s): **E. Wascher**[1] (IfADo, Deutschland)

It wasn't just scientifically that he was upbeat throughout his life, the former president of the DGPA Rolf Verleger. Last year he passed away much too young. To honor his work, which has shaped German psychophysiology for many years, this symposium would like to bring former companions together again to review a small part of his work. Of course, it will be about the P300, but also about event-related asymmetries and other ideas that drove him. His goal in life was to create knowledge.

- **S10.1 - Sleep States and Awareness**
  V. Kolev, *Institute of Neurobiology, Bulgarian Academy of Sciences, Bulgaria*
- **S10.2 - What do effects of visible and invisible stimuli explored with event-related lateralizations tell us about the role of consciousness?**
  R. H. V. d. Lubbe, *University of Twente / Adam Mickiewicz University, The Netherlands*
- **S10.3 - On why left events are the favored ones: neural underpinnings of the left hemifield advantage in rapid serial visual presentation**
  D. Asanowicz, *Jagiellonian University, Krakow, Poland*
- **S10.4 - Closure denotes the moment of a new beginning**
  E. Wascher, *IfADo, Deutschland*

S11 - Recent advances in non-invasive brain stimulation

Thursday, 16:00 - 17:30 | KG I, HS 1010

Session chair(s): **T. O. Bergmann**[1], **G. Hartwigsen**[2] ([1] Johannes Gutenberg University Medical Center Mainz, Deutschland | [2] Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Deutschland)

Non-invasive transcranial brain stimulation (NIBS) techniques, such as transcranial magnetic, electric, and ultrasonic stimulation (TMS, tDCS/tACS, TUS), allow researchers to study causal structure-function relationships in the human brain by measuring, perturbing, and modulating neural processes that mediate distinct cognitive functions and are thus an invaluable tool in biological psychology. This symposium will discuss recent methodological and conceptual advances in the field of NIBS, highlighting the relevance of electric field (E-field) modelling, combined neuroimaging, experimental automation, and real-time / closed-loop applications. *Ole Numssen* will introduce a novel, E-field based approach to precisely map cortical muscle representations in the human primary motor cortex and how the same rationale can potentially be exploited to explain TMS induced effects on neural activity (fMRI) and behavioral performance. *Daria Antonenko* will talk about the relevance of E-field modelling for tDCS, its combination with fMRI and MR spectroscopy (MRS), and the usefulness of these approaches for studying age-related changes in brain function. *Zsolt Turi* will discuss the value of prospective E-field modelling for the selection of TMS intensity, the entrainment of brain rhythms via rTMS and how multi-scale neuronal modeling can help us to better understand the neuronal mechanisms of rTMS in research and clinic *Umair Hassan* will introduce an open-source toolbox (www.best-toolbox.org) supporting automated and closed-loop NIBS experiments and present results from real-time EEG phase-triggered TMS studies characterizing the cortical excitability profile of wake- and sleep-specific neural oscillations. We will discuss challenges and best practice for the experimental design of NIBS studies in biological psychology.

- **S11.1 - Precise mapping of cortical functions with transcranial magnetic stimulation**
  O. Numssen, *Max Planck Institute for Human Cognitive and Brain Sciences, Germany*
- **S11.2 - Estimating e-fields induced by tDCS on the individual level – linkage to tDCS responses and usage in explaining age-related changes of neuromodulatory effects**
  D. Antonenko, *Universitätsmedizin Greifswald, Deutschland*
- **S11.3 - Selecting stimulation parameters for transcranial magnetic stimulation**
  Z. Turi, *Albert-Ludwigs-Universität Freiburg, Institut für Anatomie und Zellbiologie, Abteilung Neuroanatomie, Germany*
- **S11.4 - Brain-state dependent brain stimulation and BEST Toolbox**
  U. Hassan, *Leibniz Institute for Resilience Research, Mainz, Germany, Germany*

S12 - Attentional dynamics in face perception and social interaction

Thursday, 16:00 - 17:30 | KG I, HS 1199

Session chair(s): **G. Domes**[1], **M. Gamer**[2] ([1] Universität Trier, Deutschland | [2] Universität Würzburg)

Eye-tracking has become an increasingly available and affordable method in biopsychology and neuroscience to track participants' overt visual attention. Technological and methodological advances such as the development of wearable eye-tracking glasses and increased tracking accuracy have opened up possibilities to precisely measure attentional dynamics across a variety of naturalistic situations. In this symposium, recent experimental studies using state-of-the-art eye-tracking technology with a focus on different attentional processes during face perception, emotional processing and social interaction will be presented and discussed.
Mario Reutter (Würzburg) will elaborate on how individual patterns of attentional exploration can be used to predict the extent of fear generalization in subjective and autonomic measures. *Antonia Vehlen* (Trier) will present a study investigating whether the perceived emotional expression of an interaction partner modulates gaze behavior in a natural face-to-face interaction. Using a similar experimental setup, *Daniel Tönsing* (Freiburg) studied the impact of self-reported gaze anxiety on gaze behavior during a naturalistic social interaction. *Matthias Gamer* (Würzburg) will concentrate on the interaction of facial exploration strategies and visual perception with respect to emotion categorization and empathy. Finally, *Marcel Linka* (Giessen) will share the results of a recent study investigating attentional biases along semantic dimensions in preschoolers.
Collectively, these presentations highlight how recent advances in eye-tracking methodology can be exploited to elucidate the mechanisms of social attention in laboratory and field conditions. Thereby, they open up new avenues for studying the influence of developmental, personality and clinical factors on the interplay of perception and action in the visual domain.

- **S12.1 - Individual patterns of attentional exploration predict the extent of fear generalization**
  M. Reutter, *Julius-Maximilians-University Würzburg*
- **S12.2 - Observed facial affect modulates gaze behavior in face-to-face interactions**
  A. Vehlen, *Universität Trier, Biologische und Klinische Psychologie, Deutschland*
- **S12.3 - Face-to-Face Gaze Behavior in Autism Spectrum Disorder**
  D. Tönsing, *Albert-Ludwigs-Universität Freiburg, Deutschland*
- **S12.4 - Visual exploration shapes face perception and vicarious pain modulation**
  M. Gamer, *Universität Würzburg, Deutschland*
- **S12.5 - Attentional biases in pre-schoolers freely viewing complex scenes**
  M. Linka, *Department of Experimental Psychology, Justus-Liebig-Universität, 35394 Gießen, Germany*

S13 - Einfluss traumatischer Kindheitserfahrungen auf soziale und emotionale Prozesse – eine transdiagnostische Perspektive

Thursday, 16:00 - 17:30 | KG I, HS 1221

Session chair(s): **K. I. Seitz**[1], **C. Schmahl**[2] ([1] Universitätsklinikum Heidelberg | [2] Zentralinstitut für Seelische Gesundheit, Mannheim)

Traumatische Kindheitserfahrungen wie Missbrauch oder Vernachlässigung stellen einen bedeutenden Risikofaktor für eine Vielzahl psychischer und körperlicher Erkrankungen dar. In den vergangenen Jahren wurden zahlreiche Mechanismen vorgeschlagen, die dem Zusammenhang zwischen traumatischen Kindheitserfahrungen und unterschiedlichen Arten von Psychopathologie zugrunde liegen könnten. Zu diesen transdiagnostischen Mechanismen zählen unter anderem eine dysfunktionale Emotionsverarbeitung, eine abweichende Belohnungsantizipation sowie eine beeinträchtigte Interozeption. Die an diesem Symposium beteiligten Wissenschaftler*innen sind allesamt Mitglieder (Sprecher bzw. Doktorandinnen) des von der Deutschen Forschungsgemeinschaft geförderten Graduiertenkollegs 2350, welches sich dem Einfluss traumatischer Kindheitserfahrungen auf psychosoziale und somatische Erkrankungen über die Lebensspanne widmet. Als Sprecher des Graduiertenkollegs 2350 wird *Christian Schmahl* zunächst einen Überblick über die Bedeutung von Art und Zeitpunkt von traumatischen Kindheitserfahrungen und die mit diesen Erfahrungen assoziierten Veränderungen der Hirnfunktion geben. Anschließend werden *Sarah Gerhardt* und *Katja Seitz* aus funktionellen Bildgebungsstudien berichten, die sich mit dem Zusammenhang zwischen traumatischen Kindheitserfahrungen und Amygdala-Habituation während impliziter Emotionserkennung bei Personen mit Alkoholkonsumstörung (*Gerhardt*) sowie finanzieller und sozialer Belohnungsantizipation in einer transdiagnostischen Stichprobe (*Seitz*) befassen. Schließlich wird *Konstantina Atanasova* die Ergebnisse von drei experimentellen Paradigmen vorstellen, in denen der Zusammenhang zwischen traumatischen Kindheitserfahrungen, Emotionsverarbeitung und Interozeption bei Personen mit chronisch-entzündlichen Darmerkrankungen untersucht wurde. Zusammenfassend erlauben die Erkenntnisse dieser Studien wichtige Schlussfolgerungen für die Entwicklung transdiagnostisch wirksamer therapeutischer Interventionen.

- **S13.1 - Die Bedeutung von Art und Zeitpunkt traumatischer Kindheitserfahrungen auf Hirnstruktur und -funktion**
  C. Schmahl, *Zentralinstitut für Seelische Gesundheit, Mannheim, Deutschland*
- **S13.2 - Fehlende Amygdala-Habituation während impliziter Emotionserkennung bei Menschen mit Alkoholgebrauchsstörung**
  S. Gerhardt, *ZI Mannheim, Deutschland*
- **S13.3 - Traumatische Kindheitserfahrungen und Belohnungsantizipation: eine transdiagnostische fMRT-Studie**
  K. I. Seitz, *Universitätsklinikum Heidelberg*
- **S13.4 - Signale aus dem Körperinneren: Der Einfluss von Kindheitstraumatisierung auf den Zusammenhang zwischen Interozeption und Emotionsverarbeitung bei Patienten mit chronisch-entzündlichen Darmerkrankungen**
  K. Atanasova, *Heidelberg University, Medical Faculty Mannheim, Deutschland*

S14 - Biological targets of early childhood adversity - genetic, epigenetic and imaging findings

Thursday, 16:00 - 17:30 | KG I, HS 1015

Session chair(s): **R. Kumsta**[1], **M. Schiele**[2] ([1] Universität Luxemburg, Luxemburg | [2] Universität Freiburg)

The experience of adversity in childhood can have life-long consequences for mental and somatic health. In search of mediators of the relationship between early adversity and increased risk for negative health outcomes, different levels of analyses and target systems have been investigated. These include genetic variants and their role in conferring vulnerability or resilience to stress or trauma exposure, basic mechanisms of gene-environment interplay such as DNA methylation, and - outside the cellular realm - the long-term effects of early adversity on brain structure and function. *Miriam Schiele* will show that genetic variation – exemplarily for the neuropeptide receptor S (NPSR1) gene – and childhood trauma act as moderators in the vulnerability-stress model of anxiety, further extending this GxE model by introducing coping as an additional dimension shaping gene-environment constellations. *Svenja Müller* will focus on the oxytocin receptor gene (OXTR) and present comprehensive DNA methylation data of the entire OXTR CpG island, identifying functionally relevant co-methylated clusters and associations with both childhood adversity and OXTR gene expression. *Johannes Zang* will show how gene and protein co-expression patterns relate to childhood adversity in the context of psychosocial stress exposure using co-expression based, supervised and unsupervised multi-omic system approaches. Finally, *Maurizio Sicorello* will present how the timing of early adversity is essential to understand alterations in limbic brain function, as well as their relation to psychopathology.

- **S14.1 - Functional NPSR1 variation and childhood trauma as moderators in the vulnerability-stress model of anxiety**
  M. Schiele, *Klinik für Psychiatrie und Psychotherapie, Universitätsklinikum Freiburg*
- **S14.2 - Epigenetic landscape of the oxytocin receptor gene (OXTR) and its association with childhood adversity**
  S. Müller, *Department of Genetic Psychology, Faculty of Psychology, Ruhr University Bochum, Germany*
- **S14.3 - Biological embedding of childhood adversity - a multi-omics perspective on stress regulation**
  J. Zang, *Klinik für Psychische Gesundheit, Universitätsklinikum Münster*
- **S14.4 - Sensitive Periods for brain changes following early (and late) adversity**
  M. Sicorello, *Central Institute of Mental Health, Deutschland*

Poster session I (overview)

Thursday, 14:30-16:00 | UB Freiburg
Setup of the posters starts at 12:00

Topic 1: Computational and Neuroimaging Methods

- **P1.001 - Detecting changes of emotional facial expressions in children and adolescents induced by emotional videos: results on the suitability of the FaceReader facial coding software**
  K. Hagelweide, *Technical University Dortmund*
- **P1.002 - EEG Frequency-Tagging in Developmental Cognitive Neuroscience: Methodological Considerations**
  S. Peykarjou, *Heidelberg University*
- **P1.003 - Survey on Open Science Practices in Functional Neuroimaging**
  C. Paret, *Zentralinstitut für Seelische Gesundheit, Deutschland*

Topic 2: Individual Differences and (Epi)Genetics

- **P1.004 - Risk-Taking Under Threat: Women Remain Hesitant Where Men Get Bold**
  K. U. Siebenhaar, *Lehrstuhl für Klinische und Biologische Psychologie und Psychotherapie, Universität Mannheim*
- **P1.005 - Testing the Effects of Intolerance of Uncertainty on the Error-Related Negativity in a Randomized Controlled Trial**
  H. P. Carsten, *Universität Hamburg, Deutschland*
- **P1.006 - Multi-Modal Brain Signal Complexity Predicts Human Intelligence**
  J. A. Thiele, *Würzburg University, Department of Psychology I, Germany*
- **P1.007 - Geschlechtsunterschiede im mimischen Schmerzausdruck**
  P. Schneider, *Medizinische Psychologie und Soziologie, Medizinische Fakultät, Universität Augsburg*
- **P1.008 - How peak alpha frequency (PAF) and intelligence work together: An EEG study on the association of PAF and intelligence measured with an advanced matrices test**
  L. M. Makowski, *University of Bern, Bern, Switzerland*
- **P1.009 - Revealing Mechanisms Underlying Individual Differences in Multitasking: An EEG study**
  M. Mückstein, *International Psychoanalytic University; Universität Potsdam*

- **P1.010 - Higher fronto-parietal upper alpha synchronization in divergent as compared to convergent thinking beyond the impact of working memory**
  V. Eymann, *Center for Cognitive Science, University of Kaiserslautern, Germany*
- **P1.011 - The relationship between chronotype and pain sensitivity in a sample of young adults**
  G. Zerbini, *Faculty of Medicine, Department of Medical Psychology and Sociology, University of Augsburg, Augsburg, DE*

Topic 3: Learning, Memory, and Sleep

- **P1.012 - Virtual reality experiences promote autobiographical retrieval mechanisms: Electrophysiological correlates of laboratory and virtual experiences**
  J. Kisker, *Experimental Psychology I, Institute of Psychology, Universität Osnabrück, Deutschland*
- **P1.013 - The forward testing effect is robust to psychosocial retrieval stress**
  B. Pastötter, *Universität Trier, Deutschland*
- **P1.014 - Mnemonische Mechanismen in der virtuellen Realität – Vergleich ereigniskorrelierter Potentiale des Repetition-Suppression Effektes zwischen VR und konventionellen Laborbedingungen**
  M. Johnsdorf, *Universität Osnabrück, Deutschland*
- **P1.015 - Behavioral and computational evidence for compositional reuse of experience in humans**
  L. Luettgau, *Max Planck UCL Centre for Computational Psychiatry and Ageing Research, University College London, United Kingdom*
- **P1.016 - Short-term training attenuates the repetition probability effect for non-face objects**
  C. Li, *Friedrich-Schiller-Universität Jena, Germany*
- **P1.017 - Two distinct ways to form long-term object-recognition memory during sleep and wakefulness**
  M. Harkotte, *Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen, Germany*
- **P1.018 - Hunger drives the formation of long-term spatial memory during wakefulness**
  A. Sawangjit, *Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen, Germany*
- **P1.019 - Acute stress influences decisions informed by social and reward inference**
  S. Schulreich, *Universität Hamburg, Deutschland*

- **P1.020 - Cognitive processing during sleep: designed to be parsimonious and sleep-protective**
  C. Blume, *Centre for Chronobiology, Psychiatric Hospital of the University of Basel, Switzerland*
- **P1.021 - Generalization, memory specificity and their overnight fate are differentially associated with age in childhood**
  E. S. Buchberger, *Max Planck Institute for Human Development, Berlin, Germany*
- **P1.022 - Challenges of tracking sequential memory replay during wakeful rest**
  S. Kern, *Zentralinstitut für seelische Gesundheit Mannheim*
- **P1.023 - Measuring the effect of reward on memory without the confounding influence of response bias**
  D. P. Morgan, *Department of Clinical Psychology, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany*
- **P1.024 - Differential oscillatory processes associated with successful sequence memory encoding in young and older adults**
  N. Ehrhardt, *Klinik und Poliklinik für Neurologie, Universitätsmedizin Greifswald*
- **P1.025 - Modeling adaptation to environmental volatility using recurrent neural networks**
  D. Tuzsus, *Department Psychologie, Universität zu Köln, Deutschland*
- **P1.026 - Quantifying information processing in human and rodent sleep signatures**
  M. A. Hahn, *University Medical Center, Tübingen, Germany*
- **P1.027 - Erotic cue exposure modulates physiological arousal, increases temporal discounting and attenuates model-based reinforcement learning**
  D. Mathar, *Department Psychologie, Universität zu Köln, Deutschland*
- **P1.028 - The role of dopamine, reward learning and prefrontal activity in expectation-induced mood enhancement**
  N. Augustat, *Philipps-Universität Marburg, Deutschland*
- **P1.029 - The adaptation process of sleep during non-consecutive nights in unfamiliar versus familiar environments**
  A. Wick, *Universität Fribourg, Schweiz*
- **P1.030 - Attentive immobility in the face of inevitable distal threat— Startle potentiation and fear bradycardia as an index of emotion and attention**
  C. Szeska, *Universität Potsdam*
- **P1.031 - Memory reprocessing of narrative contents in sleep and wakefulness**
  J. Palmieri, *University of Freiburg, Germany*
- **P1.032 - Functional dissociation of hippocampal and neocortical ripples: From information transfer to consolidation**
  F. v. Schalkwijk, *Hertie-Institute for Clinical Brain Research, Center for Neurology, University Medical Center Tübingen, Tübingen, Germany*

- **P1.033 - Oscillatory and non-oscillatory brain activity and peripheral indicators in fear and extinction memory**
  P. Bierwirth, *Universität Osnabrück, Deutschland*
- **P1.034 - Investigation the role of serotonin in declarative memory using a human serotonin lesion model**
  R. Coray, *Experimental and Clinical Pharmacopsychology, Department of Psychiatry, Psychotherapy, and Psychosomatics, Psychiatric University Hospital Zurich, University of Zurich, Switzerland*

Topic 4: Cognition

- **P1.035 - High density parietal alpha training for sense of presence in Virtual reality. A pilot study**
  L. Botrel, *Universität Würzburg, Deutschland*
- **P1.036 - Preference for and proficiency in mathematical cognition differentially affect early and late stages of primed mathematical vs. non-mathematical meaning processing**
  L. Bechtold, *Heinrich Heine Universität Düsseldorf, Deutschland*
- **P1.037 - Slip or fallacy? The influence of error severity on the error-related negativity in pianists**
  C. Albrecht, *Heinrich-Heine-Universität Düsseldorf, Deutschland*
- **P1.038 - Modulation of self-control by acute and chronic stress**
  J. Stein, *TU Dresden, Deutschland*
- **P1.039 - The effects of working memory load on conscious and unconscious neural processing of task-unrelated acoustic stimuli**
  L. Brockhoff, *Institute of Medical Psychology und Systems Neuroscience, University of Muenster*
- **P1.040 - Anticipatory and task-specific allocation of cognitive effort modulates EEG low frequency dynamics during task preparation**
  N. Liegel, *Leibniz Research Centre for Working Environment and Human Factors, Germany*
- **P1.041 - Opposing effects of intentionally reduced effort and adverse examiner intervention on cognitive control in a simulated neuropsychological assessment scenario**
  J. Schott, *Phillips Universität Marburg*
- **P1.042 - Conjunctive coding of the past and present impairs human behavior**
  J. Weber, *Hertie Institute for Clinical Brain Research, Center for Neurology, University Medical Center Tübingen, Tübingen, Germany.*
- **P1.043 - A trial-wise gripforce model reveals effects of model-based values on response vigour during intertemporal choice**
  E. Smith, *Department Psychologie, Universität zu Köln, Deutschland*

- **P1.044 - Effects of methylphenidate on the motivation of flexible and focused cognitive control**
  M. I. Froböse, *Heinrich Heine University, Düsseldorf, Germany*
- **P1.045 - Parameterization of Slow Cortical Potentials During States of Tension and Relaxation and the Moderating Role of Trait and State Variables Linked to Action Control**
  M. Hense, *Institute for Frontier Areas of Psychology and Mental Health, Freiburg, Germany*
- **P1.046 - Investigating Error Monitoring From an Affective Perspective: Association Between Valence Evaluation, Neural Indices, and Autonomic Arousal in Healthy Individuals and Patients With OCD**
  L. Balzus, *Department of Psychology, Humboldt-Universität zu Berlin, Germany*
- **P1.047 - EEG correlates of cognitive effort during cued task-switching**
  S. Arnau, *Leibniz Research Centre for Working Environment and Human Factors, Dortmund*
- **P1.048 - Distilling neural correlates of consciousness during the attentional blink**
  T. Dellert, *Institute of Medical Psychology and Systems Neuroscience, University of Münster*

Topic 5: Attention and Perception

- **P1.049 - Differential effects of prediction error and adaptation along the auditory cortical hierarchy during deviance processing**
  I. Schl, *Institute of Medical Psychology and Systems Neuroscience, University of Münster*
- **P1.050 - Music tempo influences performance and emotional state in a visual oddball task**
  A. Dienst, *Technische Universität Berlin*
- **P1.051 - Longitudinal development of distributed responses in ventral temporal cortex in children is linked to face recognition and reading performance**
  M. Nordt, *Department of Psychology, Stanford University, Stanford, CA, US*
- **P1.052 - The THINGS initiative: a global large-scale effort for the representative study of objects in brains, behavior, and computational models**
  O. Contier, *Max Planck Institut für Kognitions- und Neurowissenschaften, Deutschland*
- **P1.053 - A neurodevelopmental case of severe impairments in mid-level vision but intact higher-level vision**
  S. Weigelt, *Vision, Visual Impairment & Blindness, Department of Rehabilitation Sciences, TU Dortmund, Deutschland*
- **P1.054 - Causal evidence for the role of the frontoparietal network in rhythmic attentional sampling**
  I. Raposo, *Hertie Institute For Clinical Brain Research, Germany*
- **P1.055 - Sound processing in everyday life: A mobile ear-EEG study**
  D. Hölle, *Universität Oldenburg, Deutschland*

- **P1.056 - Listen to me! Auditory attention in online meetings**
  M. Stollmann, *University of Oldenburg*
- **P1.057 - Sensory attenuation of auditory-visual action effects**
  S. Ayatollahi, *University of Hildesheim, Germany*
- **P1.058 - Reward-based multi-session attentional bias modification: A longitudinal EEG study**
  S. Kang, *Universität Osnabrück, Deutschland*
- **P1.059 - Spontaneous alpha-band oscillations modulate stimulus-specific features representation**
  E. Balestrieri, *University of Muenster, Germany*
- **P1.061 - Investigating EEG correlates of bottom-up and top-down processing during perceptual uncertainty**
  M. Maschke, *Institut für Grenzgebiete der Psychologie und Psychohygiene e.V., Germany*

Topic 6: Brain and Periphery, Neuroendocrinology, and Stress

- **P1.063 - Short-term high-fat feeding induces a reversible net decrease in synaptic AMPA receptors in the hypothalamus**
  J. Liu, *Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen, Tübingen, Germany*
- **P1.064 - Baseline and inflammation-induced state fatigue impact motivated behavior in the context of a SARS-CoV-2 vaccination model**
  F. Luebber, *Social Neuroscience Lab, Department of Psychiatry and Psychotherapy, University of Lübeck, Lübeck, Germany*
- **P1.065 - Burnout, Chronic Work Stress and Allostatic Load: First Results from the Regensburg Burnout Project**
  C. Bärtl, *Institute of Psychology, University of Regensburg, Germany*
- **P1.066 - Keep calm and relax: increase in parasympathetic activity by watching 360° and 2D nature videos**
  R. J. Gaertner, *Universität Konstanz, Deutschland*
- **P1.067 - Digitalisierungs-assoziierte Veränderungen in stress-relevanten Arbeitsbedingungen von Ärzt:innen**
  M. K. Wekenborg, *TU Dresden*
- **P1.068 - Die automatische Erkennung von nicht-metabolischen HRV-Reduktionen im Alltag: Ist die Bewegung oder deren Inverse sinnvoller für einen Algorithmus zur Erkennung psychologischer Phänomene?**
  A. Schwerdtfeger, *Karl-Franzens-Universität Graz, Österreich*

- **P1.069 - The effect of early-life adversity and cognitive reappraisal on cortisol stress responses in healthy young women**
  U. U. Bentele, *Department of Psychology, University of Constance, Constance, Germany*
- **P1.070 - Validation of an online version of the Trier Social Stress Test in adults**
  M. Meier, *Department of Psychology, Neuropsychology, University of Konstanz, Constance, Germany*
- **P1.071 - The influence of induced positive emotions on psychobiological stress reactions**
  K. Henkel, *Justus-Liebig-Universität Gießen, Deutschland*
- **P1.073 - Evaluation and update of the expert consensus guidelines for the assessment of the cortisol awakening response**
  T. Stalder, *Universität Siegen, Deutschland*
- **P1.074 - Prediction of antibody levels after COVD-19 vaccination: a study on immune interoception**
  S. J. Dimitroff, *Department of Psychology, Division of Neuropsychology, University of Konstanz, Germany*
- **P1.075 - The Association of Hair Cortisol, Stressful Life Events, and Psychosocial Stress Habituation**
  J. Planert, *Universität Siegen, Deutschland*
- **P1.076 - How hair keeps track: Associations between hair concentrations of psychoactive substances and steroid hormones in a large cohort sample of young adults in Switzerland**
  L. Johnson-Ferguson, *Jacobs Center for Productive Youth Development, University of Zurich, Switzerland*

Topic 7: Social and Environmental Neuroscience

- **P1.077 - On using fNIRS in the cockpit: Frontal cortical oxygenation changes as a means of measuring mental workload in simulated flights**
  A. Hamann, *Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Deutschland*
- **P1.078 - The reward-like nature of smiling and sad faces: Social influence on costly punishment**
  M. Weiß, *University Hospital Würzburg; Würzburg; Germany*
- **P1.079 - Behavioral and neural dissociation of social anxiety and loneliness**
  J. Lieberz, *Department of Psychiatry and Psychotherapy, University Hospital Bonn, Germany*
- **P1.080 - EmBody, EmFace – Ein neues, offenes Tool zur Erfassung von Emotionserkennung aus Körper- und Gesichtsausdrücken**
  L. L. Lott, *Universität Freiburg, Germany*

- **P1.081 - Cross-modal decoding of emotional expressions in fMRI – mirror neurons in social cognition**
  L. A. Wallenwein, *Department of Psychology, University of Konstanz, Konstanz, Germany*
- **P1.082 - Imitation - a basic mechanism culturally influenced? A fMRI investigation of Chinese and German participants**
  C. A. Sojer, *Universität Konstanz, Deutschland*
- **P1.083 - Does an empty stomach influence the brain's response to social recognition?**
  D. M. Pfabigan, *University of Oslo, Norway*
- **P1.084 - Always look on the bright side of life: The effect of social exclusion on emotional reactivity and emotion regulation**
  A. Reinhard, *Department of Psychology, University of Konstanz*
- **P1.085 - Investigating Mu rhythm and its source localization during the observation of human social interaction and biological movement**
  S. Dastgheib, *Department for General Psychology and Cognitive Neuroscience, Institute of Psychology, Friedrich Schiller University of Jena, Am Steiger 3/1, 07743 Jena, Germany*

Topic 8: Development and Ageing

- **P1.086 - The role of multivariate representations of task sets for age differences in task-switching performance**
  S. A. Schwarze, *Max Planck Institute for Human Development, Deutschland*
- **P1.087 - On the long term consequences of preterm birth on the self-control brain network: A DTI study on adolescents measured in the ABCD study**
  M. Marek, *Psychological Methods and Statistics, Department of Psychology, School of Medicine and Health Sciences, Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany*
- **P1.088 - Preterm birth and microstructural properties in fiber tracts among audiovisual integration brain regions in neonates**
  J. F. Quinones, *Psychological Methods and Statistics, Department of Psychology, School of Medicine and Health Sciences, Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany;*
- **P1.090 - Less efficient cognitive pain modulation in healthy older adults – the impact of executive functions, chronic stress, and physical activity**
  A. Heller, *Universität Luxembourg, FHSE*
- **P1.091 - Neural Correlates of Short and Long Delay Memory Consolidation Differ Between Children and Young Adults**
  I. Schommartz, *Goethe University Frankfurt, Deutschland*

- **P1.092 - Multimodal Brain-Phenotype Relations of the Angular Gyrus: Group Trends versus Individual Profiles**
  C. Jockwitz, *Institute of Neuroscience and Medicine (INM-1), Research Centre Jülich, Jülich, Germany*
- **P1.093 - Appetitive Operant Conditioning in Children Aged 4-6 Using a Mechanistic Game**
  J. Jagusch-Poirier, *Vision, Visual Impairments & Blindness, Department of Rehabilitation Sciences, TU Dortmund University*

Topic 9: Disorders and Interventions

- **P1.094 - Personalized neurofeedback: a systematic comparison of self- and externally-paced training in healthy adults**
  S. Uslu, *University of Luxembourg*
- **P1.095 - Interoceptive accuracy and salience network functional connectivity in depression**
  M. Blickle, *Zentrum für Psychische Gesundheit, Universitätsklinikum Würzburg, Deutschland*
- **P1.096 - Bipolar disorder moderates the relationship between self-referential thinking and impulse control**
  T. D. Meyer, *McGovern Medical School, Psychiatry & Behav. Sciences, University of Texas HSC at Houston, USA*
- **P1.097 - The neural underpinnings of approach-avoidance training changing food choices while bypassing preferences**
  A. Zahedi, *Deutsches Institut für Ernährungsforschung (DIfE), Germany*
- **P1.098 - Riemannian vs. Linear P300 classification for a tactile Brain-Computer Interface in an end-user scenario**
  M. Pfeiffer, *Universität Würzburg, Deutschland*
- **P1.099 - Der Zusammenhang von Intrusionssymptomen und kontextbezogenen Furchtkonditionierungsprozessen bei der sozialen Angststörung**
  S. Fricke, *Professur für Psychotherapie und Systemneurowissenschaften, Justus-Liebig-Universität Gießen*
- **P1.101 - The influence of visual exploration on fear generalization in social anxiety**
  J. Teigeler, *Department of Psychology, University of Würzburg, Deutschland*
- **P1.102 - Effort-based decision making and motivational deficits in stroke patients**
  M. E. Abdoust, *Biological Psychology of Decision Making, Institute of Experimental Psychology, Heinrich Heine University Düsseldorf, Düsseldorf, Germany*

- **P1.103 - Divergence of Brain Connectivity in Anxiety Disorders: A Transdiagnostic multicenter Resting-state fMRI Study**
  T. Langhammer, *Department of Psychology, Humboldt-Universität zu Berlin, Germany*
- **P1.104 - Validation of an fMRI-based Olfactory Cue Reactivity Task**
  Ç. N. Gürsoy, *Department of Clinical Psychology, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany*
- **P1.105 - Taking depression at face value: Study protocol and pilot data on utilizing facial expressions as biomarker and biofeedback intervention within a smartphone-based reappraisal training**
  K. Capito, *Lehrstuhl für Klinische Psychologie und Psychotherapie, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)*
- **P1.106 - Vagally-mediated heart rate variability is attenuated during breathing meditation in patients with borderline disorder**
  A. B. E. Benz, *Universität Konstanz, Deutschland*
- **P1.107 - Altered EEG Variability on Different Time Scales in Participants with Autism Spectrum Disorder - An Exploratory Study**
  L. Hecker, *Department of Psychiatry and Psychotherapy, University of Freiburg Medical Center, Freiburg, Germany.*
- **P1.108 - Treatment response prediction based on resting-state neurofunctional data in spider phobia**
  J. Böhnlein, *Institute for Translational Psychiatry, University of Münster, Germany*
- **P1.109 - Differentiability of extinction and reconsolidation by prefrontal brain activation in social drinkers**
  I. Int-Veen, *Universitätsklinikum Tübingen, Deutschland*
- **P1.110 - The N400 response as a marker of cognitive processing in patients with disorders of consciousness – evidence from semantic violations in sentences and proverbs**
  S. Geukes, *Universität Bielefeld, Deutschland*
- **P1.111 - The interplay of acute trauma, stress and brain morphology**
  M. Ehlers, *University Medical Center Hamburg Eppendorf, Deutschland*
- **P1.112 - Now or later? A comparison of the effectivity of continuous and intermittent feedback for neurofeedback learning**
  M. Jindrova, *Department of Psychosomatic Medicine and Psychotherapy, Central Institute of Mental Health, Mannheim, Germany*

- **P1.113 - Interactions of Prenatal and Postpartum Depression and Infants' Temperament Trajectories: From Age 6 Weeks to 18 Months**
  F. Sörensen, *1. Pediatric Neurology & Developmental Medicine, University Children's Hospital Tübingen, Germany*

Topic 10: (Brain) Stimulation

- **P1.115 - Distinct Neuromodulation-Induced Eeg-Behavior Prediction Patterns: Low-Intensity Transcranial Focused Ultrasound Targeting the Right Prefrontal Cortex Increases Approach and Decreases Withdrawal Behavior Via Specific Inhibition of Midfrontal Theta**
  P. Ziebell, *University of Würzburg, Würzburg, Germany*
- **P1.116 - When time matters: differential effects of electrical stimulation on learning performance**
  S. Paßmann, *Universität Fribourg, Schweiz*
- **P1.117 - Optimizing transcranial electrical stimulation for improved sleep physiology and memory**
  J. Ladenbauer, *Universitätsmedizin Greifswald, Deutschland*

Topic 11: Affective Neuroscience

- **P1.118 - The Balance of Approach and Avoidance Behavior – The Role of Noradrenaline and Cortisol**
  K. Fricke, *MSH Medical School Hamburg, Deutschland*
- **P1.119 - Ewww - Investigating the neural basis of disgust in response to naturalistic and virtual nauseating stimuli**
  G. Berretz, *Department of Biopsychology, Institute of Cognitive Neuroscience, Faculty of Psychology, Ruhr University Bochum, Bochum, Germany*
- **P1.120 - ERP effects of emotion and selective attention on face processing**
  J. Schmuck, *Universität Bonn, Deutschland*
- **P1.121 - Unterscheiden sich die appetitiven Konditionierungs- und Extinktionsprozesse mit pornographischen, gaming-bezogenen und monetären Belohnungsstimuli?**
  K. Krikova, *Universität Siegen, Deutschland*
- **P1.122 - Early and mid-latency amygdala gamma responses to faces are dependent on the attended to expression. Insights from intracranial recordings**
  E. M. Weidner, *Bielefeld University, Department of Psychology, Bielefeld, Germany*
- **P1.123 - Individual freezing-like behavior in relation to threat proximity**
  A. Koppold, *Universitätsklinikum Hamburg-Eppendorf, Deutschland*

- **P1.124 - The amygdala in emotional word reading: Event-related potentials following unilateral medial temporal lobe resections**
  J. Kißler, *Abteilung für Psychologie, Universität Bielefeld, Deutschland*
- **P1.125 - Processing emotion words in the absence of subjective awareness: an fMRI study**
  M. Ghio, *Heinrich Heine University Düsseldorf, Germany*
- **P1.126 - Sexual cue processing across the oral contraceptive regimen: Neural correlates and self-reported sexual desire**
  N. M. Schmidt, *Differentielle und Biologische Psychologie, Justus-Liebig-Universität Gießen*
- **P1.127 - Absolute reduction in eliciting stimulus intensity as a new index of startle PPI**
  A. Behrje, *Uni Trier, Deutschland, GERMANY*
- **P1.128 - Kann der Bachelorstudiengang Psychologie als psychologischer Stressor angesehen werden? Ergebnisse einer Pilotuntersuchung**
  A. Geiss, *Universität zu Köln, Deutschland*

Keynote

Prof. Dr. John F. Cryan

Gut Feelings: Microbiome as a Key Regulator of Brain and Behaviour Across the Lifespan

Friday, 15:30 - 16:30 | KG I, Aula

Ever had a "gut feeling" about something? It turns out, the connection between our gut and our brain might be stronger than we think. Professor John F. Cryan, from Cork in Ireland will share surprising facts and insights about how our thoughts and emotions are connected to our guts. Dr. Cryan shares his fascination with biomedicine and why it offers a perfect way to explore the interaction between the brain, gut and microbiome, and how this relationship applies to stress- and immune-related disorders such as depression, anxiety, irritable bowel syndrome, obesity, and neurodevelopmental disorders including autism.

John F. Cryan *is Professor and Chair, Department of Anatomy & Neuroscience, University College Cork and was appointed Vice President for Research & Innovation in March 2021. He is also a Principal Investigator in the APC Microbiome Ireland Institute. Prof. Cryan has published over 600 peer-reviewed articles and has an h-index of 137 (Google Scholar). He is a Senior Editor of Neuropharmacology and of Neurobiology of Stress and is on the editorial board of a further 15 journals. He has co-edited four books and is co-author of the bestselling "The Psychobiotic Revolution: Mood, Food, and the New Science of the Gut-Brain Connection" (National Geographic Press, 2017). He has received numerous awards including UCC Researcher of the Year in 2012, the University of Utrecht Award for Excellence in Pharmaceutical Research in 2013, UCC Research Communicator of the Year 2017, and being named on the Highly Cited Researcher list in 2014 and from 2017 to the present. He was elected a Member of the Royal Irish Academy in 2017. He also received a Research Mentor Award from the American Gastroenterology Association and the Tom Connor Distinguished Scientist Award from Neuroscience Ireland in 2017 and was awarded an honorary degree from the University of Antwerp, Belgium in 2018. He was a TEDMED speaker in Washington in 2014, TEDx Speaker in 2017 and is a Past-President of the European Behavioural Pharmacology Society.*

Symposia

Symposia IV

S15 - Psychological and Neural Underpinnings of Curiosity

Friday, 08:30 - 10:00 | KG I, HS 1010

Session chair(s): **N. Bunzeck**[1] (Universität zu Lübeck)

Curiosity is one of the most powerful forms of intrinsic motivation enabling us to seek and explore novel information, thereby shaping individual development. While such a view is primarily based on psychological studies in children and younger adults, the developmental trajectories, underlying neural mechanisms, and possible age-related changes remain unclear. From a conceptual point of view, epistemic curiosity can be distinguished from other forms by focusing on the desire to acquire unknown knowledge. Moreover, curiosity can refer to an individual's personality (i.e. trait curiosity) or to a context-specific state (i.e. state curiosity). In this symposium, we will present interdisciplinary work that provides evidence in favor of and beyond such taxonomies as well as links between personality psychology and decision neuroscience. We will take a life span perspective by including studies on children, adolescents, as well as young and older adults, to show, for instance, a direct link between state epistemic curiosity and subsequent memory performance as well as trait epistemic curiosity and formal education. Finally, by using functional imaging methods, our studies implicate the mesolimbic system, which has previously been associated with reward and novelty, in curiosity for different types of information, including intensely negative content. Together, the goal of this symposium is to discuss conceptual views of curiosity, highlight its behavioral relevance across the life span and pinpoint underlying neural processes.

- **S15.1 - State-curiosity closely relates to formal education – a lifespan perspective**
  N. Bunzeck, *Department of Psychology, University of Lübeck*
- **S15.2 - Curiosity is Not the Same Construct Across Disciplines**
  H. K. Jach, *The University of Tübingen, Hector Research Institute of Education Sciences and Psychology*
- **S15.3 - Choosing the negative: The psychology of morbid curiosity**
  S. Oosterwijk, *Department of Social Psychology, University of Amsterdam, The Netherlands*
- **S15.4 - How curiosity affects learning and information seeking via the dopaminergic circuit**
  M. Gruber, *Cardiff University, Vereinigtes Königreich*

S16 - Acquiring and extinguishing fears: The modulating role of cognitive, biological, environmental and developmental factors

Friday, 08:30 - 10:00 | KG I, HS 1098

Session chair(s): **V. Jentsch**[1] (Ruhr-Universität Bochum, Deutschland)

Fear acquisition, extinction and return of fear paradigms serve as experimental models for the development, treatment and relapse of anxiety. These processes can be shaped by various factors, including individual life experiences, cognitive processing, contextual features or the presence of certain hormones. This symposium will outline how these cognitive, biological, environmental and developmental factors modulate the acquisition, extinction and return of fear in humans using neuroendocrine measures as well as peripheral (e.g. skin conductance, facial muscles, heart rate, pupil dilation) and central (fMRI) physiology. First, *Maren Klingelhöfer-Jens* will demonstrate, how childhood maltreatment alters the acquisition and generalization of threat. Thereafter, *Franziska Labrenz* will talk about the role of contingency awareness for acquiring conditioned neural responses to threat- and safety-predicting cues within an experimental model of visceral pain. *Rachel Sjouwerman* will then critically reflect the context dependency of reinstatement induced return of fear by demonstrating context effects in reinstatement and reinstatement-free control groups. Next, *Matthias Sperl* will introduce a novel imagination-based paradigm, showing successful conditioning with solely imagined social stimuli intriguingly captured by facial muscle activity. Finally, *Valerie Jentsch* will reveal how an acute bout of physical exercise modulates the consolidation and retention of extinction memories and how these effects might generalize to other perceptually similar stimuli. Taken together, this symposium explores a broad variety of factors modulating the acquisition, extinction and stability of fear and opens new perspectives on how this knowledge can be used to design innovative behavioral interventions for augmenting extinction-based therapeutic efficacy.

- **S16.1 - From then to now: Effects of childhood maltreatment on acquisition and generalization of conditioned fear**
  M. Klingelhöfer-Jens, *Institute of Systems Neuroscience, University Medical Center Hamburg-Eppendorf, Hamburg, Germany*
- **S16.2 - The impact of contingency awareness on the neurocircuitry underlying visceral pain-related fear and safety learning**
  F. Labrenz, *Department of Medical Psychology and Medical Sociology, Ruhr University Bochum, Bochum, Germany*
- **S16.3 - Systematic investigation of the role of context in reinstatement induced return of fear**
  R. Sjouwerman, *Maastricht University, The Netherlands*
- **S16.4 - Corrugator and zygomaticus activity during imagery-based social conditioning**
  M. F. J. Sperl, *University of Giessen (Germany), Department of Psychology, Clinical Psychology and Psychotherapy*
- **S16.5 - The impact of physical exercise on the consolidation and retention of extinction memories**
  V. L. Jentsch, *Ruhr-Universität Bochum, Deutschland*

S17 - Moderators of social connectedness: neurobiological mechanisms and clinical implications

Friday, 08:30 - 10:00 | KG I, HS 1199

Session chair(s): **D. Scheele**[1], **A. Lischke**[2] ([1] University of Oldenburg | [2] Medical School Hamburg)

Humans strive for social connections and social support is a well-established resilience factor buffering against the detrimental effects of psychosocial stress. However, previous research has provided heterogeneous findings regarding the neural and hormonal substrates of social connectedness. In the current symposium, we examine possible sociodemographic and psychological moderating variables such as relationship status, parenthood, attachment experience and gender that could help to explain previous conflicting evidence. *Dora Hopf* presents findings from an ambulatory assessment study during a COVID-19 lockdown indicating that relationship status moderates the association between loneliness and cortisol levels. *Julian Packheiser* collected neurophysiological data from romantic partners to study how loneliness and relationship status moderate the association between daily hugging and momentary mood. *Alexander Lischke* used structural imaging data to explore how parenthood affects reward and salience processing brain regions in mother and fathers. *Lara Pulmann* investigated how attachment experiences alter the development of prefrontal and subcortical brain regions throughout adolescence. *Mitjan Morr* probed the interactions between sex and loneliness in psychophysiological responses to an analogue trauma and the processing of neural fear signals.

- **S17.1 - Loneliness and diurnal cortisol levels during COVID-19 lockdown: the roles of living situation, relationship status and relationship quality**
  D. Hopf, *Institute of Medical Psychology, Heidelberg University Hospital, Heidelberg, Germany*
- **S17.2 - Neurophysiological correlates of hugging and its behavioral effects on well-being**
  J. Packheiser, *Netherlands Institute for Neuroscience, Deutschland*
- **S17.3 - Associations between brain structure and parenthood – a community based imaging study with more than 900 individuals**
  A. Lischke, *Medical School Hamburg, Germany*
- **S17.4 - Prospective associations between attachment style and neurostructural development from adolescence to early adulthood**
  L. M. Puhlmann, *Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany*
- **S17.5 - Lonely in the Dark: Trauma Memory and Sex-specific Dysregulation of Amygdala Reactivity to Fear Signals**
  M. Morr, *Division of Medical Psychology, Department of Psychiatry and Psychotherapy, University Hospital Bonn*

S18 - Brain and behavioral plasticity in the context of early adversity - across the lifespan and generations

Friday, 08:30 - 10:00 | KG I, HS 1015

Session chair(s): **K. Pittner**[1], **N. Moog**[1] (Charité Universitaetsmedizin Berlin, Deutschland)

Adversity experienced early in life can have a profound impact on the brain and associated behavior. In addition to more general sequelae of stress, adverse exposures may also show effect specificity i.e., specific brain areas may be affected depending on the type of adversity or the co-occurrence of psychopathology. Moreover, behavioral changes may be related to specific changes in the brain: In the first talk, *Johannes Falck* will present work showing that hippocampal but not striatal volumes mediated the association between household income and value-based learning in children. Following this, *Andrea Knop* will present an fMRI-compatible sensory-tactile stimulation paradigm to map the precise location of the female genital field, which may show sexual abuse-specific plasticity. The next two talks will shed light on the intersection of psychopathology and adversity. *Catarina Rosada* will disentangle differences in cortical thickness in the lingual gyrus and cingulate cortex that are related to childhood trauma versus borderline personality disorder. Importantly, the consequences of adversity may be transmitted to the following generation. *Nora Moog* will present findings indicating that newborns of women with maltreatment experiences and higher levels of prenatal depression exhibit alterations in brain microstructure. These effects of maternal adversity on newborn brain structure may be mediated by gestational biology including the immune system. *Steven Schepanski* will present on the relation between specific maternal immune challenges during pregnancy and executive functions of preschoolers. This symposium aims to discuss multiple forms of brain and behavioral plasticity across the lifespan and across generations in response to adversity.

- **S18.1 - Hippocampal volumes in middle childhood are developmentally sensitive and indirectly mediate the association of household income with value-based learning**
  J. Falck, *Goethe University Frankfurt, Deutschland*
- **S18.2 - Structural variation of the human genital somatosensory representation field**
  A. Knop, *Charité-Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Humboldt-Universität zu Berlin, Institute of Medical Psychology, 10117 Berlin, Germany*
- **S18.3 - Cortical thickness and childhood trauma in healthy women, women with borderline personality disorder and women with post-traumatic stress disorder**
  C. Rosada, *Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin, Humboldt-Universität zu Berlin, and Berlin Institute of Health, Klinik für Psychiatrie und Psychotherapie, Campus Benjamin Franklin, Berlin, Germany*
- **S18.4 - Interaction between maternal depression in pregnancy and a history of childhood maltreatment on newborn global brain microstructure**
  N. Moog, *Charité - Universitätsmedizin Berlin*
- **S18.5 - Prenatal immune challenges and cognitive development in childhood**
  S. Schepanski, *Division for Experimental Feto-Maternal Medicine, Department of Obstetrics and Fetal Medicine, University Medical Center Hamburg-Eppendorf, Hamburg, Germany*

Symposia V

S19 - How Real is Virtual Reality? Evidence from Explicit, Implicit and Physiological Measures

Friday, 10:30 - 12:00 | KG I, HS 1015

Session chair(s): **M. Rubo**[1] (Marius Rubo, Postdoc, University of Fribourg, Schweiz)

Virtual Reality (VR) is increasingly used in psychology and neuroscience for its ability to elicit a sense of presence ("being there") and its derivates such as social presence or illusory body ownerships. Here we further explore these phenomena by testing explicit, implicit and physiological reactions to virtual scenarios. *B. Schöne* shows that a real-life and a virtual height exposure are mostly indistinguishable on a electrophysiological level (alpha- and theta-band oscillations) as opposed to a conventional 2D laboratory setup. VR thus appears to be capable of eliciting real-life cognitive and emotional processes that are distinct from those induced by conventional experimental setups. *J. Kisker* observed lifelike behavioral patterns in a threatening VR cave, which, however, were only partially reflected in established electrophysiological markers. Indicated by their sensation of walking *M. Dobricki* observed in seated participants presented with visuo-tactile stimuli the perceptual formation of a locomotor structure that corresponds to the global array of stimulation during real walking. *M. Rubo* observed a more reactive and naturalistic gaze behavior towards a virtual agent's social behavior in VR compared to the viewing on a computer monitor. He furthermore found enhanced difficulties in participants' source memory in distinguishing VR from reality compared with distinguishing stimuli seen on a computer monitor from reality. We discuss how these novel findings contribute to understanding how the brain processes VR simulations and how basic research, but also applications in clinical or work psychology, may profit from observed phenomena.

- **S19.1 - The Reality of Virtual Reality**
  B. Schöne, *Experimental Psychology I, Institute of Psychology, Osnabrück University, Germany*
- **S19.2 - Complex fear responses in Virtual Reality: A mobile EEG study**
  J. Kisker, *Experimental Psychology I, Institute of Psychology, Osnabrück University*
- **S19.3 - A dynamic body illusion generated by perceptual organization**
  M. Dobricki, *PHBern, Schweiz*
- **S19.4 - Traces of Presence in Virtual Reality: Social Behavior and Source Memory Performance**
  M. Rubo, *Marius Rubo, Postdoc, University of Fribourg, Schweiz*

S20 - Deciphering the memory function of the sleeping brain

Friday, 10:30 - 12:00 | KG I, HS 1010

Session chair(s): **M. Petzka**[1], **T. Schreiner**[2] ([1] Max-Planck-Institute for Human Development, Berlin | [2] LMU Munich)

Sleep's critical contribution to memory consolidation has been consistently demonstrated throughout the last century. Nonetheless, due to methodological constraints the mechanistic vehicles conveying the memory function of sleep, e.g., memory reactivation as well as neural homeostasis, remain poorly understood. However, the recent emergence of multivariate analysis methods and access to direct cortical recordings from epileptic patients have proven powerful tools for deciphering sleep's role in memory formation.
In this symposium, the speakers will present their latest approaches towards identifying mechanistic vehicles that enable sleep related memory consolidation by applying diverse experimental strategies and cutting-edge analyses.
Thomas Schreiner (LMU Munich) will demonstrate that head direction related information enriches memory traces with spatial context, which is reactivated during non-REM sleep. *Marit Petzka* (Max-Planck-Institute for Human Development, Berlin) will present evidence that slow oscillations (SOs) during non-REM sleep act as a pacemaker for sequential memory reactivation. *Hong-Viet Ngo* (University of Lübeck) will further highlight that SOs represent possible time-windows for memory reactivation. He will show that presenting reminder cues during specific SO phases (i) renders the reactivation of associated memories trackable and (ii) results in elevated memory performance. *Deniz Kumral* (University of Freiburg) will depict evidence for the reactivation of previously learned memory content in REM sleep. Lastly, *Randolph Helfrich* (University of Tübingen) will demonstrate, using combined scalp and intracranial EEG recordings, that REM sleep enables neural homeostatic systems recalibration in support of memory consolidation.

- **S20.1 - Reactivating real-world spatial context using targeted memory reactivation**
  T. Schreiner, *Ludwig-Maximilians-Universität München, Deutschland*
- **S20.2 - Slow oscillations are the pacemaker for sequential memory reactivation during sleep**
  M. Petzka, *Max Planck Institute for Human Development, Berlin, Germany*
- **S20.3 - Closed-loop targeted memory reactivation during slow oscillation up- and down-states**
  H.-V. Ngo, *University of Lübeck, Germany*
- **S20.4 - Real-world experiences shape neural activity and dream content in the sleeping brain**
  D. Kumral, *Albert-Ludwigs-Universität Freiburg, Germany*
- **S20.5 - Human REM sleep mediates memory consolidation through recalibration of neural homeostasis**
  R. Helfrich, *Universitätsklinikum Tübingen, Deutschland*

S21 - How oxytocin and sex hormones affect social cognition

Friday, 10:30 - 12:00 | KG I, HS 1098

Session chair(s): **K. Bertsch**[1], **G. Domes**[2] ([1] Ludwig-Maximilians-Universität München, Deutschland | [2] Universität Trier)

In the last decades the neuropeptide oxytocin has gained a lot of attention for its seemingly positive effects on social cognition particularly in experimental clinical but also (neuro)biological research. In the current symposium, new results from state-of-the-art experimental studies will be presented and discussed. The questions of these studies are important since oxytocin research has been lately criticized for its lack in power, the insufficient recognition of interindividual differences (e.g., sex or age) the interaction with other neuropeptides and hormones, in particular sex hormones, as well as the limited knowledge about effects in clinical samples. The studies presented in this symposium target particularly these aspects, i.e., the investigation of sex-dependent effects of oxytocin and the interaction of oxytocin with sex hormones on social cognition as well as clinical implications for patients with deficits in social cognitions, such as social anxiety and borderline personality disorder. The talks will focus on different social-cognitive processes, such as facial emotion processing, emotional memory and social learning as well as trust and include both behavioral and neuroimaging data collected in large samples of healthy men and women as well as individuals with different clinical conditions.

- **S21.1 - Exogenous estradiol and oxytocin modulate sex differences in hippocampal reactivity and episodic memory**
  M. Coenjaerts, *Division of Medical Psychology, Department of Psychiatry and Psychotherapy, University Hospital Bonn, 53105 Bonn, Germany*
- **S21.2 - Sex differences in the effects of oxytocin on trust**
  J. Brustkern, *Albert-Ludwigs-Universität Freiburg, Deutschland*
- **S21.3 - Oxytocin and social learning in socially high anxious men and women**
  S. Levine, *Department of Psychology, Ludwig-Maximilians-University München*
- **S21.4 - Effects of oxytocin on face processing in Borderline Personality Disorder**
  A. Lischke, *Medical School Hamburg, Deutschland*

S22 - The Neurobiological foundations of psychotherapy for anxiety disorders

Friday, 10:30 - 12:00 | KG I, HS 1199

Session chair(s): **M. Herrmann**[1], **U. Lueken**[2] ([1] Universitätsklinikum Würzburg, Deutschland | [2] Humboldt-Universität zu Berlin)

Anxiety disorders represent one of the most common mental health conditions, with a prevalence of 3.8% (2.5-7%) of the global population (Dattani, Ritchie, and Roser, 2018; Mental Health). To further optimize existing therapies, it is necessary to explore both the basic neurobiological processes and the prediction of therapeutic success. This symposium will present papers at the interface of biological and clinical psychology, all examining the neurobiological basis of psychotherapy for anxiety disorders. In the first contribution by *Fabian Breuer*, the ability to control inhibition as a correlate of anxiety disorders will be investigated in patients with specific phobia using an anti-saccade task. Furthermore, the modifiability of inhibitory control as a possible therapeutic option will be investigated. The next two presentations (*Ulrike Lueken, Martin Herrmann*) show results of a multicenter therapy study in patients with specific phobia with a focus on distinguishing baseline differences in functional activation (measured by fMRI) between responders and non-responders. In the paper of *Ulrike Lueken*, N= 148 patients are included and resting-state data are analyzed. In the contribution of *Martin Herrmann* (N=77), functional activation during a fear anticipation paradigm is used for therapy prediction. The last two contributions (*Lisa Cybinski, Yunbo Yang*) examine the trans-diagnostic changes in neural activation to be measured in the context of psychotherapy for anxiety disorders. While *Lisa Cybinski* presents data from a meta-analysis, focusing on whole-brain analyses, *Yunbo Yang* examines the effects of psychotherapy on amygdala activation in an ROI-based approach.

- **S22.1 - Inhibitory control and its modification in specific phobia – An antisaccade study**
  F. Breuer, *Universitätsklinikum Münster, Institut für tranlsationale Psychiatrie, Münster, Deutschland*
- **S22.2 - Intrinsic brain connectivity patterns as moderators of treatment response in spider phobia: a cross-site replication approach**
  U. Lueken, *Humboldt-Universität zu Berlin, Deutschland*
- **S22.3 - Differentiation of neural activity between responder and non-responder of exposure-based therapy in spider phobic patients**
  M. Herrmann, *Department of Psychiatry, Psychosomatics, and Psychotherapy, Center for Mental Health, University Hospital of Würzburg, Germany*
- **S22.4 - Neural Correlates of Psychotherapy: A systematic review and meta-analysis of functional brain activation studies in anxiety disorders**
  L. M. Cybinski, *Center of Mental Health, Dept. of Psychiatry, Psychosomatics, and Psychotherapy, University Hospital of Wuerzburg, Margarete-Hoeppel-Platz 1, D-97080 Wuerzburg, Germany*
- **S22.5 - Neural plasticity of the amygdala: does psychotherapy for anxiety disorders modulate amygdala responsiveness to fearful stimuli?**
  Y. Yang, *Department of Psychiatry and Psychotherapy, Philipps-University Marburg, Marburg*

Symposia VI

S23 - Personality Neuroscience: A walk through the garden of forking paths

Friday, 16:30 - 18:00 | KG I, HS 1199

Session chair(s): **A.-L. Schubert**[1], **K. Hilger**[2] ([1] Universität Mainz | [2] Universität Würzburg)

Electrophysiological measures of brain activity have become increasingly popular in personality research, as they allow studying the biological basis of individual differences in personality traits and cognitive abilities. "Personality neuroscience" as a growing field has not only identified benchmark findings in many areas of personality research, but also contributed to theory development and testing. However, while behavioral measures of personality traits – questionnaires and ability tests – are usually extensively tested and validated, little is known about the reliabilities, consistencies, and validities of electrophysiological measures. Moreover, researcher degrees of freedom in EEG preprocessing and in the selection of specific measures can affect psychometric properties of personality-related EEG measures in unpredictable ways. The aim of this symposium is to initiate a debate about these methodological challenges with the aim of developing ideas for improving the robustness of personality neuroscience. In the first talk, *Cassie Short* will introduce the CoScience project, a collaboration of ten EEG-personality laboratories that employs the principles of cooperative forking paths analysis. Next, *Anna-Lena Schubert* and *Johannes Rodrigues* will present multiverse analysis approaches to assess the robustness and generalizability of EEG-personality associations. Finally, *José C. García Alanis* and *Kirsten Hilger* will close with discussing convergent and divergent validities of different measures of neural variability and signal complexity. Our symposium highlights how accounting for the psychometric properties of electrophysiological measures and systematically evaluating the effects of design decisions and analytical choices might foster the robustness of research findings in personality neuroscience.

- **S23.1 - A novel attempt to improve replicability of EEG-Personality associations: The CoScience Project**
  C. A. Short, *University of Hamburg, Germany*
- **S23.2 - How Robust is the Relationship between Neural Processing Speed and Cognitive Abilities?**
  A.-L. Schubert, *Johannes Gutenberg-Universität Mainz, Deutschland*
- **S23.3 - The model is bend but never broken: Evidence for a situational induction strength based quadratic extension to the capability model**
  J. Rodrigues, *Julius-Maximilians Universität Würzburg, Deutschland*
- **S23.4 - More than noise? A multi-level EEG approach for the investigation of neural variability and its relation to human cognitive performance**
  J.C. García Alanis, *Johannes Gutenberg University Mainz*
- **S23.5 - A Multi-Modal Approach to Individual Differences in Brain Signal Complexity**
  K. Hilger, *Department of Psychology I, Würzburg University, Germany*

S24 - Social learning: Learning from and about others

Friday, 16:30 - 18:00 | KG I, HS 1015

Session chair(s): **G. Hein**[1] (Universitätsklinikum Würzburg)

In recent years, computational learning models have been increasingly and successfully applied to the social realm, most commonly to formally quantify observational learning processes. However, social learning research has not only elucidated how we learn from others, but also how social information impacts our learning processes and how we learn social information about other people. This symposium brings together scientists from three countries (Austria, Switzerland, Germany) and five different universities (Universities of Lübeck, Heidelberg, Vienna, Würzburg, & Zürich) who investigate different aspects of social learning.
In more detail, our symposium provides insights into the neural basis of learning from others in intergroup contexts (*Pyungwon Kang*) and sheds light on how social feedback impacts first-hand learning about one's own abilities (*Annalina V. Mayer*). We will discuss how reinforcement learning integrates social knowledge to learn about others' personalities (*Koen Frolichs*) and how it can explain the formation and decay of prosocial motives towards other people (*Anne Saulin*). A final presentation will elucidate how individuals compute the influence of other's decisions on probabilistic reversal learning, using brain stimulation (*Lei Zhang*).
Together, the presentations of the invited experts provide insights into different facets of social learning. Applying different methodologies and modelling approaches, the contributions demonstrate the potentials of learning models in explaining social learning from observation and first-hand experiences.

- **S24.1 - Observational learning in intergroup contexts**
  P. Kang, *Department of Economics and Laboratory for Social and Neural Systems Research, University of Zurich*
- **S24.2 - Biases in learning about the self and their association with affect**
  A. V. Mayer, *University of Lübeck, Germany*
- **S24.3 - How do humans learn about other people? Incorporating social knowledge structures into reinforcement learning**
  K. M. M. Frolichs, *Section Social Neuroscience, Department of General Psychiatry, University of Heidelberg, Heidelberg, Germany*
- **S24.4 - Learning prosocial motives: Modelling empathy and reciprocity driven closeness**
  A. Saulin, *Center of Mental Health, Department of Psychiatry, Psychosomatic and Psychotherapy, Translational Social Neuroscience Unit, University of Würzburg, Würzburg, Germany*
- **S24.5 - A causal role of temporoparietal junctions in computing social influence during goal-directed learning**
  L. Zhang, *Institute of Systems Neuroscience, University Medical Center Hamburg-Eppendorf, Hamburg, 20246, Germany*

S25 - The social side of stress

Friday, 16:30 - 18:00 | KG I, HS 1010

Session chair(s): **K. Wingenfeld**[1], **O. T. Wolf**[2] ([1] Charité Universitätsmedizin, Deutschland | [2] Ruhr Universität Bochum)

There is a close and bidirectional interaction between social cognitive processes and the neuroendocrine stress response. The initial cognitive evaluation of a situation as potentially threatening activates the stress system. The hormones released influence social cognition and social behavior in return. The traditional concept of the fight or flight response has been challenged more recently by the idea of a stress induced tend and befriend behavior. The current symposium provides an overview on current research in this area using different methodological approaches ranging from controlled laboratory studies, to an epidemiological survey and an intervention study. The first presentation reports on an experiment testing the impact of experimentally induced social stress (with the Trier Social Stress Test) on reciprocal punishment and empathy (*Schürmann*, Pützer & Wolf). The second laboratory study investigated the effect of social exclusion (Cyberball) on empathy and punishment behavior in patients with BPD and healthy controls (*Graumann*, Cho, Kulakova & Wingenfeld). The third presentation describes findings from a large international online survey investigating the associations between Covid related stress and social and non-social decision making (*Kalenscher*, Plassmann & Ling). The final talk will present data from an intervention study targeting attention and interoception, socio-affective or socio-cognitive abilities (*Engert* & Linz). Effects of the three interventions were characterized in the field using EMA techniques. The symposium will provide a state of the art overview about current methodological and conceptual developments in this research field. Findings are of relevance for the prevention of mental disorders and societal conflicts alike.

- **S25.1 - Empathy and Negative Reciprocity Under Stress**
  N. Schürmann, *Ruhr-Universität Bochum, Deutschland*
- **S25.2 - Effects of Social Exclusion on Social Cognition in Healthy Individuals and Patients with Borderline Personality Disorder**
  L. Graumann, *Klinik und Hochschulambulanz für Psychiatrie und Psychotherapie, Charité Universitätsmedizin Berlin, Campus Benjamin Franklin (CBF)*
- **S25.3 - The impact of physical distancing during the Corona pandemic on stress, interpersonal relationships and social wellbeing**
  P. Forbes, *Heinrich-Heine-Universität Düsseldorf, Deutschland*
- **S25.4 - Impact of distinct contemplative mental training elements on daily life stress, thoughts and affect**
  V. Engert, *Universitätsklinikum Jena, Deutschland*

S26 - The gut microbiome and mental health

Friday, 16:30 - 18:00 | KG I, HS 1098

Session chair(s): **E. Schneider**[1,2] ([1] Psychiatric Hospital (UPK) Basel, Center of Affective, Stress and Sleep Disorders, Basel, Switzerland | [2] Department of Clinical Research, University of Basel, Basel, Switzerland)

Growing evidence underscores the importance of the gut microbiome in mental health by linking peripheral intestinal functions to emotional and cognitive centers of the brain. Even though basic research including preclinical studies have demonstrated different communication pathways of the gut-brain-axis, i.e. the connection between the gut microbiome and the brain, the precise mechanisms underlying this bidirectional regulation are still open to discussion. The aim of the proposed symposium is to discuss possible mechanisms of the gut-brain-axis as well as the potential of microbiome-related treatments in psychiatry. Therefore, we address (1) the basics of microbiology in mental health research, (2) the role of adult hippocampal neurogenesis in the antidepressant actions of lactate and (3) the microbial regulation of tryptophan metabolism. Furthermore, we will present evidence of a successful administration of a short-term probiotic supplementation in depressive patients to treat their (3) affective and (4) cognitive symptoms. Elucidating the pathways linking the gut-microbiota and the brain might have a direct impact on mental health and provide novel ideas for innovative therapies in various mental diseases. Focusing on the interplay between the gut, brain and behavior will allow us to get a better understanding of the human body as an integral system and further highlights the necessity of interdisciplinary research.

- **S26.1 - The gut microbiota in depression**
  J. F. Vazquez-Castellanos, *VIB-KU Leuven, Belgium*
- **S26.2 - Role of adult hippocampal neurogenesis in the antidepressant effects of lactate**
  A. Carrard, *CHUV, Centre de Neurosciences Psychiatriques (CNP), Switzerland*
- **S26.3 - Microbial Regulation of Tryptophan Metabolism**
  C. E. Gheorghe, *Department of Psychiatry and Neurobehavioral Science, University College Cork, Cork, Ireland*
- **S26.4 - Clinical and gut microbial effects of a probiotic add-on therapy in depressed patients: A randomized controlled trial**
  A. Schaub, *Department of Psychiatry (UPK) Basel, University of Basel, Switzerland*
- **S26.5 - Effect of short-term, high-dose probiotic supplementation on cognition, related brain functions and BDNF in depressive patients: A secondary analysis of a randomized controlled trial**
  E. Schneider, *Universitäre Psychiatrische Kliniken Basel, Schweiz*

Poster session II (overview)

Friday, 14:00-15:30 | UB Freiburg
Setup of the posters starts at 12:00

Topic 1: Computational and Neuroimaging Methods

- **P2.001 - Ear-EEG compares well to cap-EEG in recording auditory ERPs: a quantification of signal loss**
  A. Meiser, *University of Oldenburg, Deutschland*
- **P2.002 - The P600 and P3 are linked to noradrenergic activity: Evidence from EEG and pupillometry**
  F. Contier, *Universität Potsdam, Deutschland*
- **P2.003 - Brain Dynamics And The Relationship to Conspiracy Theories**
  Z. Razzaghpanah, *Heidelberg Academy of Sciences and Humanities, Heidelberg, Germany*

Topic 2: Individual Differences and (Epi)Genetics

- **P2.004 - Epigenetic modulation of psychobiological stress in everyday life: The moderating role of neuroticism**
  M. Stoffel, *Institut für Medizinische Psychologie, Universitätsklinikum Heidelberg, Deutschland*
- **P2.005 - Epigenetic signatures of war-related trauma - a study of refugee families in Africa**
  K. Mattonet, *Institute for Interdisciplinary Research on Conflict & Violence (IKG), Bielefeld University, Germany*
- **P2.006 - Context Effects, Skin Conductance Responses and Personality Traits - Influencing Variables on Risk-Taking within a Modified Version of the Balloon Analog Risk Task**
  A. T. Henn, *Department of Psychiatry, Psychotherapy and Psychosomatics, School of Medicine, RWTH Aachen University, Aachen, Germany*
- **P2.007 - On the Highway of Human Cognition: Brain Structure-Function Coupling and its Relation with General Cognitive Ability**
  J. Popp, *Julius-Maximilians-University, Würzburg, Germany*
- **P2.008 - Structural architecture and brain network efficiency links polygenic scores to intelligence**
  D. Metzen, *Biopsychologie, Institut für kognitive Neurowissenschaften, Fakultät für Psychologie, Ruhr-Universität Bochum, Deutschland*

- **P2.009 - Resting-state networks of believers and non-believers: An EEG microstate study**
  T. Kleinert, *University of Alberta, Canada*
- **P2.010 - Trait curiosity is associated with schizotypy in human adults**
  T. Steiger, *Universität zu Lübeck, Institut für Psychologie*
- **P2.011 - From hands to heart: a trend for higher interoceptive accuracy in left-handed as compared to right-handed female participants**
  S. Bernard, *University of Luxembourg, Luxemburg*

Topic 3: Learning, Memory, and Sleep

- **P2.012 - Exercise-induced increase in cytokine levels correlates with implicit learning in young adults**
  K. Hötting, *Universität Hamburg, Biologische Psychologie und Neuropsychologie, Deutschland*
- **P2.013 - Increases in theta power precede successful formation of crossmodal associative memory**
  J. Ostrowski, *Universitätsklinikum Hamburg-Eppendorf, Deutschland*
- **P2.014 - Attentional control and pattern reinstatement: on-going processes during long-term memory retrieval**
  M. Sabo, *Leibniz Research Centre for Working Environment and Human Factors, Germany*
- **P2.015 - Investigating the functional specialization of human declarative memory subsystems**
  S. Klinkowski, *University of Tuebingen*
- **P2.016 - Reactivation of Sequential Head Direction Memory Traces in Humans**
  J. K. Schaefer, *Department of Psychology, Ludwig-Maximilians-Universität München, Munich, Germany*
- **P2.017 - (Re)learning of self-related beliefs**
  A. Schröder, *University of Lübeck, Deutschland*
- **P2.018 - Reward responsiveness (BAS) facilitates gaining contingency awareness in appetitive, yet not aversive, conditioning**
  J. Finke, *Universität Siegen, Deutschland*
- **P2.019 - Spatio-temporal theta pattern dissimilartiy in superior parietal cortex during memory generalization**
  H. Heinbockel, *Universität Hamburg, Deutschland*
- **P2.020 - How far would you go to survive? An Approach-avoidance foraging task in immersive virtual reality**
  A. Kastrinogiannis, *University Medical Center Hamburg-Eppendorf, Germany*

- **P2.021 - The Role of Source Memory for Reward-Motivated Learning**
  J. Tkotz, *Department of Clinical Psychology, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany*
- **P2.022 - Characterization of slow oscillations and spindles during sleep from the juvenile to the peri-adolescent developmental stage in rats**
  J. Fechner, *Institut für Medizinische Psychologie und Verhaltensneurobiologie, Universität Tübingen*
- **P2.023 - Neural signatures of serial dependence emerge during cued selection in working memory**
  C. Fischer, *Institut für Medizinische Psychologie, Goethe-Universität Frankfurt am Main*
- **P2.024 - Cerebellar involvement in memory formation**
  E. Stroukov, *Institut für Psychologie, Abt. Neuropsychologie, Albert-Ludwigs-Universität Freiburg, Germany*
- **P2.025 - Heuristic-Based Strategic Exploration in Sequential Reinforcement Learning**
  A. M. Brands, *Department Psychologie, Universität zu Köln, Deutschland*
- **P2.026 - Auditory closed- loop stimulation of slow oscillations and delta waves during sleep**
  N. Niethard, *Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen, Tübingen, Germany*
- **P2.027 - Removal of reinforcement reduces propensity to respond in instrumental learning**
  E. Ort, *Heinrich-Heine Universitaet Duesseldorf, Deutschland*
- **P2.028 - Effects of Acute Stress on Item and Source Emotional Memory: an fMRI Study**
  C. Ventura-Bort, *Department of Biological Psychology and Affective Science, University of Potsdam, Potsdam, Germany*
- **P2.029 - Interindividuelle Unterschiede bei der Generalisierung von Extinktionslernen entlang des Spektrums der Trait Anxiety**
  E. Nazarenus, *Universität Greifswald, Deutschland*
- **P2.030 - Successful mnemonic discrimination: linked to decreased functional connectivity between hubs in the frontoparietal and default mode network**
  P. Iliopoulos, *Institut für Kognitive Neurologie und Demenzforschung (IKND), Magdeburg, Germany*
- **P2.031 - Association of Spermidine Blood Levels with Slow-Wave Sleep Physiology**
  S. Wortha, *Department of Neurology, University Medicine Greifswald, Greifswald, Germany*
- **P2.032 - Identifying sequential memory reactivation during sleep in humans**
  M. Kutlu, *Ludwig Maximilian University of Munich, Germany*

- **P2.033 - The structure of experience: Examining the emergence of value-weighted schematic representations in the mPFC**
  P. C. Paulus, *Department of Psychology, Neuropsychology, University of Freiburg, Germany*

Topic 4: Cognition

- **P2.035 - Der Einfluss von Reappraisal (Hochregulation) auf Emotionsverarbeitung und emotionale Schmerzmodulation**
  P. Reicherts, *Lehrstuhl für Medizinische Psychologie und Soziologie, Medizinische Fakultät, Universität Augsburg*
- **P2.036 - Eye Did This! Sense of Agency in Eye Tracking Tasks**
  J. Gutzeit, *Julius-Maximilians-Universität, Deutschland*
- **P2.037 - Classifying Cognitive Load in a Quasi-Realistic Scenario Based on Multimodal Neurophysiological Data**
  S. Gado, *Julius-Maximilians-Universität Würzburg, Deutschland*
- **P2.038 - Identifying Interacting Cognitive and Affective Processes – Effects of Emotional Distractions on Different Cognitive Load Levels**
  K. Lingelbach, *Applied Neurocognitive Psychology Lab, Department of Psychology, Carl von Ossietzky University, Oldenburg, Germany*
- **P2.039 - Conflict related midfrontal theta in an approach avoidance task is independent from midfrontal theta in a Flanker task**
  L. Lange, *Differential Psychology & Personality Research, Institute of Psychology, Osnabrück University*
- **P2.040 - A non-linear temporal discounting drift diffusion model accurately accounts for rodent choices and response times and yields parameter estimates with high test-retest reliability**
  J. Peters, *Department Psychologie, Universität zu Köln, Deutschland*
- **P2.041 - Distraction prevents decoding of auditory working memory contents**
  P. Deutsch, *Institut für Medizinische Psychologie, Goethe-Universität Frankfurt*
- **P2.042 - New insights into the neural correlates of error processing as revealed by the Speeded Inference Game**
  E. Niessen, *Universität zu Köln, Deutschland*
- **P2.043 - Using Computational Models of Reinforcement Learning and Choice Frequency to Study Human Habits**
  S. Nebe, *University of Zurich, Schweiz*
- **P2.044 - Interaction of negative, visual primes with cognitive control**
  M. Kampa, *Universität Siegen, Deutschland*

- **P2.045 - Effects of visual appetitive cues on neural reward circuits and intertemporal decision-making**
  K. Knauth, *Universität zu Köln, Deutschland*
- **P2.046 - Measuring individual differences in electrophysiological correlates of executive functions**
  C. Löffler, *Institute of Psychology, Heidelberg University , Germany*
- **P2.047 - Stress and the cardiac cycle: Influence on conflict processing in a Simon task**
  L. v. Haugwitz, *Leibniz-Institut für Arbeitsforschung an der TU Dortmund (IfADo), Deutschland*

Topic 5: Attention and Perception

- **P2.048 - Dissociable neuronal mechanism for different crossmodal correspondence effects**
  C. Jaap, *NeuroImage Nord, Department for Systems Neuroscience, University Medical Center Hamburg Eppendorf*
- **P2.049 - Spontaneous Necker-cube Reversals are not that Spontaneous – An EEG Study**
  M. Wilson, *Faculty of Biology, University of Freiburg, Germany*
- **P2.051 - The phase of prestimulus alpha oscillations causally modulates the causal prior in multisensory perception**
  T. Rohe, *Institute of Psychology, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Erlangen, Germany*
- **P2.052 - SOA-dependent spatial pre-cueing effects of emotional face distractors on target performance and event related potentials**
  V. Shivani, *University of Bonn, Germany*
- **P2.053 - Auditory attention in workplace-related complex sound environments**
  M. Rosenkranz, *Neurophysiology of Everyday Life Group, Department of Psychology, University of Oldenburg, Oldenburg, Germany*
- **P2.054 - Allocating spatial attention in multisensory environments: insights from ERPs and neural oscillations**
  L. Klatt, *Leibniz Research Centre for Working Environment and Human Factors, Deutschland*
- **P2.055 - Effects of self-generated positive and negative pain-related expectations on pain processing: Multivariate analyses of pre- and post-stimulus EEG activity**
  C. Wittkamp, *Department of Systems Neuroscience, University Medical Center Hamburg Eppendorf Germany*

- **P2.056 - Effects of inhibitory TMS over visual area V5/MT on visual speech recognition**
  L. Jeschke, *Technische Universität Dresden, Germany*
- **P2.057 - The role of conflicting motor plans in sensory attenuation: Comparison of N1 amplitude reduction for sounds elicited by pro- and anti-saccades**
  A. Seidel, *Heinrich-Heine Universität Düsseldorf, Deutschland*
- **P2.058 - Development of distraction by emotional sounds —between costs of orienting of attention and benefits of arousal**
  C. Bonmassar, *Leibniz-Institut für Neurobiologie (LIN), Deutschland*
- **P2.059 - Investigating lip-movement modelling on cortical speech tracking in virtual environments with mobile EEG**
  M. Daeglau, *Neuropsychology Lab, Department of Psychology, University of Oldenburg, Germany*
- **P2.060 - Investigating the neural correlates of personally familiar scenes**
  H. Klink, *Friedrich-Schiller-Universität Jena, Deutschland*
- **P2.061 - Orienting in an uncertain world: pupil-linked neuromodulation and temporal dynamics of expected and unexpected uncertainty**
  A. Marzecová, *Heinrich Heine Universität Düsseldorf, Germany*
- **P2.062 - Re-analyses of auditory N1 response in an auditory oddball paradigm with slow presentation rate**
  S. Berti, *Johannes Gutenberg-Universität Mainz, Deutschland*

Topic 6: Brain and Periphery, Neuroendocrinology, and Stress

- **P2.063 - Interoception and pain perception across the menstrual cycle in young healthy women**
  A. Dierolf, *University of Luxembourg, Department of Cognitive Neuroscience and Behavioral Science; Research Group: Stress, Pain and Gene-Environment Interplay*
- **P2.064 - The impact of a tailored mindfulness-based program for resident physicians on distress, hair cortisol secretion, and the quality of care: A randomised controlled trial**
  J. C. Fendel, *Department of Occupational and Consumer Psychology, Institute of Psychology, University of Freiburg, Freiburg, Germany*
- **P2.065 - Stability and Durability of Human Salivary Alpha Amylase Across Different Storing Conditions**
  L. S. Pfeifer, *Ruhr-Universität Bochum, Deutschland*
- **P2.066 - Stress effects on memory retrieval of aversive and appetitive instrumental counterconditioning in men**
  J. Caviola, *Ruhr-Universität Bochum, Deutschland*

- **P2.067 - The Influence of a Glucose Administration on Stress Responsivity and Memory After a Socially Evaluated Cold Pressor Test**
  T. Rüttgens, *Ruhr-Universität Bochum, Institut für Kognitive Neurowissenschaft, Deutschland*
- **P2.068 - Effects of Chronic Stress on Path Integration**
  O. Akan, *Ruhr-Universität Bochum, Deutschland*
- **P2.069 - Optimal timing of stress cortisol suppression by oral metyrapone**
  L. Drost, *Universität Trier*
- **P2.070 - Movement during the Trier Social Stress Test**
  B. Denk, *Department of Psychology, University of Konstanz, Germany*
- **P2.071 - A pooled mega-analysis on the modulating effect of transcutaneous auricular vagus nerve stimulation (taVNS) on salivary alpha-amylase as indirect noradrenergic marker**
  M. Giraudier, *Department of Biological Psychology and Affective Science, Faculty of Human Sciences, University of Potsdam, Potsdam, Germany*
- **P2.072 - Elimination of salivary cortisol in female and male volunteers**
  H. Schächinger, *Universität Trier, Deutschland*
- **P2.073 - Stability of Steroids in Hair Samples and Methodological Recommendations for Psychoendocrine Research**
  J. Eder, *Biopsychology, TU Dresden, Dresden, Germany*
- **P2.074 - Einfluss von Stress und Kortisolrezeptoren auf Entscheidungsprozesse**
  C. E. Deuter, *Charité Universitätsmedizin Berlin, Deutschland*
- **P2.075 - Stress effects on top-down vs. bottom-up control of attention**
  M. Larra, *IfADo, Dortmund*
- **P2.076 - Evaluation of a short respiration focused training to help others during stress**
  V. Zamoscik, *Zentralinstitut für Seelische Gesundheit, Deutschland*

Topic 7: Social and Environmental Neuroscience

- **P2.077 - Developing an Autonomous Driving Paradigm for Electrophysiological experiments**
  M. Weil, *Carl von Ossietzky Universität Oldenburg, Deutschland*
- **P2.078 - Another's pain vs. my gain: Evidence of absence for a causal role of the dorsolateral prefrontal cortex in costly decision-making**
  H. Hartmann, *Social Brain Laboratory, Netherlands Institute for Neuroscience, Royal Academy of Arts and Sciences, Amsterdam, Netherlands*

- **P2.079 - Does personal significance impact social modulation?: An EEG Study of Early Auditory Components in Joint Action**
  G. A. L. Montoya, *Hildesheim University, Germany*
- **P2.080 - My Brain knows Me: Neural Oscillatory Markers for the Self-Prioritization Effect**
  C. Haciahmet, *Universität Trier, Deutschland*
- **P2.081 - Measuring the effect of familiarity on state anxiety and related changes in heart rate (HR) and heart rate variability (HRV) in everyday life**
  M. Gründahl, *Center for Mental Health, Department of Psychiatry, Psychosomatics and Psychotherapy, Translational Social Neuroscience Unit, University of Würzburg, Würzburg, Germany*
- **P2.082 - Hohe Reliabilität der Gehirnaktivierung in einer monetären und einer sozialen Risiko-Aufgabe**
  S. N. L. Schmidt, *Klinische Psychologie, Universität Konstanz*
- **P2.083 - Event-related brain potentials of preparing and giving an untruthful response**
  H. Gibbons, *University of Bonn*
- **P2.084 - Electrophysiological correlates of social feedback processing in healthy and depressive individuals**
  S. Scholz, *Universität Bielefeld, Deutschland*
- **P2.085 - Using EEG to measure shared audience engagement during real-life videos against distraction in road traffic**
  M. Imhof, *Universität Konstanz, Deutschland*

Topic 8: Development and Ageing

- **P2.086 - Multimodal prediction of cognitive performance differences in older age**
  C. Krämer, *Institute of Neuroscience and Medicine (INM-1), Research Centre Jülich, Jülich, Germany*
- **P2.087 - Interrelating differences of structural and functional connectivity in the older adult's brain**
  J. Stumme, *Institute for Anatomy I, Medical Faculty & University Hospital Düsseldorf, Heinrich Heine University Düsseldorf, Düsseldorf, Germany*
- **P2.088 - Lifestyle-related differences in neurite morphology of white matter tracts in older adults**
  N. Bittner, *Institute for Anatomy I, Medical Faculty & University Hospital Düsseldorf, Heinrich-Heine-University, Düsseldorf*
- **P2.089 - Lifespan trajectory of oscillatory power and phase-based connectivity**
  C. Stier, *Clinic of Neurology, University Medical Center Göttingen, Göttingen, Germany*

- **P2.090 - The Role of Maternal Mental Health on the Development of Infant's Self-Regulation: A prospective longitudinal Study**
  C. E. Schwarze, *Universität Heidelberg, Deutschland*
- **P2.091 - Distraction from Pain in Aging – the Impact of Acute Stress**
  A. Dierolf, *Universität Luxemburg; Department of Behavioural and Cognitive Sciences; Institute for Health and Behaviour; Stress, Pain, and Gene-Environment Interplay*
- **P2.092 - Individual Alpha and Theta Frequency Across Age: In Search of Resting-State EEG Markers of Working Memory Capacity**
  P. Khader, *Fresenius University of Applied Sciences*
- **P2.093 - Locus coeruleus-related insula activation supports implicit learning across the adult lifespan**
  M. J. Dahl, *Center for Lifespan Psychology, Max Planck Institute for Human Development, 14195 Berlin, Germany*
- **P2.094 - The neural basis of motor sequence learning in children and adults**
  M. Hille, *Center for Lifespan Psychology, Max Planck Institute for Human Development, Germany*

Topic 9: Disorders and Interventions

- **P2.095 - Direct subthalamic nucleus stimulation influences speech and voice quality in Parkinson's disease patients**
  S. Frühholz, *University of Zurich, Schweiz*
- **P2.096 - Verbal memory performance in euthymic patients with bipolar disorder – a reflection of mood?**
  T. D. Meyer, *McGovern Medical School, Psychiatry & Behavioral Sciences, UT Health, Houston, TX, USA*
- **P2.097 - Larger N170 after Sad Faces in Individuals with Elevated Depressive Symptoms in a Facial Oddball Task**
  K. Riepl, *University of Würzburg, Würzburg, Germany*
- **P2.098 - Potential use of the cEEGrid EEG for Tactile Brain-Computer Interfaces**
  M. Eidel, *Universität Würzburg, Deutschland*
- **P2.099 - Verbale Gewalt in Institutionen: Zusammenhänge mit erlebter Diskriminierung und Depressivität**
  F. Hauck, *Lehrstuhl für Gesundheitspsychologie, Friedrich-Alexander-Universität Erlangen-Nürnberg, Deutschland*
- **P2.100 - Primed to Fail? An fMRI Study of Emotion Recognition After Affective Priming in Schizophrenia**
  A. H. J. Sahm, *Universität Konstanz, Deutschland*

- **P2.101 - Tonic pupil dilation during sustained attention in children with ADHD**
  U. Schöllkopf, *Neurocognitive Development, Leibniz Institute for Neurobiology, Magdeburg, Germany*
- **P2.102 - Chronic pain and its influence on Creative Ideation: An EEG study**
  D. A. Gubler, *Unversity of Bern, Schweiz*
- **P2.103 - Is the decrease in bodily response to negative auditory chills specific to insula damage?**
  L. M. Witt, *Functional Imaging Unit, Center for Diagnostic Radiology, University of Greifswald, Greifswald, Germany*
- **P2.104 - Social Skills following Deep Brain Stimulation in Treatment-Resistant Depression: An explorative study**
  H. Kilian, *Abteilung für Interventionelle Biologische Psychiatrie, Department für Psychische Erkrankungen, Klinik für Psychiatrie und Psychotherapie, Uniklinikum Freiburg*
- **P2.105 - Reduced modulation of frowning muscle activity in stroke patients during an emotion induction paradigm**
  K. Klepzig, *University Medicine Greifswald*
- **P2.106 - Meta-analysis of convergent macro- and microstructural white matter alterations in patients with Alcohol Use Disorder**
  C. Spindler, *Department of Psychology, Faculty of Human Sciences, Medical School Hamburg, Am Kaiserkai 1, 20457 Hamburg, Germany*
- **P2.107 - An EEG Test Battery for the Early Diagnosis of Alzheimer's Disease**
  J. M. Meixner, *Department of Psychology, Brandenburg Medical School Theodor Fontane, Neuruppin, Germany*
- **P2.108 - Heart rate variability and attentional control in premenstrual syndrome**
  B. L. Blaser, *University of Potsdam, Deutschland*
- **P2.109 - Belief formation in depression: reduced integration of positive feedback for self but not other-related information**
  N. Czekalla, *Department of Psychiatry, University of Lübeck, Deutschland*
- **P2.110 - Anhedonia Relates to Reduced Reward Anticipation in the Striatum in Patients with Major Depression**
  A. Daniels, *Charité – Universitätsmedizin Berlin, Department of Psychiatry and Neurosciences | CCM*
- **P2.111 - Mindfulness-based instruction to improve real-time fMRI neurofeedback efficiency in problematic alcohol use**
  J. Zhang, *Department of Clinical Psychology, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany*
- **P2.112 - Heart Rate and Heart Rate Variability in Patients With Obsessive-Compulsive Disorder and Healthy First-Degree Relatives**
  F. Jüres, *Department of Psychology, Humboldt-Universität zu Berlin, Germany*

- **P2.113 - Using mind control to modify cue-reactivity in AUD: The impact of mindfulness-based relapse prevention on real-time fMRI neurofeedback to modify cue-reactivity in alcohol use disorder**
  A. Aslan, *Department of Addiction Behavior and Addiction Medicine, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany*
- **P2.114 - Benefits of Caffeine augmentation in Electroconvulsive therapy**
  M. D. Ridder, *Universitäre Psychiatrische Kliniken (UPK) Basel, Schweiz*

Topic 10: (Brain) Stimulation

- **P2.115 - The Modulation of Attentional Control and Prospective Memory with Non-Invasive Brain Stimulation in Older Adults**
  N. Schmidt, *University Hospital of Old Age Psychiatry and Psychotherapy, University of Bern, Switzerland*
- **P2.116 - Does Transcranial Alternating Current Stimulation at Alpha Frequency Induce Similar Alterations in Theory of Visual Attention Cognitive Functions as Video Games?**
  Y. Hilla, *Ludwig-Maximilians-Universität, Department Psychologie, Biologische Psychologie, Deutschland*

Topic 11: Affective Neuroscience

- **P2.118 - Measuring the neural correlates of real-life fear using virtual reality and mobile EEG**
  J. Packheiser, *Netherlands Institute for Neuroscience, Deutschland*
- **P2.119 - Priming-Effekte auf subjektive und mimische Schmerzreaktionen**
  P. Göller, *Medizinische Psychologie und Soziologie, Universität Augsburg*
- **P2.120 - Kodierung individueller Belohnungswerte visueller sexueller Stimuli in Striatum und OFC**
  S. Klein, *JLU Gießen, Deutschland*
- **P2.121 - Inherently threatening contexts facilitate visuocortical engagement to conditioned threat**
  Y. Stegmann, *University of Würzburg, Germany*
- **P2.122 - Implicit Emotion Regulation: A Replication Study on the Counter Regulation of Emotions by Attentional Biases in Affective Processing**
  H. Heyer, *Universität Koblenz-Landau, Deutschland*

- **P2.123 - Distinct activation of the rACC and the vmPFC during different emotion regulation strategies**
  M. Burghart, *Universität Konstanz*
- **P2.124 - Hemodynamic correlates of emotion regulation in frontal lobe epilepsy patients and healthy participants**
  K. Johanna, *Abteilung für Psychologie, Universität Bielefeld, Deutschland*
- **P2.125 - Fear lies in the eye of the beholder - freezing of gaze upon avoidable threat**
  A. Merscher, *Universität Würzburg, Deutschland*
- **P2.126 - Heart rate variability biofeedback reduces anxiety sensitivity in young healthy individuals**
  M. C. Hufenbach, *Universität Potsdam, Deutschland*
- **P2.127 - Nahinfrarotspektroskopie crossmodaler Emotionseffekte im auditorischen und visuellen Kortex**
  T. Höfling, *Universität Mannheim, Deutschland*

Saturday | 18 June 2022

Keynote

Prof. Dr. Brigitte Röder

Wie frühkindliche Erfahrungen das menschliche Gehirn formen

Saturday, 10:45 - 11:45 | KG I, Aula

Die Rolle frühkindlicher Erfahrungen auf die Gehirnentwicklung ist beim Menschen schwer zu erforschen, da es nicht möglich ist, Erfahrungen beim Menschen systematisch zu manipulieren. Daher wurden natürliche Fälle mit atypischen Erfahrungen untersucht, darunter auch von Geburt an blinde Menschen. Die Modelle menschlicher Blindheit geben Aufschluss über die Fähigkeit des Gehirns, sich an atypische Erfahrungen anzupassen. Von entscheidender Bedeutung ist die Frage, ob das zentrale Nervensystem durch die Wiederherstellung typischer Erfahrungen im späteren Leben in der Lage ist, eine typische Entwicklung wiederherzustellen, z. B. typische visuelle und multisensorische Funktionen nach der Behandlung von Blindheit. In diesem Vortrag werden die jüngsten Erkenntnisse über die neuronalen Korrelate der sensorischen Restitution bei Patienten, die aufgrund eines angeborenen Katarakts blind geboren worden waren, zusammengefasst. Es wird erörtert, was die Forschung zur sensorischen Restitution beim Menschen über die neuronalen Mechanismen sensibler Perioden im Allgemeinen offenbart und ob diese Befunde auch auf andere abweichende frühkindliche Situationen zutreffen könnten.

Brigitte Röder *ist Professorin für Biologische Psychologie und Neuropsychologie an der Universität Hamburg. Sie studierte Psychologie an der Philipps Universität Marburg, wo sie auch promovierte. Nach einer Postdoc-Zeit in USA und der Leitung einer Emmy Noether Gruppe an der Philipps Universität Marburg wechselte sie 2003 an die Universität Hamburg. Prof. Röder ist u. a. Mitglied der Deutschen Nationalakademie (Leopoldina) und der Akademie der Wissenschaften in Hamburg. Zu ihren bedeutendsten Auszeichnungen zählen die Wilhelm Wundt-Medaille der Deutschen Gesellschaft für Psychologie, der Leibnizpreis der Deutschen Forschungsgemeinschaft und ein ERC Advanced Grant des Europäischen Forschungsrats.*

Symposia

Symposia VII

S27 - Prediction in language: from sensation to semantics

Saturday, 9:00 - 10:30 | KG I, HS 1010

Session chair(s): **M. Rabovsky**[1] (University of Potsdam, Deutschland)

Prediction has been suggested to play an important role in language processing. However, language processing spans a vast array of levels at which such predictions could operate, from the perception of sounds and shapes to the composition of meaning. This symposium brings together researchers investigating language prediction at all these levels, using behavioral experiments, fMRi, M/EEG, eye tracking, and computational modelling. *Helen Blank* will present a series of behavioral studies investigating how priors concerning a speaker's voice modulate vowel perception. *Susanne Eisenhauer* will present MEG evidence demonstrating activation of orthographic and lexical-semantic representations of predicted words before their actual presentation. In addition, she found that after word presentation lexical-semantic representations of predicted as compared to unpredicted words were more robust suggesting that neural representations of predicted features were not "explained away" but rather "sharpened". Moving up the language hierarchy from words to sentences, *Milena Rabovsky* will show that a large-scale neural network model of predictive sentence comprehension successfully predicts the N400 ERP component during naturalistic reading, and that the N400 serves as a prediction error based learning signal driving adaptation, in line with model predictions. Finally, *Micha Heilbron* will present neurocomputational work spanning levels of representation by showing that predictions can enhance visual representations already in V1, and that listening to audiobooks evokes a hierarchy of predictions across processing levels (phonemes, syntax, semantics). Overall, the symposium will present a comprehensive view of prediction in language, from sensation to semantics.

- **S27.1 - Influence of voice context on vowel perception**
  H. Blank, *University Medical Center Hamburg-Eppendorf, Germany*
- **S27.2 - Predictive pre-activation of orthographic and lexical-semantic representations facilitates visual word recognition**
  S. Eisenhauer, *Goethe University Frankfurt*
- **S27.3 - Modelling N400 amplitudes as an internal temporal difference prediction error**
  M. Rabovsky, *University of Potsdam, Germany*
- **S27.4 - Multi-level prediction during reading and listening**
  M. Heilbron, *Donders Institute, Nijmegen, The Netherlands*

S28 - A Neuroscience Perspective on Prospective Memory Across the Lifespan

Saturday, 9:00 - 10:30 | KG I, HS 1199

Session chair(s): **J. Peter**[1], **S. Horn**[2] ([1] University of Bern, Switzerland | [2] University of Zurich, Switzerland)

Prospective memory — the ability to remember to execute an intended action at a specific moment in the future — is fundamental to navigating our daily lives and becomes particularly important in old age with increasing health related demands (e.g., taking medication or keeping appointments with doctors). Despite a long history of interest in the topic of a potential age-related decline in prospective memory, the circumstances under which older adults are less well able to remember future intentions remain poorly understood. In addition, the neurobiological underpinnings of potential age-related changes in prospective memory have only rarely been investigated. In this symposium, we aim to provide a neuroscience perspective on prospective memory across the lifespan by presenting recent studies that combined behavioural data with structural and functional imaging or electrophysiology in different age groups. The symposium will include five talks, covering how reward, punishment, or stress affect younger and older adults' prospective memory, and how the estimation of time influences memory for intended actions. The presentations will follow a multimethod approach: Each speaker (4 PhD students and 1 assistant professor) will present behavioural data, mostly in combination with EEG or fMRI. We will discuss implications and possible directions for future theoretical and experimental approaches at the intersection between neuroscience and aging.

- **S28.1 - A possible framework of internal time processing and strategic time monitoring in time-based prospective memory**
  G. Laera, *Cognitive Aging Lab (CAL), Faculty of Psychology and Educational Sciences, University of Geneva, Switzerland*
- **S28.2 - Acute stress and prospective memory**
  G. Mikneviciute, *University of Geneva, Switzerland*
- **S28.3 - The neural correlates of remembering intentions in light of gains and losses**
  A. Hering, *Tilburg University, Netherlands*
- **S28.4 - Neural substrates of prospective memory in old age and their interplay with financial reward**
  M. Menéndez Granda, *University Hospital of Old Age Psychiatry and Psychotherapy, University of Bern, Switzerland*
- **S28.5 - Adult Age Differences in Time- and Event-Based Prospective Remembering with Motivational Incentives**
  J. Brummer, *University of Zurich, Schweiz*

S29 - The effects of social touch on emotion, cognition and health

Saturday, 9:00 - 10:30 | KG I, HS 1221

Session chair(s): **M. Eckstein**[1], **R. Böhme**[2] ([1] Institut für Medizinische Psychologie Heidelberg, Deutschland | [2] Universität Linköping)

In times of the Covid19 pandemic, many people have experienced less social touch than before. This might contribute to the observed increase in mental health issues during the last two years.
In this symposium, we will explore the role social touch plays in infant development, body perception, social cognition and stress regulation. The four original research studies investigate tactile-sensory, neuroendocrine and central mechanisms with methods ranging from fMRI to hormone analyses, tactile evoked illusions and to ecologically momentary assessment. Thereby we aim for a multilevel perspective to the question why a lack of social touch might contribute to health issues.
Combining these aspects, we will draw the attention to the importance of interpersonal connectedness, with implications for potential interventions based on the idea that social touch buffers stress, improves relationships, and strengthens individual mental health.

- **S29.1 - Social Touch and Self-Touch in Autism, ADHD and Anorexia**
  R. Boehme, *Linköping University, Schweden*
- **S29.2 - Stroking in preterm babies – C-tactile activation promotes autonomic regulation**
  Y. Friedrich, *Friedrich Schiller University Jena, Institute of Psychology, Department for Clinical Psychology, Jena, Germany*
- **S29.3 - Social self-touch in embodied rescripting**
  B. Lenggenhager, *Department of Psychology, University of Zuirch*
- **S29.4 - Cortisol and Oxytocin Concentrations during Covid-19 lockdown: Associations with affectionate touch and individuals' wellbeing**
  E. Schneider, *Institute of Medical Psychology, Center for Psychosocial Medicine, Heidelberg University Hospital, Heidelberg, Germany*

S30 - Risk and Resilience Factors for the Development of Neurodevelopmental Disorders

Saturday, 9:00 - 10:30 | KG I, HS 1098

Session chair(s): **V. Brandt**[1], **D. Golm**[1] (University of Southampton)

Neurodevelopmental disorders encompass conduct disorder, attention-deficit/ hyperactivity disorder (ADHD), autism spectrum disorders (ASD), and tic disorders. These disorders have been associated with a number of somatic, psychological, and social risk and resilience factors. This symposium will feature these across five presentations. The first contribution will present research on the bidirectional, longitudinal relationship between head injuries, conduct problems and common risk factors in a large cohort of youths (N = 7140, age = 9 months to 17 years). The second talk focuses on resilience in young people from a community sample with conduct problems and callous-unemotional traits, showing that social functioning relates to higher resilience. The third contribution will present research on the longitudinal relationship between weight, other physical conditions, and ADHD (N > 18000; from birth to age 17) and investigates risk factors for both. The fourth contribution will examine the impact of early adverse experiences on cognitive functioning with a focus on memory problems and its association with ADHD symptoms across multiple samples (i.e., children, adults) and designs (i.e., systematic reviews). The fifth presentation investigates common strengths and deficits across neurodevelopmental disorders using the research domain criteria (RDoC), which will situate the four other talks in the broader context of understanding psychopathological symptoms across levels of analysis and systems. This symposium will showcase the value of a developmental psychopathology perspective on neurodevelopmental problems and identify targets for research and intervention.

- **S30.1 - The longitudinal Relationship Between Physical Factors and ADHD**
  V. Brandt, *University of Southampton*
- **S30.2 - The interplay between experiences of childhood maltreatment, memory problems and ADHD symptoms**
  D. Golm, *University of Southampton, Vereinigtes Königreich*
- **S30.3 - Bidirectional Associations Between Childhood Head Injuries and Conduct Problems from 3 to 17 years in the UK Millennium Cohort Study**
  H. Carr, *University of Southampton, United Kingdom*
- **S30.4 - How neurodevelopmental disorders fit into the research domain criteria: an umbrella review**
  R. Seneviratne, *University of Southampton, United Kingdom*
- **S30.5 - Social Functioning and Resilience in Young People with Conduct Problems and Callous-Unemotional Traits**
  H. Eisenbarth, *Victoria University of Wellington, New Zealand*

S31 - Cardiac and brain parameters of self & other emotion processing and regulation

Saturday, 9:00 - 10:30 | KG I, HS 1015

Session chair(s): **L. Kaltwasser**[1], **S. Guendelman**[1] (Humboldt-Universität zu Berlin, Deutschland)

The brain and peripheral bodily organs continuously exchange information while we navigate in a complex social world. Interoception refers to the processing of afferent signals from the body to the brain. The phylogenetic and ontogenetic development of the human brain is sculpted not only by input from peripheral bodily organs but also by its social environment. As such the regulation of emotion and stress is embedded within a social context. The processing and regulation of socially induced emotions relies on the inference of cognitive and visceral states in self and others, through processes ranging from interoception, over empathy to mindreading. In this series of talks we will present different psychophysiological paradigms applying functional Magnetic Resonance Imaging (fMRI) or Electroencephalography (EEG) simultaneously with the Electrocardiogram (ECG) in order to study the integration of cardiac and brain parameters on the brain-body axis (i.e. interoception and stress) in healthy individuals and mechanisms of potentially altered brain-body communication in stress-associated diseases. Results suggest benefits of actively regulating another person's emotions for reducing one's own distress while the interoceptive signal transmission may indicate the course of stress-related disorders. The findings will be discussed in the light of theories that integrate brain and heart interactions in the context of self and other processing. In conclusion, new intervention methods (from psychotherapies, neurofeedback, to nerve/brain stimulation) that enhance the communication between the brain and the body while accounting the social environment, may help to improve mental and physical health.

- **S31.1 - Emotional self-referential processing in event-related potentials**
  L. Kaltwasser, *Humboldt-Universität zu Berlin, Deutschland*
- **S31.2 - How do we read affective mental states in others and the self? Influences of heart rate feedback and autistic traits on mindreading**
  K. Bögl, *Department of Psychology, Berlin School of Mind and Brain, Humboldt-Universität zu Berlin*
- **S31.3 - Regulating negative emotions of others reduces own stress: Neurobiological correlates and the role of individual differences in empathy**
  S. Guendelman, *Clinical Psychology of Social Interaction, Berlin School of Mind and Brain, Institute of Psychology. Humboldt-Universität zu Berlin, Unter den Linden 6, 10117, Berlin, Germany*
- **S31.4 - Interoception, stress and stress-associated diseases**
  A. Schulz, *Clinical Psychophysiology Laboratory, Department of Behavioural and Cognitive Sciences, University of Luxembourg, Esch-sur-Alzette, Luxembourg*

Symposia VIII

S32 - Neurophysiological correlates of inter-individual differences: The role of situational variables

Saturday, 11:45 - 13:15 | KG I, HS 1010

Session chair(s): **K. Paul**[1] (Universität Hamburg)

Associations between inter-individual differences measures and brain activity are often complex, difficult to reveal and context dependent. Presenting five examples, this symposium provides an overview of selected methods and approaches to identify important moderators of these associations. First, *Katharina Paul* examines associations of self-reports of approach motivation with a putative index of approach tendencies (frontal alpha-asymmetry) during rest and during motivating situations (monetary rewards, erotic pictures; n=720). As expected, her findings suggest that these associations are larger for motivating versus unspecific resting conditions. Second, *Andrea Hildebrandt* describes associations of self-reports of extraversion and empathy with an EEG marker of saliency processing (LPP component) during a dynamic facial expression task (n=93). Herewith, she shows that these traits relate to the processing of faces, but only for motivationally relevant facial expressions. Third, *Corinna Kührt* associates dispositional willingness to invest effort with neurophysiological correlates of conflict processing (N2, pupil dilation) in a flanker and n-back task (n=146) as well as behavioral markers of effort exertion. She discusses how these markers relate to each other depending on cognitive demand levels of the task. Fourth, *Chris Stolz* relates trait neuroticism/anxiety to behavioural and electrocortical (frontal theta activity) indices of reward-based learning (n=105). He focuses on positive prediction errors, i.e. outcomes better than expected. Fifth, *Johannes Rodrigues* examines the link of cardiac defensive reaction and orienting response to different types of avoidance behavior in a virtual t-maze (n=76). Additionally, gender effects on the behavioral choice and frontal asymmetry to different types of avoidance behavior are shown.

- **S32.1 - Is frontal alpha asymmetry an index of trait approach motivation in motivational contexts? Evidence from a large-scale dataset**
  K. Paul, *Universität Hamburg, Deutschland*
- **S32.2 - The Late-Positive-Potential only to motivationally relevant facial expressions is a correlate of empathy and extraversion**
  A. Hildebrandt, *Carl von Ossietzky Universität Oldenburg, Deutschland*
- **S32.3 - Cognitive effort investment under varying demand: Results from event related potentials and pupil dilation**
  C. Kührt, *TU Dresden, Deutschland*
- **S32.4 - Frontal theta oscillations as an index for unexpected monetary reward vs. non-reward processing and its associations with individual differences in instrumental learning and dispositional neuroticism/anxiety**
  C. Stolz, *University of Marburg, Germany*

- **S32.5 - Follow your heart: Cardiac defensive reactions and orienting responses correspond to virtual avoidance behavior choices in a virtual T-maze, while frontal asymmetry is linked to approach and avoidance**
  J. Rodrigues, *Julius-Maximilians Universität Würzburg, Deutschland*

S33 - The (un)familiar face: from neurobiology to psychophysiological mechanisms and clinical implications

Saturday, 11:45 - 13:15 | KG I, HS 1199

Session chair(s): **M. Bayer**[1], **F. Bublatzky**[2] ([1] Humboldt-Universität zu Berlin, Deutschland | [2] Zentralinstitut für Seelische Gesundheit Mannheim)

Identifying whether a person is unknown, known, or even a loved one is a core social function with far-reaching implications. Previous research has elucidated the basic principles of face processing, but the process of familiarization and how familiar or personally relevant faces are identified is poorly understood. This symposium spans current neuroscientific research on familiar face processing, including neuronal bases, perceptual and psychophysiological mechanisms to clinical and social relevance. *Gyula Kovács* reports on the emergence of neural representations of familiarity and identity (EEG, fMRI). *Niclas Willscheid* shows neural adaptation to in- and outgroup faces and the relevance of perceptual familiarity for generalization of threat and safety associations (EEG). *Florian Bublatzky* explores the role of loved familiar faces on fear acquisition, reversal, and extinction learning (startle EMG, SCR, HR). *Mareike Bayer* demonstrates the impact of face familiarity on altered processing of emotional faces in autism spectrum conditions (combined EEG-fMRI). Finally, *Monika Eckstein* talks about the neural basis of postpartum bonding problems in mothers viewing their own child or other familiar persons (fMRI). Overall, this symposium takes an integrative perspective to face familiarity from basic neural adaptation to psychophysiological responding, social learning to attachment and relevant psychopathology.

- **S33.1 - Getting to know someone. How facial familiarity and identity representation emerges in the human brain**
  G. Kovács, *Inst. Psychol. Friedrich Schiller Univ., Deutschland*
- **S33.2 - Neural distinguishment between visual outgroup faces and generalization of threat and safety learning**
  N. Willscheid, *Central Institute of Mental Health*
- **S33.3 - Perceiving significant others: Are loved familiar face pictures prepared safety signals?**
  F. Bublatzky, *Central Institute of Mental Health, Germany*
- **S33.4 - Personal relevance and emotional face perception in Autism Spectrum Conditions**
  M. Bayer, *Humboldt-Universität zu Berlin, Deutschland*
- **S33.5 - Neural Reponses to Infant- and Partner Faces in Postpartum Bonding Disorder**
  M. Eckstein, *Institut für Medizinische Psychologie, Universitätsklinikum Heidelberg, Deutschland*

S34 - Digital Methods for Induction, Measurement and Reduction of Acute Psychosocial Stress

Saturday, 11:45 - 13:15 | KG I, HS 1015

Session chair(s): **H. Drimalla**[1] (Universität Bielefeld, Deutschland)

Reliable and valid induction and measurement of acute stress is the foundation for empirical stress research. This symposium encompasses five presentations that demonstrate the potential of digital methods for induction, measurement, and reduction of psychosocial stress. First, *Gregor Domes* (Trier University) will demonstrate the induction of acute psychosocial stress in virtual reality with the TSST-VR, an adaptation of the "classic" face-to-face TSST. Validation studies revealed robust self-reported and endocrine stress responses, largely comparable to the face-to-face TSST. Next, *Matthias Norden* (Bielefeld University) will introduce a smartphone-based approach for conducting stress studies in outside-the-lab settings. This Digital Stress Test has shown its stress induction capability and its feasibility for large-scale data collection. Machine learning models can be trained on such datasets to automatically measure stress-related behavior. *Hanna Drimalla* (Bielefeld University) will present two studies on automated video analysis of non-verbal behavior under psychosocial stress.
Digital solutions also enable new ways to examine and support stress coping. *Theresa Wechsler* (University of Regensburg) will speak about examining stress coping. Within a TSST-VR it is possible to measure biological, physiological, and behavioral variables along a psychosocial stressor and to examine their relationship to stress coping strategies. *Anna Felnhofer* (Medical University of Vienna) will talk about reducing stress through the social support of virtual others. A study series shows that avatar's non-verbal social support and inclusion have buffering effects on heart rate and self-reported stress. We expect a fruitful discussion on the potential and challenges of digital methods for empirical stress research.

- **S34.1 - TSST-VR: Induction of acute stress in virtual reality**
  G. Domes, *Universität Trier, Deutschland*
- **S34.2 - Inducing and Recording Acute Stress Responses on a Large Scale with a Smartphone-based Digital Stress Test**
  M. Norden, *CITEC - Center for Cognitive Interaction Technology, Bielefeld University, Bielefeld, Germany*
- **S34.3 - Automatic Detection of Stress in the Trier Social Stress Test**
  H. Drimalla, *Cognitive Interaction Technology (CITEC), Bielefeld University, Bielefeld, Germany*
- **S34.4 - Attentional, affective and physiological correlates of stress coping within a VR-TSST**
  T. Wechsler, *Universität Regensburg, Institut für Psychologie, Lehrstuhl für Klinische Psychologie und Psychotherapie, Regensburg, Deutschland*
- **S34.5 - Reducing stress through the social support of virtual others**
  A. Felnhofer, *Medizinische Universität Wien, Univ.-Klinik für Kinder- und Jugendheilkunde, Klinische Abteilung für Pädiatrische Pulmologie, Allergologie und Endokrinologie, Österreich*

S35 - Interozeptive Verarbeitung bei Psychopathologie: pharmakologische und neurophysiologische Konzeptualisierungen und Interventionen

Saturday, 11:45 - 13:15 | KG I, HS 1221

Session chair(s): **A. Schulz**[1], **K. Bertsch**[2] ([1] University of Luxembourg, Luxembourg | [2] Ludwig-Maximilians-Universität München, Deutschland)

Interozeption umfasst die Repräsentation, Verarbeitung und Wahrnehmung körpereigener Prozesse. Veränderungen der Interozeption sind potenziell transdiagnostische Störungsmechanismen bei Psychopathologie. Bisherige Studien deuten auf ein komplexes Zusammenspiel zwischen interozeptiven Prozessen und modulierenden Faktoren, wie humoralen Signalwegen und sozialen Faktoren, hin. Dieses Symposium präsentiert und diskutiert aktuelle Befunde zu pharmakologischen und neurophysiologischen Grundlagen von Interozeption, sowie Interventionen bei Populationen mit psychischen Störungen. Die Auswirkungen von akutem Stress auf die interozeptive Verarbeitung werden von *Greta Hansen* (Luxemburg) beschrieben. *André Schulz* (Luxemburg) wird Daten zu gastrisch-interozeptiven Prozessen bei Patienten mit entzündlichen Darmerkrankungen und Reizdarmsyndrom vorstellen. *Aline Tiemann* (Fribourg) wird Zusammenhänge von gastrischer und kardialer Interozeption mit pathologischem Essverhalten (einschließlich bei Individuen mit Bulimie- und Binge-Eating-Symptomatik) vorstellen, sowie Pilotdaten über ein neu entwickeltes virtuelles gastrisches Biofeedback-Paradigma als Intervention bei beeinträchtigter gastrischer Interozeption. Mögliche Interventionen für veränderte neurobiologische Mechanismen im Zusammenhang mit Interozeption umfassen pharmakologische und neurophysiologische Interventionen. *Sarah Back* (München) wird vagale neurophysiologische Veränderungen im Hinblick auf die Herzfrequenzvariabilität und Herzschlag-evozierte Potenziale bei Borderline-Persönlichkeitsstörung, sowie Modulationen durch das Neuropeptid Oxytocin vorstellen. Schließlich wird *Marius Schmitz* (Heidelberg) ein ätiologisches Modell interozeptiver Prozesse für Psychopathologie vorstellen und zukünftige Richtungen für das weitere Forschungsfeld aufzeigen. Zusammen zeigen diese Beiträge auf, dass veränderte Interozeption auf verschiedenen Verarbeitungsebenen für spezifische Symptome bei psychischen Störungen verantwortlich sein könnte. Außerdem könnte Interozeption zu diagnostischen Prozessen und als Verlaufsindikator bei Interventionen beitragen.

- **S35.1 - Akuter Stress und kardiale interozeptive Genauigkeit in einer Herzschlagzählaufgabe**
  G. Hansen, *Universität Luxemburg, Luxemburg*
- **S35.2 - Gastrische Interozeption und gastrische myoelektrische Aktivität bei chronisch-entzündlichen Darmerkrankungen und Reizdarmsyndrom**
  A. Schulz, *Clinical Psychophysiology Laboratory, Department of Behavioural and Cognitive Sciences, University of Luxembourg, Esch-sur-Alzette, Luxembourg*
- **S35.3 - Dimensionen der kardialen und gastrischen Interozeption und ihr Zusammenhang mit gestörem Essverhalten**
  A. Tiemann, *Universität Fribourg, Schweiz*

- **S35.4 - Vagale neurophysiologische Verarbeitung bei Frauen mit Borderline-Persönlichkeitsstörung: Herzschlag-evozierte Potentiale, Herzratenvariabilität und Effekte pharmakologischer Intervention durch Oxytozin Vergabe**

  S. N. Back, *Lehrstuhl für Klinische Psychologie, Ludwig-Maximilians-Universität München, Deutschland*

- **S35.5 - Interozeption in der Genese von Psychopathologie am Beispiel trauma-assoziierter Erkrankungen**

  M. Schmitz, *of General Psychiatry, Center for Psychosocial Medicine, University of Heidelberg, Germany*

S36 - Prediction perspectives on perception

Saturday, 11:45 - 13:15 | KG I, HS 1098

Session chair(s): **N. Wetzel**[1] (Leibniz Institute for Neurobiology, Germany)

An emerging perspective over the last decades is that perception cannot be studied in isolation, but is intrinsically bound to the knowledge of the perceiver. This knowledge is thought to influence perception in the form of sensory predictions. In this symposium, we introduce latest research on prediction mechanisms in different modalities.
Dimitris Voudouris will present his work on tactile suppression in moving limbs. He demonstrates, using behavioral and psychophysiological methods, a core contribution of predictive processes in the regulation of tactile suppression. *Tjerk Dercksen* presents an EEG-study that investigates relationships between predictions based on self-paced actions and the perception of coupled tactile stimuli. The omission of expected stimuli results in a neural response, that is first observed over somatosensory areas, and is followed by later responses that are similar to auditory studies. This work is closely related to that presented by *Betina Korka*, who coupled motor acts with sounds. Her results demonstrate that action intention determines predictions based on stimulation regularities. She merges results into an integrative theoretical model that emphasizes the critical role of prediction errors for both action-related and environmental-related sensory processing. Finally, *Luigi Grisoni* presents his work on predictive mechanisms supporting perception and language processing. He introduces research on the Prediction Potential: an electrophysiologically measured negative shift observed just before the presentation of expected stimuli and he explains systematic relationships to the well-known subsequent prediction error responses.
The diverse approaches to the same topic of prediction in this symposium are promising an engaging scientific discourse.

- **S36.1 - Somatosensory omission reveals action-related predictive processing**
  T. Dercksen, *Leibniz Institute for Neurobiology, Germany*
- **S36.2 - Action intentions shape the auditory sensory predictions**
  B. Korka, *Leibniz Institute for Neurobiology, D-39118 Magdeburg, Germany*
- **S36.3 - The role of predictions in tactile suppression**
  D. Voudouris, *Justus Liebig University Giessen, Germany*
- **S36.4 - Brain correlates of perceptual and semantic prediction and resolution**
  L. Grisoni, *Brain Language Laboratory, Department of Philosophy and Humanities, Freie Universität Berlin.*

All Abstracts

Symposia

S01.1 - Error monitoring in dual-tasking

M. Steinhauser[1], **R. Steinhauser**[1], **P. Löschner**[1]

Catholic University of Eichstätt-Ingolstadt

Efficient task performance requires an error monitoring system that detects errors and initiates control adjustments to prevent further errors. These mechanisms are even more important when multiple tasks are executed simultaneously or in rapid succession because interference makes dual-tasking performance particularly error-prone. Here, we present several behavioral and event-related potential studies that investigate which types of interference can impair error monitoring in dual-tasking and which mechanisms serve to maintain reliable error monitoring under these conditions. All studies use variants of the psychological refractory period paradigm in which participants perform two tasks with variable temporal overlap. In a first part, we consider neural signatures of error awareness (the error positivity) to demonstrate how the time point of error processing is flexibly scheduled to adapt to dual-task interference. In a second part, we investigate whether early errors signals (the error-related negativity) interact when two errors occur at the same time and elaborate how the error monitoring system solves the credit assignment problem that arises under these conditions. Together, our results demonstrate a remarkable flexibility by which the brain faces the challenges of error monitoring under dual-tasking.

S01.2 - Electrophysiological correlates of decision confidence for correct and error responses

S. Bode[1], **D. Feuerriegel**[1]

The University of Melbourne, Australien

Adaptive decision-making in humans involves constantly monitoring one's own decision processes. To decide whether a decision should be corrected, or whether we should quickly change our mind, the subjective sense of confidence in the accuracy of our decisions is crucial. Recent work has proposed several event-related potential (ERP) correlates of decision confidence, in particular the pre-response centro-parietal positivity (CPP) and the post-response error positivity (Pe), using electroencephalography (EEG). In this talk, I will present results from studies which show that pre-response confidence-related signals might be better captured by a frontal component (instead of the parietal CPP), which scaled in amplitude with decision confidence in trials with correct responses only. In trials with erroneous responses, the Pe component only scaled in amplitude with confidence in having made an error, but not confidence in correct responses. We further argue for carefully selecting baseline periods and additional filters (such as current-source density analysis; CSD) for the respective ERP analyses, as suboptimal parameters can potentially obscure the real relationships between components and confidence and artificially project these associations in time and space. Our findings provide initial evidence for dissociable neural correlates of decision confidence and error detection, which are not well-specified in existing theoretical models.

S01.3 - Linking Neurophysiological Processes of Action Monitoring to Post-Response Speed-Accuracy Adjustments in a Neuro-Cognitive Diffusion Model

A. Mattes[1], **E. Porth**[1], **J. Stahl**[1]

University of Cologne, Deutschland

The cognitive system needs to continuously monitor actions and initiate adaptive measures aimed at increasing task performance and avoiding future errors. While action monitoring can be divided into early and late processes, post-response adaptation comprises processes such as the increase of response caution and the redirection of attention towards task-relevant features. To investigate the link between these cognitive processes, we introduce the neuro-cognitive diffusion model. This statistical approach allows a combination of computational modelling of behavioural and electrophysiological data on a single-trial level. Across three experiments, we found that early response monitoring indicated by the error/correct negativity (Ne/c) was related to slower and more accurate responses on the following trial. Our results suggest that increased early response monitoring is associated with an increased decision threshold (i.e. more evidence is accumulated before a response is initiated) and the redirection of attention towards the task-relevant features on the following trial, a phenomenon that improves future response accuracy. Furthermore, our novel methodological approach provides evidence that later response monitoring indicated by the error/correct positivity (Pe/c) might counteract early response monitoring regarding the decision threshold. This mechanism may serve to avoid an overly high decision threshold that would impede timely responses. Thus, for the first time, we provide evidence that early and late response monitoring keep each other in check regarding the conflicting demands of response speed and accuracy by adjusting the decision threshold of the following response.

S01.4 - Motor Inhibition and Interference Suppression Linked to Individual Differences in Trait-Impulsivity, Selective-Attention and Working-Memory Capacity

E. Porth[1], **J. Stahl**[1]

Universität zu Köln, Deutschland

Action inhibition is essential to manage everyday life tasks. We need motor inhibition to overcome action impulses, and interference suppression to ignore distractions. When these mechanisms fail, it is crucial that we process our errors and learn from our mistakes. For both types of inhibition, action monitoring and error processing may vary with individual differences in trait-impulsivity, selective-attention capacity, and working-memory capacity. In 86 participants, we investigated these variations in the event-related potential by using (i) a complex choice task that captures motor inhibition and interference suppression in two separate conditions and (ii) psychometric testing. We correlated the psychometric scores with indicators of action monitoring (N2, P3) and error processing (error negativity, error positivity). Selective-attention capacity accounted for most of the variance. Conflict monitoring (N2) was stronger for motor inhibition than for interference suppression when the selective-attention capacity was higher. Conflict monitoring might be particularly important in the motor inhibition condition since it is enhanced when resources are available. For individuals with lower selective-attention capacity, early error monitoring (error negativity) was more active for motor inhibition than for interference suppression. Thus, early error monitoring seems to be more resourceful for interference suppression, probably due to a more complex response selection process in this condition. The difference in error evidence accumulation (error positivity) between errors and correct responses increased with selective-attention capacity for both inhibition types. Trait-impulsivity mainly varied with performance parameters such as response force and the number of multiple responses, while working-memory capacity was mainly related to response times.

S02.1 - Neural responses to acute stress predict chronic stress perception in daily life over 13 months – Findings from the LawSTRESS project

M. Giglberger[1], H. L. Peter[1], G. Henze[1], E. Kraus[2], C. Bärtl[1], L. Kreuzpointner[1], J. Konzok[3], S. Zänkert[1], B. M. Kudielka[1], P. Kirsch[4], S. Wüst[1]

[1] Institute of Psychology, University of Regensburg, Regensburg, Germany
[2] Department of Psychology, Educational Science and Sport Science, University of Regensburg, Regensburg, Germany
[3] Department for Epidemiology and Preventive Medicine, University of Regensburg, Regensburg, Germany
[4] Department for Clinical Psychology, Central Institute of Mental Health, University of Heidelberg, Medical Faculty Mannheim, Mannheim, Germany

In the present analysis, we focused on the predictive value of neural reactions to stress induction in the laboratory for daily life stress responses over 13 months.
Law students from Bavarian universities (n = 470) have been studied at six sampling points from T1 (-12 months) to T6 (+1 month). The stress group (SG) consisted of students preparing for the final state examination (T4). Law students experiencing usual study related workload were assigned to the control group (CG).
In a subgroup of 124 participants, the fMRI paradigm ScanSTRESS was applied at T1 (SG: n = 61 (59.0% female); CG: n = 63 (71.4% female)). ScanSTRESS prompts the subject to solve arithmetic and rotation tasks while being evaluated by an observation panel. Stress perception in daily life was measured ten times per sampling day via the AA stress scale. Additionally, the cortisol awakening response (CAR) was administered at each sampling point.
Our analysis revealed a significant increase of perceived stress in the SG until the exam followed by a distinct decrease, while the CG stayed relatively stable. The CAR was blunted in the SG during the exam. Remarkably, we found significant interactions between AA stress scale increases and neural stress responses in the a-priori defined ROIs amygdala and hippocampus but not in the mPFC in the SG. Associations between ROI activations and CAR trajectories could not be observed.
Our results suggest that neural stress responses in amygdala and hippocampus significantly predicts stress perception in daily life.

S02.2 - Differential mental health trajectories during the first COVID-19 related lockdown and their prediction through hair cortisol and polygenic risk scores

B. Kollmann[1,2], K. F. Ahrens[3], R. J. Neumann[3], T. M. Kranz[3], R. Kalisch[1,4], A. G. Chiocchetti[5], M. M. Plichta[3], K. Lieb[1,2], A. Reif[3], O. Tüscher[1,2]

[1] Leibniz-Institut für Resilienzforschung
[2] Universitätsmedizin der Johannes Gutenberg-Universität Mainz
[3] Universitätsklinikum der Goethe Universität Frankfurt
[4] Neuroimaging Center (NIC) der Universitätsmedizin Mainz
[5] Klinik für Psychiatrie, Psychosomatik und Psychotherapie des Kindes- und Jugendalters, Goethe Universität Frankfurt

Investigating participant's mental health prior to and over the course of eight weeks during the first lockdown in Germany, we observed an increase in mental health in N = 523 healthy participants, compared to pre-lockdown. However, we identified three subgroups with distinct mental health trajectories, i.e. "acute dysfunction" (9.0%), "resilient" (82.6%), and "delayed dysfunction" (8.4%). While the resilient group maintained stable mental health throughout lockdown, the acute dysfunction group displayed a sharp increase in mental distress upon lockdown, followed by a reduction below pre-lockdown scores. Contrary, delayed dysfunction subjects showed an initial improvement, followed by a gradual decline after four weeks of lockdown. Hence, two risk groups, whose mental health was challenged by the lockdown, were identified.
Further analyses (Kira F. Ahrens) revealed, that assignment to the acute dysfunction subgroup was associated with elevated hair cortisol concentrations averaged over 9 months 5-27 months prior to the pandemic (b = .45, p = .045, OR = 1.56, $R\hat{2}$ = .25). Moreover, this subgroup was related to a general polygenic risk factor for psychopathology (b = .44, p = .025, OR = 1.55, $R\hat{2}$ = .21) and a neurodevelopmental disorders subfactor, i.e. risk for autism and ADHD (b = .43, p = .031, OR = 1.53, $R\hat{2}$ = .21). Thus, additive effects of prolonged stress experiences and genetic predispositions towards psychiatric disorders render participants vulnerable to future stressors. This likely resulted in an exacerbation of mental health problems in the acute dysfunction subgroup, when confronted with a major stressor, i.e. lockdown.

S02.3 - Associations of personality traits, resilience and biological stress during the first wave of Covid-19

J. Blasberg[1]

Institut für Psychosoziale Medizin, Psychotherapie und Psychoonkologie, Universitätsklinikum Jena

After the first Covid-19 outbreak, countries across the world were forced to declare strict contact restrictions, flattening the infection curve but at the same time potentiating the already severe psychosocial stress load. Our study was concerned with the question whether the biological stress response to the first lockdown in Germany can be predicted by resilience and the Big Five personality traits. N = 80 adult participants took part in an internet-based survey prior to the first Covid-19-related fatality in Germany (T0; Spring 2020), during the first lockdown period (T1), and during the subsequent period of contact restrictions (T2). Systemic cortisol and cortisone levels assessed via hair strands as well as subjective stress in the last three months were collected at T2. High neuroticism was associated with greater hair cortisol, cortisone and subjective stress levels. Higher levels of extraversion were linked to greater hair cortisone levels. Individual differences in resilience showed no effects on stress markers. Our study provides longitudinal evidence that neuroticism and extraversion have predictive utility for the accumulation of lockdown related biological stress. In conclusion, evidence supporting the notion that extraversion is a solely protective personality trait regarding mental disease cannot be generalized to the post-pandemic context. Individuals reporting high neuroticism may currently suffer due to their general emotional lability. Extraverted individuals may primarily be stressed because of social deprivation. With possible future pandemics in sight, differences in neuroticism and extraversion should be further investigated in terms of their predictive value in relation to lockdown induced psychosocial stress and.

S02.4 - Investigating Prospective and Dynamic Associations between Psychosocial Resilience Factors and Stressor Reactivity during COVID-19

L. M. Puhlmann[1,2], **J. J. Piloth**[3,4], **K. Yuen**[1,3], **M. Wessa**[1,5], **O. Tüscher**[1,6], **R. Kalisch**[1,3]

[1] Leibniz Institute for Resilience Research, Mainz, Germany
[2] Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany
[3] Neuroimaging Center, Focus Program Translational Neuroscience, Johannes Gutenberg University Medical Center, Mainz, Germany
[4] Eberhard-Karls-Universität Tübingen, Tübingen, Germany
[5] Department of Clinical Psychology and Neuropsychology, Institute of Psychology, Johannes Gutenberg University, Mainz, Germany
[6] Department of Psychiatry and Psychotherapy, Johannes Gutenberg University Medical Center, Mainz, Germany

Resilience is defined as the maintenance or quick recovery of mental wellbeing when faced with adversity. The present study investigated how both stable and state-like psychosocial factors predict resilient responding during the COVID-19 pandemic, either prospectively or concurrently. As part of the MARP longitudinal cohort study, N = 89 young adults (aged 18-20 at inclusion) were phenotyped up to four years before, and monitored weekly during the pandemic. Resilience, as an outcome, was operationalized as low stressor reactivity (SR), meaning few mental health symptoms relative to individual stressor exposure, via residualization. We investigated SR during three phases: initial onset of the crisis, a subsequent recovery period in summer, and second lockdown in Winter 2020 in Germany.
Sample average mental health symptoms varied over the three pandemic phases. However, this pattern was fully accounted for by systematic differences in stressor exposure, and average SR scores remained stable over time. Multiple regression analyses revealed significant long-term prospective predictors, including Neuroticism and Optimism, and concurrent predictors, namely Positive Appraisal and Loneliness. Prediction differed between phases and except for Loneliness, was always strongest during recovery. Network analyses highlighted an indirect connection between general Positive Appraisal tendencies and lower SR via Positive Appraisal of the pandemic.
Stable and state-like psychosocial resilience factors appear to be applied dynamically and in context-dependent fashion. In particular, specific appraisal of ongoing stressors can mediate the association between general appraisal tendencies and mental wellbeing. To accurately quantify resilience, it is essential to account for individual exposure to adversity.

S02.5 - Psychological Risk and Protective Factors for Changes in Mental Health During COVID-19: Insights from a German Representative Panel Study

A. Riepenhausen[1,2], **I. M. Veer**[1,3], **C. Wackerhagen**[1], **Z. C. Reppmann**[1], **R. Kalisch**[4,5], **H. Kröger**[6,7], **H. Walter**[1,2]

[1] Charité - Universitätsmedizin Berlin, Department for Psychiatry and Neurosciences | CCM, Research Division of Mind and Brain, Berlin, Germany
[2] Berlin School of Mind and Brain, Faculty of Philosophy, Humboldt-Universität zu Berlin, Berlin, Germany
[3] Department of Developmental Psychology, University of Amsterdam, Amsterdam, The Netherlands
[4] Neuroimaging Center (NIC), Focus Program Translational Neuroscience (FTN), Johannes Gutenberg University Medical Center, Mainz, Germany
[5] Leibniz Institute for Resilience Research (LIR), Mainz, Germany
[6] Socio-Economic Panel (SOEP), German Institute for Economic Research (DIW), Berlin, Germany
[7] Munich Center for the Economics of Aging (MEA), Max Planck Institute for Social Law and Social Policy, Munich, Germany

The COVID-19 pandemic has been and still is a considerable stressor affecting large parts of the population. Identifying possibly malleable psychological risk and protective factors is important for informing tailored prevention and intervention efforts.
Associations with mental health during the pandemic have been investigated in a plethora of studies, for a variety of psychological factors. However, many of the published studies are cross-sectional and thus cannot provide insights regarding prospective prediction or measures of intra-individual change. Most studies moreover rely on convenience sampling, which impedes a generalization of the results onto the general population.
To address both shortcomings, we conducted survey-weighted multiple linear regressions in a stratified random sample of the German household population (n=6,684) that offers pre-pandemic baseline data. Our goal was to determine the association of various psychological risk and protective factors assessed between 2015 and 2020 with changes in psychological distress (measured via PHQ-4) from pre-pandemic (average of 2016 and 2019) to peri-pandemic (both 2020 and 2021) time points. Regularized regressions were computed to inform on which factors were statistically most influential in the multicollinear setting.
PHQ-4 scores in 2020 and 2021 were elevated compared to 2019. Several risk factors (catastrophizing, neuroticism, asking for instrumental support) and protective factors (perceived stress recovery, positive reappraisal, optimism) were identified for the peri-pandemic outcomes. Regularized regression mostly confirmed the results and highlighted perceived stress recovery as most consistent influential protective factor across peri-pandemic outcomes.

S03.1 - A direct comparison of social attention in the light of potential face-to-face interactions in the laboratory and the real world

J. D. Großekathöfer[1,2], **C. Seis**[2], **M. Gamer**[2]

[1] Uni Bielefeld, Deutschland
[2] Uni Würzburg, Deutschland

Humans often show reduced social attention in situations with the potential of face-to-face interactions. In contrast, controlled laboratory studies show a strong prioritization of social information. However, such studies not only lack the potential for interactions but also introduce additional confounding factors, such as they often constrained exploratory behavior. Here, we aimed to assess social attention in almost identical environments under potential face-to-face interactions and the lack thereof. Therefore, we used virtual reality for ecologically valid stimuli that closely resemble real situations in the laboratory, solely lacking the potential of face-to-face interactions. We chose five public places in the city of Würzburg and measured eye movements of 44 participants for 30 s at each location twice: Once in a real environment with mobile eye-tracking glasses and once in a virtual environment playing a spherical video of the location in an HMD with an integrated eye tracker. As hypothesized, participants demonstrated reduced social attention with less exploration of passengers in the real environment than the virtual one. This is in line with earlier studies showing social avoidance in situations with the potential of face-to-face interactions. Furthermore, we only observed consistent gaze proportions on passengers across locations in virtual environments. These findings highlight that the potential for social interactions and an adherence to social norms are essential modulators of viewing behavior in social situations. Although spherical videos by themselves cannot easily simulate potential face-to-face situations, they might still be helpful to complement the range of methods in social cognition research and other fields.

S03.2 - Proxemics and personality in mixed reality environments

R. Welsch[1]

LMU Munich

When a stranger approaches us, there comes a point when we begin to feel uncomfortable and intruded upon. Our sense of inappropriate distance from another person can be conceptualized as a need for psychological distance, i.e., personal space. Although many factors determining the size of personal space have been identified, some key properties such as the shape, regulation, and maintenance of the proximity relationship have rarely been studied, probably because experimentally varying these characteristics is particularly challenging. Recent developments in mixed reality (MR) have allowed us to study these properties of personal space in virtual encounters. Here, subjects participate in social interactions with a virtual person. Studying personal space in such MR settings allows us to control for many confounding variables and manipulate the stimuli with relative ease while maintaining external validity. My studies have found that personal space in real and mixed reality settings has an approximately round shape. Moreover, personal space is strongly regulated by social cues (e.g., angry or happy facial expressions) and can increase during encounters with uncanny virtual objects, such as talking pillars. In addition, personality variables such as psychopathy, social anxiety, or eating disorders influence how interpersonal distance is regulated in social interaction.

S03.3 - How reciprocity shapes social interactions: Insights from Virtual Reality

L. Kroczek[1], **A. Mühlberger**[1]

Department of Psychology, Clinical Psychology and Psychotherapy, Regensburg University

Human social interactions are highly coordinated in time and typically involve the reciprocal exchange of social signals such as gaze and facial expressions. Eliciting a social response in another person has been described as social agency, but it is unclear how such reciprocity affects experience, physiology, and behavior during face-to-face interactions. In a first experiment, virtual agents were presented on a computer screen. Overall 40 participants exchanged facial emotional expressions (smiles or frowns) with the virtual agents and rated perceived interactivity. The temporal delay between participants' expressions and the agents' responses was manipulated. We observed an inverse U-shaped relation between latency and interactivity – with highest interactivity ratings for latencies between 500 and 1000 ms. In addition, a Virtual Reality experiment (N = 32) was conducted to investigate the influence of reciprocity on social attitudes and behavior. While being immersed in a virtual environment, participants interacted with two virtual agents. A closed-loop paradigm was implemented where eye contact and facial expressions triggered responses of the virtual agents in real-time. Response patterns were manipulated between agents. One agent always responded contingent and reciprocal on eye contact and facial expressions, while another agent showed eye contact and facial expressions randomly. Additional tests were implemented to measure attitudes and behavior towards both agents. We found that reciprocal compared to random responses resulted in increased sympathy ratings and increased facial mimicry. These results highlight social reciprocity as a driving factor for experience and behavior in face-to-face social interactions.

S03.4 - Defensive states in response to a threatening attacker in an unconstrained virtual environment

L. Hildebrandt[1], **A. Merscher**[1], **M. Gamer**[1]

Universität Würzburg, Deutschland

In threatening situations, animals respond with different defensive states (e.g., freezing, fight, or flight) depending on threat imminence. Research on human defensive states, however, is scarce and has usually been conducted using impoverished stimuli and behaviorally constraining laboratory studies, which neither represent personally relevant threats nor allow for naturalistic defensive responses. Therefore, we addressed the question whether humans show behavioral-physiological defensive states when threatened by another person using Virtual Reality (VR), enabling us to study naturalistic behavior with high experimental control. Participants (N=50) could move freely in a virtual field while collecting cherries on the ground. During the experiment, different stages of threat imminence were presented: The environment occasionally shifted from sunny to thundery, and a masked person appeared in the surrounding before running towards and attacking the participant. Participants could shoot the attacker or were punished with white noise when attacked. Our results indicate that participants adjusted their movement and gaze to the different stages of threat imminence: While they freely explored the environment in the safer phases, they slowed down when the attacker approached. Skin conductance increased during attacks, whereas heart rate initially increased but decreased during attacks. These results are in line with earlier findings of human freezing, and thus show threat-imminence-dependent defensive states in a naturalistic, unconstrained environment. The results also indicate that we respond in line with different situational demands, such as preferably orienting towards the attacker, which would have been difficult to measure with less immersive experiments.

S04.1 - Temporal dynamics of emotion relation: Regulatory and post-regulatory effects of distancing

A. Gärtner[1], K. Diers[1], D. Dörfel[1], S. Schönfeld[1], H. Walter[2], B. Brocke[1]

[1] Faculty of Psychology, Technische Universität Dresden, Dresden, Germany
[2] Division of Mind and Brain Research, Department of Psychiatry and Psychotherapy, CCM, Charité Universitätsmedizin, Berlin, Germany

Emotion regulation (ER) is an indispensable part of mental health and adaptive behavior. Research into ER processes has largely focused on the concurrent effects during regulation. However, there is scarce evidence considering post-regulatory effects with regard to neural mechanisms and emotional experiences. Therefore, we compared concurrent effects of ER (during stimulation, T1) with effects at three different time points: post-stimulation (immediate, T2), re-exposure after 10 minutes (short-term, T3), and re-exposure after 1 week (long-term, T4). In an fMRI study with N = 46 young healthy adults, we investigated neuronal responses to negative and neutral pictures while participants had to distance themselves from or to actively permit emotions in response to these pictures. At T1, negative (versus neutral) pictures elicited a strong response in regions of affective processing, including the amygdala. Distancing (versus permit) led to a decrease of this response, and to an increase of activation in the right middle frontal and inferior parietal cortex. We observed an interaction effect of time and regulation, indicating a partial reversal of regulation effects during the post-stimulation (T2). Similarly, after 10 minutes (T3) and after 1 week (T4), activation in the amygdala was higher during pictures that were previously regulated via distancing. The results show that the temporal dynamics are highly variable within experimental trials and across brain regions. This can even take the form of paradoxical aftereffects at immediate and persistent effects at prolonged time scales.

S04.2 - Effects of acute stress and cortisol on cognitive emotion regulation

K. Langer[1], **V. L. Jentsch**[1], **O. T. Wolf**[1]

Department of Cognitive Psychology, Institute of Cognitive Neuroscience, Faculty of Psychology, Ruhr University Bochum, Germany

Acute stress influences how we experience and respond to emotional situations possibly mediated via altered emotion regulatory processes. Initial empirical work suggests that cortisol may play a key role in mediating beneficial effects of stress on cognitive emotion regulation (ER). In two studies, we therefore characterized acute stress vs. cortisol effects on the ability to regulate negative emotions via reappraisal and distraction. Assuming a shift towards low demanding cognitive ER strategies under stress, we additionally investigated whether and how acute stress may influence ER strategy choice in a third study. Affective ratings and pupil dilation served to measure ER performances and the cognitive effort to regulate upcoming emotions. In the first study, exposure to psychosocial stress (TSST) improved the effectivity of reappraisal exclusively in men, which was positively related to cortisol increases. Seeking to mimic these effects pharmacologically in the second study, cortisol reduced arousal ratings particularly when downregulating high intensity negative emotions via reappraisal and distraction. These results in fact demonstrated beneficial effects of cortisol on regulatory outcomes identifying emotional intensity as a crucial moderator. The third study revealed that stress promotes the preference for distraction relative to reappraisal when dealing with high intensity negative emotions accompanied by a general increase in subjective regulatory success. Stress may thus prompt advantageous short-term regulatory decisions in favor of low demanding ER strategies. Taken together, these studies argue for beneficial stress-induced glucocorticoid effects on the cognitive control of especially high intensity emotions that might aid successful adaptation to emotionally challenging environments.

S04.3 - Impact of subjective effort and personality traits on emotion regulation choice

C. Scheffel[1], S. Graupner[2], J. Zerna[1], A. Gärtner[1], D. Dörfel[1], A. Strobel[1]

[1] Professur für Differentielle und Persönlichkeitspsychologie, Technische Universität Dresden, Deutschland
[2] Professur für Ingenieurpsychologie und angewandte Kognitionsforschung, Technische Universität Dresden

Adaptive emotion regulation (ER) behavior is characterized by choosing ER strategies in certain situations that facilitate goal achievement. Several factors influencing the choice have been identified, including effort. However, only little is known about the differences in subjective and physiological effort required between strategies and the influence of broad and narrow personality traits. In two studies, N = 110 and N = 52 healthy adults conducted an ER paradigm. Participants used suppression and distancing during inspection of positive and negative pictures. Subjective effort was assessed via ratings and physiological effort via pupillometry. Habitual ER use, flexible ER, and Big Five were assessed as personality traits. Although distancing was more effective in downregulation of subjective arousal (Study 1: p = .678 and $\eta_p^2 \leq .01$). Interestingly, individual differences in effort and ER choice were not related to personality traits. The findings suggest that people tend to use the ER strategy that is perceived as less effortful, even though it might not be the most effective strategy. Given the lack of associations between individual differences in effort and personality traits, a new approach to quantify individual subjective values of ER strategies is presented in an outlook.

S04.4 - Individual Differences in Emotion Regulation Choice: Regulation Tendency is Associated with Capacity, Resilience, and Well-Being

U. Basten[1], **R. A. Rammensee**[1], **C. Morawetz**[2]

[1] Universität Koblenz-Landau, Campus Landau, Deutschland
[2] Universität Innsbruck, Österreich

Individual differences in emotion regulation are assumed to play an important role for resilience and mental health. This study investigates how the individual tendency to choose reappraisal vs. distraction as regulation strategy is related to the individual capacity to implement both strategies and to personality traits associated with mental health. For 159 healthy participants, capacity and tendency were measured with established experimental tasks assessing (a) the individual capacity to down-regulate negative emotions with reappraisal and (b) the individual tendency to choose each of the strategies, respectively. Mental health-related personality traits were assessed with questionnaires on emotion regulation habits, trait resilience and well-being. While the individual capacity to down-regulate negative emotions in the experimental setting was not consistently associated with personality, a higher tendency to choose reappraisal over distraction was associated with higher resilience and better well-being. Furthermore, for stimuli of high emotional intensity, participants showed a tendency to selected the strategy they were personally more successful with. The observation of associations between regulation capacity, tendency and personality traits of resilience and well-being in a sample of healthy young adults suggests that systematic differences in the tendency to choose particular regulation strategies may precede the development of mental disorders. Thereby, our study points to emotion regulation choices as a potential target for interventions fostering resilience and mental health.

S04.5 - SmartPTBS: Longitudinal assessment of posttraumatic stress disorder symptomatology and coping strategies - insights from ecological momentary and hair cortisol data

L. Schindler-Gmelch[1,2], P. Lorenz[3], S. Steudte-Schmiedgen[3], K. Weidner[3], A. Steffen[2], M. Berking[1], J. Schellong[3], C. Kirschbaum[2]

[1] Department of Clinical Psychology and Psychotherapy, Friedrich-Alexander-Universität Erlangen-Nürnberg, Deutschland
[2] Faculty of Psychology, Technische Universität Dresden, Germany
[3] Faculty of Medicine, Technische Universität Dresden, Germany

While theoretical models and therapy manuals underline the relevance of individual coping with symptoms for the development and maintenance of Posttraumatic Stress Disorder (PTSD), longitudinal investigations of symptom fluctuation and regulation in the daily lives of those affected are still sparse. In particular, potential predictors for symptom trajectories bear high clinical relevance. The aim of the SmartPTBS study was to utilize ecological momentary assessment (EMA) for insights into inter- and intraindividual variability of symptom severity and coping strategies. Further, the predictive value of baseline symptom severity, coping/emotion regulation capacities, and hair cortisol concentration (HCC) as long-term psychoendocrine stress markers were studied. Twenty participants clinically diagnosed with PTSD (95% female, mean age = 34.85, SD = 12.87) provided baseline data on symptom severity and emotion regulation/coping as well as 2cm hair samples for an overview of integrated cortisol levels over the last two months. After that, they participated in a four-week EMA phase with daily questionnaires on symptom severity and coping analyzed via multilevel models. First results confirmed both inter- and intraindividual variance of symptom severity and regulation during the EMA phase. Further in-depth insights into specific patterns of symptom clusters, regulation, and HCC will be presented. The preliminary findings suggest both symptom severity and regulation to show considerable fluctuation over everyday life, stressing the relevance of longitudinal EMA assessments and the complex interplay of burdening and relieving mechanisms in PTSD.

S05.1 - Preregistering an fMRI study: First experiences and lessons learned

H. Hartmann[1,2]

[1] Department for Cognition, Emotion, and Methods in Psychology, Faculty of Psychology, University of Vienna, Vienna, Austria
[2] Netherlands Institute for Neuroscience, Royal Academy of Arts and Sciences, Amsterdam, Netherlands

Preregistration can be a valuable tool to openly and publicly declare one's research hypotheses, design and analyses before conducting an experiment. However, the use of neuroscientific methods such as functional magnetic resonance imaging (fMRI) increases a researcher's degrees of freedom in how to collect, preprocess and analyze the data to a great extent, which makes an exhaustive preregistration difficult. This is especially true for early career researchers who start out with little experience in open scholarship practices and whose research labs might not have prior experience with preregistration of such complex studies. In this talk, I will give first-hand insights from preregistering and subsequently publishing an fMRI study on the Open Science Framework. My talk will focus on my personal experiences of deep-diving into a complex preregistration right at the start of my PhD. As I was one of the first lab members directly implement open science practices in their work, I will also talk about challenges and lessons learned during that process. I end my talk with currently available resources in place that can aid future researchers who want to preregister their neuroscientific studies.

S05.2 - Analyzing MEG Data with Machine Learning – Exploration and Confirmation

S. Gais[1]

Universität Tübingen, Deutschland

Biopsychological data, especially imaging data, is often highly multivariate, and explicit hypotheses are sometimes difficult to devise in advance. Typically, there is a period of exploration of the data (with or without explicit statistical testing) and one final statistical test, which is reported in the publication. This results in either a large number of false positive findings (accumulation of type-I-errors over all explorative tests) or a large number of false negative findings (low statistical power when adjusting for all possible statistical tests). Here, I will present an approach to data analysis that combines exploratory and confirmatory analyses using machine learning.
We investigated spontaneous memory reprocessing during sleep by applying machine learning to source space-transformed magnetoencephalographic (MEG) data in a two-step exploratory and confirmatory study design. Exploratory analyses showed that we can decode memory-related activity from slow oscillations in hippocampus, frontal cortex and precuneus, indicating parallel memory processing during sleep. Moreover, hippocampus and neocortex show complementary roles: while gamma activity indicated memory reprocessing in hippocampus, delta and theta frequencies allowed decoding of memory in neocortex.
These exploratory analyses were performed in a cross-validation approach on half of the data set. After exploration was finalized, a suitable classifier was trained on this entire half of the data and tested on the second, hitherto untouched half of the data. This approach avoids overfitting of the classifier and combines exploratory and confirmatory approaches. We could thus confirm findings of the exploratory phase with hypothesis-driven statistical tests.

S05.3 - Equivalence and inferiority/superiority tests in mass-univariate situations – the example of fMRI

M. F. Gerchen[1]

Zentralinstitut für Seelische Gesundheit, Mannheim, Deutschland

The majority of statistical tests conducted in biological psychology and human neuroscience are null hypothesis significance tests (NHST) which are often applied in mass-univariate approaches with up to tens or even hundreds of thousands of parallel tests in complex data modalities like functional magnetic resonance imaging (fMRI). To control the false positive rate in these mass-univariate situations, very strict statistical thresholding is applied, and results surviving the statistical threshold are the only ones that are usually reported. These procedures relying on arbitral thresholds provide only a very limited perspective on the present effects, and tend to ignore the richness of information in a data set. This can result in major drawbacks for open and reproducible science, for example, when significant effects are the only ones deemed relevant in an underpowered study, or when the replicability of effects is assessed based on the repeated survival of conservative statistical thresholds. The implicit assumptions about the relationship of effects in such interpretations can however also be tested directly by equivalence and inferiority/superiority tests and the respective statistical questions can be addressed explicitly. The talk will use examples from fMRI to describe the implementation and application of equivalence and inferiority/superiority tests in mass-univariate situations and discuss how the resulting statistical approaches can be used to gain deeper insights into the relationships of statistical effects inside and outside of data sets that could not be obtained by conventional mass-univariate NHST.

S05.4 - Using shareable coding environments and synthetic datasets to increase reproducibility and facilitate collaboration

P. Jawinski[1]

Humboldt-Universität zu Berlin, Deutschland

Open code is often regarded to increase reproducibility, facilitate collaboration, and enhance trust in scientific results. In practice, there are many obstacles for scientists to re-run code and verify results or to perform one's own analysis. One of these barriers is that researchers often fail to provide crucial information on software package dependencies. For instance, stating in an article that 'Analysis were conducted using R package BayesFactor 0.9.12-4.3' and providing one line of R code such as 'require(BayesFactor)' neglects that there are nine other packages plus their dependencies that will either be installed in their newest versions, or updated, or taken as is from the user's current R library. Consequently, researchers end up with different software environments that hamper reproducibility and re-running the analysis code. To overcome this issue, one easy-to-implement strategy is to use isolated project environments that contain a comprehensive record of exact package versions and can be shared easily among researchers. In this talk, I will give a brief practical introduction into the two environment managers 'renv' and 'conda' and will address both their pros and cons. Importantly, analysis code cannot be executed without datasets. In many situations, however, original data cannot be shared publicly as this may compromise research participants' consent. In the second part of my talk, I will offer a glimpse in how to create synthetic datasets resembling the original data using 'synthpop'. With the presented tools I seek to draw attention to practical solutions that increase reproducibility and facilitate collaboration in biological psychology.

S06.1 - A self-controlled mind is reflected by stable mental processing

T. Kleinert[1,2], K. Nash[2], J. Leota[2], T. Koenig[3], M. Heinrichs[1,4], B. Schiller[1,4]

[1] Laboratory for Biological and Personality Psychology, Albert-Ludwigs-University of Freiburg, Stefan-Meier-Straße 8, 79104 Freiburg, Germany
[2] Department of Psychology, University of Alberta, T6G 2E9 Edmonton, AB, Canada
[3] Translational Research Center, University Hospital of Psychiatry, University of Bern, CH-3000, Bern, Switzerland
[4] Freiburg Brain Imaging Center, University Medical Center, University of Freiburg, 79104 Freiburg, Germany

Self-control – the ability to inhibit inappropriate impulses – predicts economic, physical, and psychological well-being. However, recent findings challenge the leading theory on self-control and demonstrate low correlations among self-control measures, raising the questions what self-control actually is. Here, we examine the idea that people high in self-control show more stable mental processing, characterized by fewer, but longer lasting processing steps due to fewer interruptions by distracting impulses. To test this hypothesis, we relied on resting EEG microstate analysis, a method that provides access to the stream of mental processing by assessing the sequential activation of neural networks. Across two samples (N=159), the temporal stability of resting networks (i.e., longer durations and fewer occurrences) was positively associated with self-reported self-control and a neural index of inhibitory control, and negatively associated with risk-taking behavior. These findings suggest that stable mental processing represents a core feature of a self-controlled mind.

S06.2 - Neurophysiology of alcohol-specific inhibitory control in alcohol use disorder

M. Stein[1]

Universität Bern, Institut für Psychologie, Schweiz

Alcohol use disorder (AUD) is a frequent and relapsing condition with detrimental effects on societal and individual levels. Neuroscientific models view an imbalance between enhanced appetitive processes and impaired inhibitory control as crucial for AUD. Of central interest is thus alcohol-specific inhibitory control, i.e. inhibition in the context of alcohol-related cues, which typically activate appetitive processes and may evoke craving.
The presentation will on one hand explore the neurophysiological signature of this imbalance by reporting on studies examining alcohol-specific inhibition and its relation to craving and relapse. To this aim an alcohol-related Go-NoGo task was administered during multi-channel EEG measurement and event-related potentials (ERPs) were computed for alcohol-related as well as neutral Go and NoGo trials. Topographical analyses indicated that during the N2 timeframe, the neurophysiological signature differed between neutral and alcohol-related inhibition and varied with craving. Furthermore, topographic variations during the P3 timeframe differentiated between patients subsequently relapsing and those remaining abstinent.
Given the inhibitory impairments observable in patients with AUD, an alcohol-specific inhibition training was developed as a potentially beneficial add-on to existing treatment options. The second part of the presentation reports on a study investigating whether the topographic variations in the N2 and P3 component are influenced by such a training.

S06.3 - Anxiety disrupts performance monitoring: Integrating behavioral, event-related potential, EEG microstate, and sLORETA evidence

K. Nash[1], **J. Leota**[1,2], **T. Kleinert**[1], **D. Hayward**[1]

[1] University of Alberta
[2] Monash University

Anxiety impacts performance monitoring, though theory and past research is split on how and for whom. However, past research has often examined either trait anxiety in isolation or task-dependent state anxiety, and has indexed event-related potential (ERP) components, such as the error-related negativity (ERN) or post-error positivity (Pe), calculated at a single node during a limited window of time. We introduced three key novelties to this electroencephalography (EEG) research to examine the link between anxiety and performance monitoring processes: (i) we manipulated antecedent, task-independent, state anxiety to better establish the causal effect, (ii) we used a microstate analysis approach to isolate and sequence the neural networks and rapid mental processes in response to error commission, and (iii) we conducted moderation analyses to determine how state and trait anxiety interact to impact performance monitoring processes. Results showed that state anxiety disrupts response accuracy in the Stroop task and error-related neural processes, primarily during a Pe-related microstate. Source localization analysis shows that this disruption involves reduced activation in the dorsal anterior cingulate cortex and compensatory activation in the right lateral prefrontal cortex, particularly among people high in trait anxiety. We conclude that antecedent anxiety is largely disruptive to performance monitoring.

S06.4 - Ruhezustände des Gehirns im Zusammenhang mit traumähnlichen Erlebnissen beim Übergang zum Schlaf

S. Diezig[1], S. Denzer[2], F. Mast[2], T. König[1]

[1] Universitätsklinik für Psychiatrie und Psychotherapie Bern, Universität Bern, Schweiz
[2] Institut für Psychologie, Universität Bern, Schweiz

Der Übergang in den Schlaf ist ein heterogener Zustand, sowohl in Bezug auf neurophysiologische als auch auf mentale Prozesse: Die Qualität des Bewusstseins kann sich deutlich vom Wachzustand unterscheiden, mit abnehmendem situativem Bewusstsein, Verlust der Kontrolle über die eigenen Gedanken, und dem Auftreten von halluzinatorischer Wahrnehmungen (hypnagoge Bilder oder Mikroträume). Psychophysiologisch gesehen werden Bewusstseinsgrad und -inhalt vermutlich durch global angelegte Gehirnnetzwerke realisiert, die mit Hilfe von EEG-Mikrozuständen untersucht werden können. Beim Übergang zum Schlaf interagieren daher mutmasslich Bewusstseinsniveau und -qualität mit dem Vorhandensein bestimmter EEG-Mikrozustände. Das erlaubt uns, die funktionelle Rolle bestimmter neurokognitiver Netzwerke für bestimmte Qualitäten des bewussten Erlebens zu untersuchen. Wir haben Mehrkanal-EEGs von 45 Probanden aufgezeichnet, die sich frei zwischen den Zuständen bewegten, die zwischen völlig wach, schläfrig bis an die Grenze zum Schlaf waren. Die Qualität des bewussten Erlebens wurde in pseudo-zufälligen Intervallen abgefragt. Der Wachheitsgrad wurde mithilfe eines halbautomatischen Klassifizierungsalgorithmus (VIGALL) geschätzt. Im Vergleich zu vollständig wachen Zuständen waren die Phasen reduzierter Wachheit durch unterschiedliche Profile von Mikrozustandsklassen gekennzeichnet. Bei der Korrelation von Mikrozustandsprofilen mit der momentanen Bewusstseinsqualität zeigte sich entgegen unseren Erwartungen, dass Kontrollverlust, vermindertes situatives Bewusstsein und das Vorhandensein hypnagoger Bilder erstens mit einer Zunahme einer Mikrozustandsklasse korrelierten, die vermutlich aufmerksamkeits-assoziierten fronto-zentralen Quellen entspricht, und zweitens mit einer Abnahme einer Mikrozustandsklasse, die mit der visuellen Verarbeitung assoziiert ist. Diese Beobachtungen werfen interessante Fragen zur funktionellen Rolle der EEG-Mikrozustände bei der Regulierung des Inhalts bewusster Erfahrung auf.

S07.1 - Unraveling the semantic nature of memory transformation over time

V. Krenz[1], A. Alink[1], T. Sommer[2], B. Roozendaal[3,4], L. Schwabe[1]

[1] Department of Cognitive Psychology, Institute of Psychology, Universität Hamburg, Von-Melle-Park 5, 20146 Hamburg,Deutschland
[2] University Medical Centre Hamburg-Eppendorf, Department of Systems Neuroscience, Martinistraße 52, 20246, Hamburg, Germany
[3] Department of Cognitive Neuroscience, Radboud university medical center, 6500 HB Nijmegen, The Netherlands
[4] Donders Institute for Brain, Cognition and Behaviour, Radboud University, Kapittelweg 29, 6525 EN Nijmegen, The Netherlands

With time, memories undergo a neural reorganization during which initially hippocampus-dependent memories eventually become reliant on neocortical storage sites. This time-dependent change in the neural underpinnings of memory is thought to be linked to a transformation of detailed memories into more gist-like representations. However, the nature of this transformation is largely unknown. In particular, it has not been systematically investigated whether the time-dependent change in memory is due to a perceptual or semantic transformation. To tackle this question, we tested 52 participants' (26 females; age: M = 24.29 years, SEM = 0.55 years) recognition memory either 1 day or 28 days after encoding. Critically, this recognition test included, in addition to initially encoded and entirely new pictures, also lures that were either semantically or perceptually related to the original stimuli. Both, encoding and recognition testing was conducted in the MRI scanner. Our behavioral data showed a time-dependent increase in the false alarm rate specifically for semantically related, but not for perceptually related lures, thus pointing to a semantic transformation of memories over time. At the neural level, representational similarity analyses revealed that this time-dependent memory semantization was reflected in gist-like representations of remote memory in prefrontal as well as posterior neocortical storage sites, while recent, detailed memory was represented in the anterior hippocampus. Together, our findings demonstrate that the time-dependent reorganization of memory, with increased reliance on neocortical storage-sites, is accompanied by a semantic, but not a perceptual, transformation of memories over time.

S07.2 - Rapid memory for complex episodic narratives in the parietal cortex

A. Lenders[1], K. Kleespies[1], S. Brodt[2], M. W. Sumner[3], E. A. McDevitt[3], C. Baldassano[4], U. Hasson[3], K. A. Norman[3], M. Schönauer[1]

[1] Albert-Ludwigs-Universität Freiburg, Deutschland
[2] Eberhard Karls Universität Tübingen, Deutschland
[3] Princeton University, Princeton, NJ, USA
[4] Columbia University, New York, USA

Traditional models of systems memory consolidation postulate two interacting memory stores, with rapid encoding of new information supported by the hippocampus and a gradually developing, stable storage in neocortical circuits. They assume that systems memory consolidation requires weeks, months or even years to form enduring neocortical engrams. Recent studies have shown that with repeated learning, the uncoupling from hippocampus and formation of a stable neocortical engram can ensue within a single learning session, especially if the learning material is already embedded into pre-existing schemas.
In the present study, we used functional and diffusion-weighted MRI to investigate the formation of content-specific memory engrams after encountering complex naturalistic stimulus material. 40 healthy participants repeatedly watched and freely recounted four movie clips that were set either at a restaurant or at an airport. Using representational similarity analysis, we could successfully discriminate the different narrative contexts in brain data recorded from the posterior parietal cortex. Moreover, with repeated encoding and retrieval, the posterior parietal cortex showed increased activity in univariate analyses when processing the memory content. Importantly, we also observed an increase in content-specific discriminability over learning repetitions, indicating a gradual strengthening of stable neocortical mnemonic representations. The same could not be observed in the hippocampus, which disengaged over repeated learning. Interestingly, the voxel pattern that coded the specific learning content remained stable over learning repetitions in the parietal cortex, but not the hippocampus. We thus propose that the parietal cortex forms stable content-specific memory traces of complex narratives from the outset of learning.

S07.3 - Investigating the functional specialization of declarative memory subsystems

S. Brodt[1]

Eberhard Karls Universität Tübingen

Traditional models of systems memory consolidation have largely influenced how we think about memory representation in the brain for the past 25 years. In this talk, I will briefly outline how joint neuroimaging of functional and microstructural plasticity in the human brain challenges these models. I will explore the hypothesis that different declarative memory subsystems serve complementary functions and acquire traces in parallel from the beginning of learning. To this end, I will present data from a novel experimental paradigm that simultaneously induces memory for unique experiences as well as conceptual knowledge and prioritizes one over the other via different encoding strategies. Participants were presented with complex, abstract stimuli and focused either on differentiating individual stimuli or on identifying categories while undergoing functional and diffusion MRI. The results indicate functionally distinct roles of the medial posterior parietal cortex, hippocampus and visual processing areas for detailed and conceptual representations. Based on this example, I will discuss how different aspects of the same event might be embedded in a distributed memory network.

S07.4 - Facilitating episodic memory with pre-existing knowledge

H. Schultz[1], **R. Benoit**[1]

Max-Planck-Institut für Kognitions- und Neurowissenschaften, Leipzig

As humans, we have the remarkable ability to retain rich episodic memories of unique events. In addition, we also extract commonalities across similar events in a more abstract fashion, e.g., as semantic or schematic memories. These latter memories constitute pre-existing knowledge that, in turn, influences how we encode and retrieve new episodic memories. Previous work has demonstrated that pre-existing knowledge facilitates the retrieval of episodic memories via interactions of the prefrontal cortex (PFC) with the medial temporal lobe (MTL). However, it is unclear how information pertaining to pre-existing knowledge is represented in these structures. In the present study, we scanned 32 human participants (15 male; planned sample size: n=40) using functional magnetic resonance imaging (fMRI) at 7T. On each trial, an abstract cue prompted participants to retrieve scene images from memory. Importantly, in the knowledge condition, the cue predicted the scene category (i.e., houses or landscapes). In the control condition, the cue was not predictive with regard to the scene category (i.e., it was randomly paired with houses or landscapes). Behaviorally, pre-existing category knowledge improved episodic memory retrieval, but also increased same-category false alarms. Univariate analyses of the fMRI data reveal differential involvement of the PFC and MTL in the knowledge and control conditions. Using multivariate analyses, we assess how the availability of pre-existing knowledge impacts memory representations in these regions. We suggest that the MTL and PFC play different, but complementary roles in knowledge-guided retrieval.

S08.1 - Effect of hormonal contraception on stress reactivity in women

Z. Bürger[1], L. Kogler[1], J. Kübbeler[1], M. Henes[2], B. Derntl[1,3]

[1] Department of Psychiatry and Psychotherapy, Tübingen Centre for Mental Health (TüCMH), Medical Faculty, University of Tübingen, Germany.
[2] Department of Women's Health, Medical Faculty, University of Tübingen, Germany.
[3] LEAD Graduate School and Research Network, University of Tübingen, Germany.

With usage of hormonal contraception (HC) becoming more widespread, it is important to understand its effects on body and brain. Additionally, comprehending the mechanisms of stress reactivity is of utmost importance to understand the emergence of stress-related mental disorders like depression and anxiety. The two endocrine systems – the hypothalamic-pituitary-adrenal axis and the hypothalamo-pituitary-gonadal axis – are closely intertwined.
While there are a handful of studies on oral contraceptives (OC), only one study investigated the association between stress reactivity and usage of hormonal intra-uterine devices (LNG-IUD): while OC-users showed a blunted cortisol reactivity compared to naturally cycling (NC) women, LNG-IUD-users had a potentiated reactivity. To better understand female stress reactivity and how it can be altered by HC, we apply the Maastricht Acute Stress Task (MAST) to women using LNG-IUD, OC-users and NC women in a cross-sectional design. To cover the multiple facets of stress, we measure cortisol, endogenous and exogenous sex hormones as well as subjective stress reactivity. As each participant undergoes both MAST and a non-stressful MAST-control, we have within- and between-subjects comparisons. We hypothesize to find a potentiated cortisol reactivity in LNG-IUD-users, while OC-users show a blunted cortisol reactivity but presumably will not differ in terms of subjective ratings from NC women. Whether LNG-IUD-users differ in subjective stress ratings and the association of endogenous and exogenous sex hormones on stress reactivity will be explored for the first time. This project has enormous societal relevance, as women worldwide can make more informed choices as to their contraceptive method.

S08.2 - Emotion regulation during pregnancy: A special role for estradiol?

M. Grahlow[1,2], F. Weinmar[1,2], E. Rehbein[1,3], I. Sundström-Poromaa[4], L. Kogler[1], B. Derntl[1,5,6]

[1] Department of Psychiatry and Psychotherapy, Innovative Neuroimaging, Tübingen Center for Mental Health (TüCMH), University of Tübingen, Tübingen, Germany
[2] Graduate Training Centre of Neuroscience, University of Tübingen, Tübingen, Germany
[3] Werner Reichardt Centre for Integrative Neuroscience, University of Tübingen, Tübingen, Germany
[4] Department of Women's and Children's Health, Uppsala University, Uppsala, Sweden
[5] Tübingen Neuro Campus, University of Tübingen, Tübingen, Germany
[6] LEAD Graduate School & Research Network, University of Tübingen, Tübingen, Germany

Variations of sex hormones such as estradiol (E2) can influence emotion regulation on a behavioural and neural level. During pregnancy, high levels of E2 prevail, however, little is known about emotion regulation abilities in pregnant women. Using fMRI, we investigated how different levels of E2 influence regulation of negative emotions. First-time pregnant women (extreme E2, n=11) and nulliparous naturally cycling women who received 12mg of E2 valerate (high E2, n=13) or a placebo (low E2, n=12) performed an fMRI paradigm, during which they passively viewed highly aversive pictures or were asked to down-regulate their negative emotions. Emotional state was rated after each stimulus. As expected, E2 levels (assessed via blood samples) differed significantly between groups: E2 was lowest in the low E2 group, higher for high E2 and highest for extreme E2. All three groups rated their emotional state as significantly less negative in the down-regulation vs. the view condition, while there were no group differences. On a neural level, we found a main effect of emotion regulation with increased activation in the hippocampus and the orbitofrontal cortex during down-regulation vs. view. Despite no significant group differences, we explored regulation effects within every group separately. For low E2 and high E2, there was a significant difference in activation for the orbitofrontal cortex with increased activation during down-regulation. For the extreme E2 group, we found increased hippocampus activation during down-regulation vs. view. This highlights the necessity to further explore adaptive emotion regulation abilities in different phases of the female reproductive lifespan.

S08.3 - Menstrual cycle phase, hormonal fluctuations, and emotional learning

E. Schneider[1,2], **B. Ditzen**[1,2], **M. Eckstein**[1,2]

[1] Institute of Medical Psychology, Center for Psychosocial Medicine, Heidelberg University Hospital, Heidelberg, Germany
[2] Heidelberg University, Heidelberg, Germany

Background: Learning of an adequate reaction to stimuli indicating safety or danger is highly relevant for human life. Epidemiological studies indicate that women are more likely to be diagnosed with anxiety and stress related disorders. Previous research has shown that hormones, such as estradiol (E2) and oxytocin (OT) facilitate fear learning and extinction. In our study, we focused on investigating the effects of menstrual cycle phase and hormonal fluctuations on emotional learning in naturally cycling women.
Methods: N=102 premenopausal women (age range: 18-45 years) participated in our experimental study. We performed a randomized between-group, double-blind placebo-controlled design with a balanced menstrual cycle phase ratio resulting in 4 groups (oxytocin nasal spray + ovulatory phase; oxytocin nasal spray + early follicular phase; placebo + ovulatory phase; placebo + early follicular phase). Participants underwent an emotional learning paradigm including visual social (faces) and non-social (houses) stimuli either paired with danger (electric stimulation) or absence of danger (safety). Throughout the laboratory visit participants provided 4 saliva samples and 2 blood samples (for subsequent hormonal analyses) as well as ratings regarding their current mental state.
Results: Biochemical and statistical analyses are currently being conducted. The results will be presented at the conference.
Discussion: Results of this project can have implications for our understanding of healthy emotional learning processes. They might also serve as a basis for interventions to improve socially modulated safety learning in clinical populations.

S08.4 - The modulation of social behavior and cognition via menstrual cycle phase, sex hormones and oral contraceptives

J. Strojny[1], B. McDonald[2], P. Kanske[2], G. Domes[1], B. v. Dawans[1]

[1] Universität Trier, Deutschland
[2] Technische Universität Dresden, Deutschland

The menstrual cycle as well as its' varying hormones appear to influence social behavior and cognition. Moreover, women using oral contraceptives (OC) seem to differ from naturally cycling women (NC) with regard to different aspects of social interaction. A recent study from our lab documented higher levels of sharing behavior and more emotional empathy in NC women. Even though preliminary evidence shows influences of sex hormones, the underlying neuroendocrine mechanisms are still not revealed. The present study investigates differences in social behavior and cognition in NC and OC users and tests women with respect to their cycle phase and OC-intake. Moreover, we assess salivary estradiol and progesterone levels in different phases.
We assess prosocial, antisocial and nonsocial risk behavior with a paradigm adapted from behavioral economics as well as the Social Value Orientation (SVO). In addition, we measure empathy and Theory of Mind (EmpaToM) and collect saliva samples to assess levels of estradiol and progesterone in NC and OC users. The online group testing session is carried out in either the early follicular or mid luteal phase for NC, while OC women are tested in their second or third pill intake week. Saliva samples in the corresponding other phase are taken to validate the phases. First results will be presented at the conference.
Our study will add important information with respect to the modulation of social behavior and cognition in young women by OC, cycle phase and sex hormones.

S08.5 - Menstrual cycle dependent fluctuations in cognitive performance and strategies - effect size and inter-individual differences

B. Pletzer[1]

Paris-Lodron-Universität Salzburg, Österreich

It is well documented that menstrual cycle dependent fluctuations in ovarian hormones relate to changes in hippocampal volume, as well as fronto-striatal activation and connectivity patterns. However, it remains unclear whether these changes in neuronal processing are adaptive or result in behavioral and psychological alterations. Results regarding changes in cognitive performance along the menstrual cycle are inconsistent due to (i) small sample sizes, (ii) differences in the definition and selection of cycle phases, and (iii) adaptation of tasks for neuroimaging studies. In this talk we will present results from 3 large-scale behavioral menstrual cycle studies utilizing spatial and verbal tasks, which also allow the assessment of variations in cognitive strategies rather than simple performance measures.

S09.1 - (Neuro)biologically informed psychotherapy: Approaches and developments

P. Kirsch[1,2]

[1] Department of Clinical Psychology, Central Institute of Mental Health Mannheim, Medical Faculty Mannheim, Heidelberg University
[2] Psychological Institute, Heidelberg University

Traditionally, attempts to explain and treat mental disorders have strictly distinguished between biological and psychological approaches, reflecting a dualistic view of separated processes. Here, we take a monistic view arguing that biological and psychological processes are just reflecting different levels of description of the same mechanism. Based on this assumption, the understanding of the biological basis of mental disorders should enrich our understanding of pathomechanisms and therefore inform the development of new psychotherapeutic treatment approaches. Such a (neuro)biologically informed psychotherapy approach uses biopsychological measures for different purposes which contribute to the development and evaluation of psychotherapeutic interventions. First of all, the identification of biological mechanisms associated to mental disorders should help us to define new treatment targets. Furthermore, an understanding of these mechanisms might also allow us to design more efficient interventions. In addition, assuming that biological mechanisms have etiological significance and that their modification contributes to an improvement of mental disorder symptomatology, such therapy effects should also be detectable and describable at the biological level. And finally, given that psychotherapeutic interventions do not show sufficient improvement in every patient, following recent approaches of a so called "personalized therapy", biological measures might be meaningfully used to predict the response of an individual to a specific psychotherapeutic intervention. These different approaches of a (neuro)biologically informed psychotherapy will be discussed and empirical examples for those will be presented.

S09.2 - Feel safe when stressed - Impact of a hypnosis-based intervention on physiological and behavioral parameters during acute stress

B. Schmidt[1]

Universitätsklinikum Jena, Deutschland

Our body's responses to acute stress protect us from harm, but they are not always helpful. Extreme stress responses can cause avoidance and even lead to anxiety or depression. In my talk, I present an intervention to reduce acute stress responses. Hypnosis-based interventions are highly effective, easy to deliver and have long-term beneficial effects. I developed a hypnosis-based intervention to induce a feeling of safety that participants can activate via a post-hypnotic trigger. When participants used the safety trigger, EEG brain responses to monetary rewards showed significantly lower reward-sensitivity compared to a control condition. Participants indicated that they felt significantly safer when using the safety trigger, even weeks after the initial experimental session. They also reported to feel less impulsive, calm and content. In my current study, participants undergo a standardized acute stress situation, the Trier Social Stress Test (TSST). Half of the participants use the safety trigger during this stress test; the other half uses a neutral trigger. During the experimental session, we measure heart rate and sweat odor and collect saliva and blood samples. We hypothesize that adrenaline and cortisol levels are lower in the safety group compared to the control group. In addition, we measure immune system responses via cytokines and C-reactive protein and hypothesize that they will also be reduced in the safety group compared to the control group.
In my research, I show empirical evidence for the efficacy of hypnosis-based interventions to increase the number of people who apply and profit from them.

S09.3 - EmpkinS: Empatho-kinesthetic Sensory Systems for Biofeedback in Depression

S. Böhme[1], L. Schindler-Gmelch[1], K. Capito[1], L. H. Rupp[1], R. Richer[1], M. Sadeghi[1], B. Eskofier[1], M. Berking[1]

Friedrich-Alexander-Universität Erlangen-Nürnberg, Deutschland

Although Cognitive Behavioral Therapy is considered the gold standard psychotherapeutic intervention for depression, dropout and nonresponder rates remain significant. Of value might be interventions focusing on affect-relevant physical aspects such as facial expression or body posture. So far, however, the assessment of such processes remains imprecise, involves high technical effort, and is therefore far from standard use in psychotherapeutic practice. The aim of the project is to test and integrate highly innovative technical approaches to assess affect-relevant bodily processes for the diagnosis and psychotherapy of depression using groundbreaking sensor and machine learning technology. 128 (n = 32 each in three intervention and one control groups) individuals with unipolar depression and 128 healthy control subjects will participate in a smartphone-based information processing training. After baseline assessment, depressive mood is induced. Subsequently, depressogenic and coping-oriented statements (e.g., "I can't do anything!"/"I have many good qualities!") are presented and dealing with depressogenic statements is trained by either verbal reappraisal only or verbal reappraisal combined with affect expressions. A third group explicitly practices antidepressant expressions (targeting the musculus masseter, orbicularis oris, zygomaticus major, corrugator supercilii, among others) without verbal reappraisal. We expect machine learning-based automated emotion recognition to allow the differentiation between individuals with and without the diagnosis of depression. Further, we hypothesize information processing training and especially the combination of reappraisal and affect expression to effectively reduce induced depressive mood as assessed by self-report, behavioral, and physiological measures. Pilot data are presented and discussed with particular regard to derivable biofeedback techniques.

S09.4 - Targeting the error-related negativity, a biomarker of overactive performance monitoring, as an add-on intervention in OCD treatment

R. L. Grützmann[1], **N. Kathmann**[1], **S. Heinzel**[2]

[1] Humboldt-Universität zu Berlin, Deutschland
[2] Freie Universität Berlin, Deutschland

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

S09.5 - FMRI Neurofeedback Treatment in Borderline Personality Disorder

C. Paret[1], **M. Jindrová**[1], **C. Schmahl**[1]

Zentralinstitut für Seelische Gesundheit, Deutschland

Self-modulation of deep-brain activation may improve emotion regulation capabilities – and may reduce symptoms of mental disorder. Real-time functional Magnetic Resonance Imaging Neurofeedback (rtfMRI-NF) empowers patients to self-modulate the amygdala, a brain region linked to symptoms of Borderline Personality Disorder (BPD).
In a randomized-controlled open-label trial (RCT), we aim to investigate the additive effect of rtfMRI-NF to state-of-the-art BPD therapy, i.e. Dialectical Behavior Therapy (DBT). We plan to recruit N=44 patients, who are allocated to a neurofeedback arm or a control arm (no neurofeedback). To be eligible, patients need to exceed a Borderline-Symptom-List (BSL) score of 1.5, evidencing at least moderate symptom severity, at half time of a 12-weeks residential DBT treatment program. Patients complete 3 neurofeedback sessions within 2 weeks. The primary outcome "affect instability" is measured via smartphone based dense sampling of subjective emotional state (i.e., ecological momentary assessments) across 4 days, before and after the treatment. Questionnaire and fMRI outcome measures complement the assessment of treatment effects. Patients attend follow up visits at 3 and at 6 months to assess the stability of treatment effects. The trial is registered at clinicaltrials.gov (NCT04333888). Interim analyses with N=10 patients showed improvements in primary and secondary outcomes in the treatment vs. the control group.
Neurofeedback could be useful to ameliorate Borderline symptoms e.g. as adjuvant treatment, offered in addition to standard care. My presentation puts the current RCT in context of a series of studies that we are doing to investigate the efficacy and scalability of amygdala-neurofeedback in BPD.

S10.1 - Sleep States and Awareness

V. Kolev[1], **J. Yordanova**[1]

Institute of Neurobiology, Bulgarian Academy of Sciences, Bulgaria

In a pioneering study inspired by Rolf Verleger (Wagner et al., 2004), sleep has been identified as a critical brain state enhancing the probability of gaining awareness of covert regularities. A series of subsequent studies co-authored by R. Verleger (e.g., Yordanova et al., 2008, 2012, 2017; Kirov et al., 2015) aimed to explore which sleep mechanisms support explicit knowledge generation after sleep: Is post-sleep awareness newly generated or emerging from re-activated implicit memories? To induce implicit memories before sleep, tasks with a hidden abstract regularity were used. Neural mechanisms of offline memory reprocessing during sleep were assessed by analyzing electroencephalographic (EEG) signals. Several mechanisms by which sleep enhances awareness of previously unknown information were revealed: (1) Deep Slow Wave Sleep (SWS) may restructure implicit memory representations in a way that allows creating an explicit representation afterward, whereas Rapid Eye Movement (REM) sleep stabilizes implicit memories. (2) Facilitated dynamic interactions between sleep stages promotes rule extraction and awareness. (3) Sleep spindle mechanisms in the right hemisphere are specifically related to enhanced explicit awareness. (4) The temporal synchronization of fast spindles by slow waves during SWS is modulated by functional pre-sleep activation patterns thus supporting information transitions across brain states. These findings provide new insights into sleep's role for insight (Verleger et al., 2013).

S10.2 - What do effects of visible and invisible stimuli explored with event-related lateralizations tell us about the role of consciousness?

R. H. V. d. Lubbe[1]

University of Twente / Adam Mickiewicz University, The Netherlands

On the basis of a selection of five scientific papers authored or co-authored by Rolf Verleger (Jaśkowski et al., 2002, 2003, 2008; Verleger et al., 2004; Verleger & Jaśkowski, 2007) the following conclusions can be drawn, which were all based on event-related lateralizations (ERLs) derived from the electroencephalogram (EEG) : 1) spatial attention can be directed by invisible stimuli, thereby speeding up the processing of subsequent stimuli; 2) the effects of invisible stimuli can add up, but there is some cognitive control over these effects; 3) there is no support for qualitative differences between the processing of visible and invisible stimuli, earlier observed differences seem due to processes triggered by the employed masks; 4) there is, however, support for motor-specific and perception-related effects of invisible stimuli. In a recent study by Szumska et al. (2019), ERL results confirmed that task differences affect the influence of prime processing, but also revealed that earlier observed ERL effects may need to be reinterpreted. Together, these studies indicate that no convincing qualitative differences have been observed between effects of visible and invisible stimuli, apart from their visibility reports. As a consequence, there is no clear answer to the question what the role of consciousness actually is.

S10.3 - On why left events are the favored ones: neural underpinnings of the left hemifield advantage in rapid serial visual presentation

D. Asanowicz[1], **K̇amila**[S]

[1] Jagiellonian University, Krakow, Poland
[2] Aix-Marseille Universite, Marseille, France

Our everyday subjective experience suggests that we are equally aware of events perceived in both visual hemifields. However, studies on temporo-spatial dynamics of visual processing have contradicted this subjective assessment. Specifically, experiments with bilateral rapid serial visual presentation (RSVP) revealed a conspicuously large left visual field (LVF) advantage. The asymmetry is, in fact, comparable with the effects typically seen in patients with hemispatial neglect, rather than with the usually observed visual asymmetries in healthy participants. This captured Rolf Verleger's attention for over ten years, and resulted in a fruitful research endeavor aimed at explaining the underlying mechanism. We will overview the main behavioral and ERP results of these studies, particularly the event-related lateralizations (ERLs) that have long been part of Verleger's scientific interests. The foremost conclusion from these studies is that the hemispheric lateralization of attentional processes is the key but not the sole factor at play here. The unusually large LVF advantage is produced by an interplay of several components co-occurring during the RSVP task performance.

S10.4 - Closure denotes the moment of a new beginning

E. Wascher[1]

IfADo, Deutschland

Rolf Verleger coined the term "closure" for the cognitive process underlying the P3. This approach is also supported by the fact that the P3 is a stimulus- but also a reaction-related ERP component. Information processing is finished and then the reaction follows. This is immediately followed by a blink, which, due to its massive influence on the EEG, has been a perennial topic in his laboratory. How can the artifact be corrected by the blink? Does it make sense to refrain participants from blinking? What does the blink do to the EEG that is not an artifact? At this point one can start and say that if the cognitive processes before the blink are a closure, then reopening the eyes maybe a new beginning. And lo and behold, also the opening of the eye is followed by a P3 which closes the circle.

S11.1 - Precise mapping of cortical functions with transcranial magnetic stimulation

O. Numssen[1], K. Williams[1], B. Kalloch[1,2], A. L. Zier[1], A. Thielscher[3,4], T. Knösche[1,2], G. Hartwigsen[1], K. Weise[1,2]

[1] Max Planck Institute for Human Cognitive and Brain Sciences, Germany
[2] Technische Universität Ilmenau, Germany
[3] Danish Research Centre for Magnetic Resonance, Hvidore, Denmark
[4] Technical University of Denmark, Kongens Lyngby, Denmark

Despite decades of research, the current understanding of structure-function relationships in the human brain remains elusive. Transcranial magnetic stimulation (TMS) provides a means to map the relationship between neuronal populations and behaviour in a non-invasive causal manner by directly modulating motor and cognitive functions. However, high resolution cortical mapping is impeded by the widespread, complex distribution of the induced electric field.
We propose a novel approach to precisely map cortical functions with TMS. This principled approach integrates recent advances in the field modelling domain with a novel experimental paradigm: Instead of relying on single TMS conditions, we combine information from many different stimulations to identify the functional relationship between induced electrical field and behavioural response at the voxel level.
We applied this method to localise motor function at the single subject level and successfully located single digit muscle representations in the primary motor cortex. Our approach allowed us to differentiate multiple muscles – in a single, concurrent experiment. The precise knowledge about cortical muscle representations provides the basis for a dosing metric that is based on subject-specific cortical field thresholds, thus unifying stimulation exposure across brain regions and participants.
Furthermore, the underlying ratio to transition from a single TMS condition to voxel-wise analyses of neuronal activation functions is not specific to motor functions per sé, but may be transferred to cognitive domains.
Currently, we are working on an automatized version of our mapping approach to simplify an implementation in clinical and neuroscientific research environments.

S11.2 - Estimating e-fields induced by tDCS on the individual level – linkage to tDCS responses and usage in explaining age-related changes of neuromodulatory effects

D. Antonenko[1]

Universitätsmedizin Greifswald, Deutschland

Individual electric fields induced by tDCS can be estimated using computational modeling, allowing exploration of associations between the induced current with functional tDCS effects and of their structural anatomical predictors. Previous studies have observed links between the strength of electric fields induced at the level of the cortex in an individual and his/her response to tDCS. Observations between e-fields and tES effects on performance, fMRI and MRS outcomes are still heterogeneous and not unequivocal, thus several questions remain to be answered. I will present and discuss existing evidence for a positive relationship between individual e-field strength and tDCS effects on behavioral and neurophysiological outcomes. E-fields are determined by head and brain anatomy differences, supporting previous observations that age-related brain alterations can impact tDCS effects in older adults. I will introduce the opportunities computational modeling approaches provide in individual modeling of e-fields and in explaining interindividual variability in tES effects in the aging human brain. This approach can help understand variability in responsiveness to tES interventions, potentially also distinguishing responders from non-responders, and can advance the understanding of underlying mechanisms in post-hoc (i.e., retrospective) analyses. I will further discuss the potential usefulness of this approach for prospective planning of stimulation parameters and development of individualized interventions.

S11.3 - Selecting stimulation parameters for transcranial magnetic stimulation

Z. Turi[1]

Albert-Ludwigs-Universität Freiburg, Institut für Anatomie und Zellbiologie, Abteilung Neuroanatomie, Germany

Transcranial magnetic stimulation (TMS) is a non-invasive brain stimulation tool that is widely used in neuroscience research and in clinical practice. The characteristics of the TMS-induced electric field (E-field) have a major impact on its specific outcomes. Linking the stimulation parameters to the induced E-field properties, and eventually, to the desired neuronal response is a crucial, yet challenging step towards better understanding the TMS-induced neural and therapeutic effects. Most TMS studies rely on the motor threshold when selecting the stimulation intensity, and on distance to the TMS coil, when defining the stimulated brain area. This convention has two key limitations. To begin with, the E-field properties remain elusive at the cortical target that is frequently another cortical area than the motor cortex. Furthermore, the spatial boundaries of the cortical target remain elusive. Contrary to this view, I argue that it is not the coil location that merely defines the effective stimulation target but the neuronal response to the TMS-induced E-field. Using multi-scale computational modeling, I will explore whether the stimulation parameters derived from one cortical target (e.g., primary motor cortex) can induce comparable macroscopic E-field strengths and subcellular/cellular responses in another cortical target (e.g., the dorsolateral prefrontal cortex). In my talk, I will briefly discuss that multi-scale modeling has the potential to overcome some of the limitations of the current methods and broaden our understanding of the neuronal mechanisms of TMS.

S11.4 - Brain-state dependent brain stimulation and BEST Toolbox

U. Hassan[1]

Leibniz Institute for Resilience Research, Mainz, Germany, Germany

For the last 30 years, non-invasive brain stimulation (NIBS) approaches, using transcranial magnetic, electric, and focused ultrasonic stimulation (TMS, tES, TUS), have treated the brain as a black box, ignoring its internal state at the time of stimulation and consequently suffering from considerable outcome variability. Instantaneous phase, amplitude, and frequency of neuronal oscillations constitute brain states determining the immediate neuronal response and the subsequent synaptic changes induced by NIBS. As two prominent examples, I will demonstrate how sensorimotor mu-rhythm during wakefulness and sleep spindles during NREM sleep modulate cortical excitability in the human primary motor cortex as indexed by real-time EEG triggered TMS induced motor evoked potentials (MEPs). Moreover, NIBS experiments involve many routine procedures that are not sufficiently standardized in the community. Therefore, automated and flexible tools are needed to increase objectivity, reliability, and reproducibility of NIBS experiments. I will introduce the Brain Electrophysiological recording and STimulation (BEST) Toolbox, a MATLAB-based open-source software to resolve the standardization issues in the NIBS community. It allows the user to design, run, and share freely configurable multi-protocol, multi-session NIBS studies, including TMS, tES, and TUS. Its functionality is continuously expanded and includes e.g., TMS motor hotspot search, threshold estimation, TMS-evoked EEG potential (TEP) measurements, paired-pulse and dual-coil TMS, rTMS interventions, interleaving of concurrent TMS-fMRI, and real-time EEG triggered stimulation. The BEST toolbox is powered by state-of-the-art signal processing algorithms combined with a user-friendly graphical user interface (GUI) that facilitates data collection. Documentation and open-source repository are available at www.best-toolbox.org.

S12.1 - Individual patterns of attentional exploration predict the extent of fear generalization

M. Reutter[1], **M. Gamer**[1]

Julius-Maximilians-University Würzburg

Generalization of fear is considered an important mechanism contributing to the etiology and maintenance of anxiety disorders. Although previous studies have identified the importance of stimulus discrimination for fear generalization, it is still unclear to what degree overt attention to relevant stimulus features might mediate its magnitude. To test the prediction that visual preferences for distinguishing stimulus aspects are associated with reduced fear generalization, we developed a set of facial stimuli that was meticulously manipulated such that pairs of faces could either be distinguished by looking into the eyes or into the region around mouth and nose, respectively. These pairs were then employed as CS+ and CS- in a differential fear conditioning paradigm followed by a generalization test with morphs in steps of 20%. Shock expectancy ratings indicated a moderately curved fear generalization gradient that is typical for healthy samples but its shape was altered depending on individual attentional deployment: Subjects who dwelled on the distinguishing stimulus regions faster and for longer periods of time exhibited less fear generalization. Although both, pupil and heart rate responses also showed a generalization gradient with pupil diameter and heart rate deceleration increasing as a function of threat, these responses were not significantly related to patterns of visual exploration. In total, the current results indicate that the extent of explicit fear generalization depends on individual patterns of attentional deployment. Future studies evaluating the efficacy of perceptual trainings that aim to augment stimulus discriminability in order to reduce (over-)generalization seem desirable. Repository: https://osf.io/4gz7f/

S12.2 - Observed facial affect modulates gaze behavior in face-to-face interactions

A. Vehlen[1], **G. Domes**[1]

Universität Trier, Biologische und Klinische Psychologie, Deutschland

Numerous studies have examined the effect of emotional stimuli on attention allocation using highly standardized experimental designs. Several theories have been put forward postulating factors that lead to attentional biases and observing them in association with psychiatric disorders. As technology advanced, studies revealed differences in gaze behavior as a function of interaction potential. This led to calls for greater ecological validity and the emergence of interactive experimental designs to study natural gaze behavior. In this study, we used such a design to examine the effect of experimentally modulated emotional expressions on gaze behavior in a face-to-face interaction.

In a final sample of 35 female participants, gaze data were recorded during a structured interaction task with a confederate who displayed emotional expressions of varying valence (positive, neutral, & negative). On the one hand, the data was analyzed classically using aggregated dwell times on automatically generated Areas of Interest. On the other hand, an analysis method that used cluster-based permutation testing was conducted to reveal dynamics in gaze behavior.

While the aggregated measures show little to no influence of emotional expressions, the dynamic analyses reveal interesting gaze patterns as a function of emotional valence of the expression displayed. Additionally, exploratory analyses hint at an association of these gaze patterns with social anxiety.

In a healthy sample, altering of emotional expressions within a positive face-to-face interaction leads to immediate changes in natural gaze behavior that are associated with measures of social anxiety. These changes cannot be observed using analyses with low temporal resolution.

S12.3 - Face-to-Face Gaze Behavior in Autism Spectrum Disorder

D. Tönsing[1], **B. Schiller**[1,2], **G. Domes**[3], **A. Vehlen**[3], **M. Heinrichs**[1,2]

[1] Albert-Ludwigs-Universität Freiburg, Deutschland
[2] Freiburg Brain Imaging Center (FBI), Neurozentrum, Universitätsklinikum
[3] Universität Trier, Deutschland

Individuals diagnosed with autism spectrum disorders (ASD) show impaired social functioning that may stem from atypical gaze behavior. Indeed, research relying on "face-to-screen" paradigms (eg, passively viewing faces or short videos sequences) has mainly demonstrated that individuals with ASD gaze less towards eyes and face regions. However, such findings are not necessarily transferable to actual social interactions occurring "face-to-face". To close this gap, we here present data from a recent study that applied a dual-eye-tracking setup enabling the assessment of interactive gaze behavior between two individuals. Participants (36 individuals with ASD and 36 age- and IQ-matched healthy individuals) performed a semi-standardized interaction with a confederate who was blind to the study purpose and had been trained to interact in a standardized manner. Our findings suggest that individuals with ASD experience less joy and more discomfort during the interaction and, importantly, gaze less towards their interaction partner's eyes and face. These results might yield novel insights regarding the ongoing debates discussing conflicting theories and the role gaze avoidance plays in face-to-face interactions in ASD.

S12.4 - Visual exploration shapes face perception and vicarious pain modulation

M. Gamer[1]

Universität Würzburg, Deutschland

Faces are the most salient and important visual stimuli for social interaction and are typically explored extensively under free-viewing conditions. However, recent studies demonstrated stable individual differences in face exploration strategies, and it was shown that specific facial features, which are diagnostic for decoding certain emotional states, receive enhanced attention. Here we investigated whether idiosyncrasies in visual exploration are associated with face perception and categorization. To this aim, participants could freely explore static faces showing a happy, angry or surprised facial expression they had to classify as either positive or negative (Study 1, N=102), or they received heat pain stimuli they had to rate regarding intensity and valence while viewing dynamic happy, neutral or painful expressions (Study 2, N=50). Both studies replicated previous findings regarding a preferential processing of diagnostic facial features. More interestingly, however, trial-by-trial changes in visual exploration predicted whether a face showing an ambiguous surprised expression was classified as negative or positive, and individual ratings of pain intensity depended on how much attention was directed towards facial cues signalling pain in others. These findings demonstrate that how we see conspecifics and respond to them crucially depends on how we sample visual information from their faces. This might have important consequences for understanding biases in social perception that have been reported for numerous mental disorders.

S12.5 - Attentional biases in pre-schoolers freely viewing complex scenes

M. Linka[1], **Ö. Sensoy**[2], **H. Karimpur**[1], **G. Schwarzer**[2], **B. de Haas**[1]

[1] Department of Experimental Psychology, Justus-Liebig-Universität, 35394 Gießen, Germany
[2] Department of Developmental Psychology, Justus-Liebig-Universität, 35394 Gießen, Germany

Previous research has shown that adult gaze behaviour towards naturalistic scenes is highly biased towards semantic object dimensions. Little is known however about the developmental aspects of these biases. We compared free gaze behaviour of 5-year-old children towards complex scenes with that of adults. Specifically, we examined whether and to what extent children differed from adults in terms of (1) the proportion of dwell time and (2) first fixations allocated towards objects of several semantic categories that were present in the images. Those categories were Faces, Text, objects with implied Motion, Touched objects as well as Bodies and Hands. Our findings show substantial differences in attentional biases between children and adults. Children compared to adults placed a significantly larger proportion of their dwell time towards Faces, objects with implied Motion, Hands and Touched objects. Children spent significantly less dwell time on Text. Moreover, fewer first fixations of pre-schoolers landed on either Faces or Text, but more of them on Touched objects, Hands and Bodies. Follow-up analyses excluding Text fixations showed that attentional biases in children vs. adults towards Touched objects and Hands are not exclusively due to the stronger competition between Text and other dimensions in adults. These findings point to a developmental rivalry of attentional resources between the categories Text and Hands, which would match recent findings on 'cortical recycling'. I will discuss this hypothesis and the potential role of socio-cognitive factors for these salience differences between children and adults.

S13.1 - Die Bedeutung von Art und Zeitpunkt traumatischer Kindheitserfahrungen auf Hirnstruktur und -funktion

C. Schmahl[1], **M. Sicorello**[1], **Y. Grauduszus**[1], **J. Herzog**[1], **T. Demirakca**[1], **G. Ende**[1]

Zentralinstitut für Seelische Gesundheit, Mannheim, Deutschland

Traumatische Kindheitserfahrungen wie z.B. sexueller und körperlicher Missbrauch oder Vernachlässigung stellen massive Stressoren dar, die auf vulnerable Phasen der somato-psychischen Entwicklung treffen und damit sowohl kurz- als auch langfristig erhebliche Auswirkungen auf die psychische und körperliche Gesundheit haben. Es wird vermutet, dass traumatische Erfahrungen in bestimmten Entwicklungsphasen einen besonderen Einfluss, z.B. auf bestimmte Hirnstrukturen oder –funktionen haben. Wir führten daher retrospektive Interviews zur Bewertung von traumatischen Kindheitserfahrungen für jedes Lebensjahr zwischen dem Alter von 3 und 17 Jahren bei einer Stichprobe von ca. 100 traumatisierten Personen durch. Mit Hilfe der strukturellen und funktionellen Magnetresonanztomographie wurden Volumina von Amygdala und Hippocampus sowie die Reaktivität der Amygdala auf bedrohliche und neutrale Szenen ermittelt. Traumatisierung in der Alterspanne der frühen Adoleszenz (10-14 Jahre) hatte den größten Einfluss auf die Volumina von Amygdala und Hippocampus. Bei den funktionellen Daten sagten das Vorliegen einer PTBS sowie die Traumatisierung die Reaktivität in der rechten Amygdala signifikant voraus. Traumatische Erfahrungen während einer präpubertären (Alter 3 & 4) und einer postpubertären (Alter 16 & 17) Periode erwies sich als besonders prädiktiv, während die Gesamtschwere der Traumatisierung nicht zur Vorhersage beitrug. Im Vergleich waren Erfahrungen von Vernachlässigung von größerer Bedeutung für die Bildgebungsbefunde als Missbrauchserfahrungen. Diese Befunde haben wichtige Implikationen für die Prävention und Therapie Trauma-assoziierter Störungen, welche in dem Beitrag diskutiert werden.

S13.2 - Fehlende Amygdala-Habituation während impliziter Emotionserkennung bei Menschen mit Alkoholgebrauchsstörung

S. Gerhardt[1]

ZI Mannheim, Deutschland

Traumatische Kindheitserfahrungen können die Wahrscheinlichkeit der Entstehung einer Substanzgebrauchsstörung erhöhen. Menschen mit einer Alkoholgebrauchsstörung zeigen zudem Veränderungen in der Emotionsverarbeitung und –regulation, was die Aufrechterhaltung der Erkrankung weiter begünstigt. So ist fehlende Toleranz negativer Emotionen ein wichtiger Faktor bei Rückfällen. Defizite in der Regulation von Emotionen auf Verhaltensebene wurden als Mediator zwischen traumatischen Kindheitserfahrungen und Substanzgebrauchsstörungen diskutiert.
Vorherige Studien mit Menschen mit Alkoholgebrauchsstörung oder traumatischen Kindheitserfahrungen zeigten sowohl strukturelle als auch funktionelle Veränderungen in der Amygdala, einer zentralen Region für Emotionswahrnehmung und -verarbeitung. Eine Habituation der Amygdala-Reaktivität wurde bisher jedoch selten untersucht. Da Amygdala-Habituation als wichtiger Marker für neuronale Plastizität beschrieben wurde, berichten wir darüber nun erstmals bei Menschen mit Alkoholgebrauchsstörung.
Mittels funktioneller Magnetresonanztomographie untersuchten wir Amygdala-Habituation während der Betrachtung negativer, emotionaler Gesichter bei Menschen mit unterschiedlicher Schwere von sowohl Alkoholgebrauchsstörung als auch traumatischen Kindheitserfahrungen (N=27) und gesunden Kontrollprobanden ohne diese Erfahrungen (N=36).
Menschen mit Alkoholgebrauchsstörung zeigten ein Defizit in Amygdala-Habituation, sowohl bezüglich der rechten ($t=4.26$, $pFWE=0.004$) als auch linken ($t=4.79$, $pFWE\leq0.001$) Amygdala. Explorative Analysen wiesen stattdessen auf eine Amygdala-Sensitivierung hin ($t=3.43$, $pFWE=0.039$). Ein Zusammenhang mit der Schwere der traumatischen Kindheitserfahrung konnte nur für gesunde Kontrollprobanden festgestellt werden ($t=3.88$, $pFWE=0.012$).
Der grundlegende Mechanismus der neuronalen Habituation, welche bei der Verarbeitung repetitiver sensorischer Information notwendig ist, scheint bei Menschen mit Alkoholgebrauchsstörung beeinträchtig zu sein. Ein Anstieg der Amygdala-Aktivierung beziehungsweise eine mögliche Sensitivierung während der Betrachtung negativer, emotionaler Gesichter könnte ein neuronales Korrelat der Defizite in der Emotionsverarbeitung bei Menschen mit Alkoholgebrauchsstörung darstellen.

S13.3 - Traumatische Kindheitserfahrungen und Belohnungsantizipation: eine transdiagnostische fMRT-Studie

K. I. Seitz[1]

Universitätsklinikum Heidelberg

Traumatische Kindheitserfahrungen zählen zu den bedeutendsten Risikofaktoren für psychische Erkrankungen. Ein möglicher Mechanismus, der dem Zusammenhang zwischen traumatischen Kindheitserfahrungen und Psychopathologie zugrunde liegen könnte, könnte eine verringerte Aktivität im ventralen Striatum während der Belohnungsantizipation sein. Aufgrund des Mangels an transdiagnostischen Studien bleibt offen, inwieweit traumatische Kindheitserfahrungen über diagnostische Grenzen hinweg mit Belohnungsantizipation im Erwachsenenalter assoziiert sind. Ziel der vorliegenden Studie war die dimensionale Untersuchung des Zusammenhangs zwischen traumatischen Kindheitserfahrungen, insbesondere mütterlicher Antipathie, und Belohnungsantizipation bei Personen mit und ohne psychische Erkrankungen. Insgesamt 118 Studienteilnehmende, darunter Patient*innen mit einer Posttraumatischen Belastungsstörung (n = 25), Depression (n = 32) oder Somatischen Belastungsstörung (n = 29) sowie gesunde Proband*innen (n = 32), bearbeiteten ein etabliertes Paradigma zur Erfassung finanzieller und sozialer Belohnungsantizipation im Magnetresonanztomographen. Art und Intensität traumatischer Kindheitserfahrungen, insbesondere mütterlicher Antipathie, wurden im Selbstbericht mithilfe eines validierten Fragebogens erfasst. Die Studienteilnehmenden zeigten eine erhöhte Aktivität in belohnungsassoziierten Hirnregionen, einschließlich des ventralen Striatums, während der Antizipation sozialer, nicht aber finanzieller Belohnungsreize. Studienteilnehmende, die retrospektiv mehr mütterliche Antipathie im Kindes- und Jugendalter berichteten, zeigten eine signifikant geringere Aktivität in belohnungsassoziierten Hirnregionen, einschließlich des ventralen Striatums, während der Antizipation sozialer, nicht aber finanzieller Belohnungsreize. Unsere Ergebnisse legen langfristige Auswirkungen traumatischer Kindheitserfahrungen auf die Antizipation sozialer Belohnungsreize im Erwachsenenalter nahe, die zukünftig in therapeutischen Interventionen berücksichtigt werden könnten.

S13.4 - Signale aus dem Körperinneren: Der Einfluss von Kindheitstraumatisierung auf den Zusammenhang zwischen Interozeption und Emotionsverarbeitung bei Patienten mit chronisch-entzündlichen Darmerkrankungen

K. Atanasova[1]

Heidelberg University, Medical Faculty Mannheim, Deutschland

In der Emotionsforschung ist schon lange nicht nur die Bedeutung körperlicher Veränderungen, sondern auch ihre Wahrnehmung und Bewertung für das Erleben von Gefühlen bekannt.
Diese als Interozeption bezeichneten Verarbeitungsprozesse und ihre Veränderungen wurden zunehmend im Bereich psychischer und somatischer Erkrankungen als wichtige Einflussfaktoren auf die psychische Gesundheit wie auch auf das Erleben von Emotionen und Stress erkannt. Chronisch-entzündliche Darmerkrankungen (CED) sind chronische Erkrankungen, die neben körperlichen Symptomen häufig mit psychiatrischen Komorbiditäten wie Depressionen und Angststörungen einhergehen.
Im Rahmen drei experimenteller Paradigmen haben wir die Zusammenhänge zwischen Interozeption, Emotionsverarbeitung und -wahrnehmung untersucht, sowie wie frühkindliche traumatische Ereignisse diese beeinflussen. Unter der Verwendung einer experimentellen Aufgabe, der Ableitung von biologischen Körpersignalen und Selbsteinschätzungsfragebögen wurde Interozeption als ein multidimensionales Konstrukt erfasst. Wir können zeigen, dass CED Patienten die Verbindung zwischen körperlichen Veränderungen und dem Erleben von Emotionen als besonders stark wahrnehmen und Ablenkung als Emotionsregulationsstrategie besonders häufig einsetzen. Diese Befunde wurden anschließend mit dem Verhalten und dem subjektiven Erleben in drei Emotionserkennungsaufgaben verbunden: Veränderungen in interozeptiven Wahrnehmungsprozessen bei CED sind mit einer höheren Intensität und Anspannung bei der Bewertung negativer Emotionen verbunden und damit mit einem verstärkten Erleben von Stress. Unsere Ergebnisse legen nahe, dass interpersonelle Traumatisierung in der Kindheit mit einer erhöhten Vulnerabilität für Veränderungen in der Wahrnehmung interozeptiver Signale eihergeht, welche mit einer beeinträchtigten Verarbeitung von emotionsrelevanten Körperreaktionen im Zusammenhang stehen.

S14.1 - Functional NPSR1 variation and childhood trauma as moderators in the vulnerability-stress model of anxiety

M. Schiele[1]

Klinik für Psychiatrie und Psychotherapie, Universitätsklinikum Freiburg

Genetic and environmental factors are assumed to interactively influence the pathogenesis of anxiety disorders and related phenotypes. However, protective influences such as functional coping ability may exert a buffering effect on the interplay of genetic disposition and environmental adversity in the conferral of risk or resilience to anxiety-related traits and, ultimately, the manifestation of disease. In the present talk, coping ability will be explored as an additional dimension in an extended gene-environment-coping (G x E x C) model. Exemplarily, functional variants in select candidate genes associated with anxiety, i.e. in the neuropeptide receptor S gene (NPSR1 rs324981) will be highlighted regarding their interplay with environmental adversity by example of childhood trauma as well as coping characteristics that, depending on their individual constellation, can either increase or decrease disorder risk. Taken together, these results provide novel insights for clinical practice, particularly with regard to the development, improvement, and application of preventive therapeutic interventions.

S14.2 - Epigenetic landscape of the oxytocin receptor gene (OXTR) and its association with childhood adversity

S. Müller[1,2], M. Sicorello[3], D. Moser[1], L. Frach[4], A. Gumpp[2], R. Kumsta[1,5], I. Kolassa[2]

[1] Department of Genetic Psychology, Faculty of Psychology, Ruhr University Bochum, Germany
[2] Department of Clinical & Biological Psychology, Institute of Psychology and Education, Ulm University, Germany
[3] Department of Psychosomatic Medicine and Psychotherapy, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Germany
[4] Department of Clinical, Educational and Health Psychology, Division of Psychology and Language Sciences, University College London, United Kingdom
[5] Department of Behavioural and Cognitive Sciences, Laboratory for Stress and Gene-Environment Interplay, University of Luxembourg, Luxembourg

The oxytocin receptor gene (OXTR) is of interest when investigating the effects of early adversity on DNA methylation. However, there is heterogeneity regarding the selection of the most promising CpG sites to target for analyses. The goal of this study was to determine functionally relevant clusters of CpG sites within the OXTR CpG island in 113 mother-infant dyads, with 58 of the mothers having experienced childhood maltreatment (CM). OXTR DNA methylation and gene expression was analyzed in peripheral/umbilical blood mononuclear cells. Different complexity reduction approaches were used to reduce the 188 CpG sites into clusters of co-methylated sites. Furthermore, associations between OXTR DNA methylation (cluster- and site-specific level) and OXTR gene expression and CM were investigated. Results showed that, first, CpG sections differed strongly regarding their statistical utility for research of individual differences in DNA methylation. Second, cluster analyses and Partial Least Squares (PLS) suggested two clusters consisting of intron1/exon2 and the protein-coding region of exon 3, respectively, as most strongly associated with outcome measures. Third, cross-validated PLS regression explained 7% of variance in CM, with low cross-validated variance explained for the prediction of gene expression. Fourth, very high mother-child correspondence was observed in correlation patterns within the identified clusters, but only modest correspondence outside these clusters. This study characterized the DNA methylation landscape of the OXTR CpG island by highlighting clusters of CpG sites that show desirable statistical properties and predictive value. We provide a Companion Web Application to guide future studies in their choice of CpG sites.

S14.3 - Biological embedding of childhood adversity - a multi-omics perspective on stress regulation

J. Zang[1], **R. Kumsta**[2,3]

[1] Klinik für Psychische Gesundheit, Universitätsklinikum Münster
[2] Genetic Psychology, Fakultät für Psychologie, Ruhr-Universität Bochum
[3] Department of Behavioural and Cognitive Sciences, University of Luxemburg

Background: The experience of adversity in childhood can have life-long consequences on health outcomes. In search of mediators of this relationship, alterations of bio-behavioral and cellular regulatory systems came into focus, including those dealing with basic gene regulatory processes. These investigations touch upon the basic mechanisms of gene-environment interplay. Systems biology oriented approaches have been proposed to gain a more comprehensive understanding of the complex multiple interactions between and within layers of analysis.
Methods: We used co-expression based, supervised and unsupervised single and multi-omic system approaches to investigate the influence of childhood adversity on gene expression, protein expression and DNA methylation in CD14*monocytes of healthy adults before and after application of psychosocial stress.
Results: Childhood adversity explained some variance at the single analyte level and within gene and protein co-expression structures. A single-omic, post stress gene expression model differentiated best between participants with a history of childhood adversity and controls in supervised analyses. In unsupervised analyses, a multi-omic based model showed best performance but separated participants based on sex.

S14.4 - Sensitive Periods for brain changes following early (and late) adversity

M. Sicorello[1], **S. Siehl**[1], **J. Thome**[1], **J. Herzog**[1], **H. Flor**[1], **C. Schmahl**[1]

Central Institute of Mental Health, Deutschland

A large body of human and animal research demonstrated structural aberrations in the hippocampus and the amygdala following exposure to stress. Most theories propose such brain changes are highly dependent on the neurodevelopmental timing of events, a hypothesis that has gained considerable support in recent years. In a data pooling effort including 150 women, we extended this research program on early adversity, contrasting neurostructural alterations between women with adverse experiences in either (a) childhood or (b) adulthood. We found that brain changes were apparent in both groups, with opposing effects for the amygdala. The distinction between participants who had PTSD, were trauma-exposed but healthy, or trauma-naïve healthy controls further grant evidence on the contribution of psychopathology and mere stress-exposure to these effects. In an fMRI subsample of 60 women with early adversity, we further found evidence that sensitive periods also exist for amygdala function in response to negative scenes. This effect of adversity differed from the effect of psychopathology in relevant ways. Hence, we find evidence for both sensitive periods and life-long plasticity concerning brain changes following adversity and highlight the importance to account for psychopathology.

S15.1 - State-curiosity closely relates to formal education – a lifespan perspective

N. Bunzeck[1], **T. Steiger**[2]

[1] Department of Psychology, University of Lübeck
[2] Department of Psychology, University of Lübeck

The ability to learn and store novel information into long-term memory is not a passive process but depends on internal motivation known as epistemic curiosity. While such a view is often limited to children and younger adults, the developmental trajectories and possible age-related changes remain unclear. Therefore, we tested the hypothesis of a relationship between state curiosity and different forms of trait-curiosity as well as their impact on formal education. In total, n=231 human subjects (15-83 years) were tested online with a focus on trait-curiosity – distinguishing between curiosity as a factor of interest (CFI) and of deprivation (CFD) – state-curiosity and sociodemographic information. Our analyses revealed (1) a positive relationship specifically between state and CFI but not state and CFD; (2) a close relationship between formal education and state curiosity, and to a lesser degree CFI but not CFD; and (3) negligible effects of age on state, CFI and CFD. In other words, the observed relationship between state curiosity and CFI remained significant even when controlling for age. Finally, a mediation analysis revealed a direct effect of state curiosity on formal education that was not mediated by trait curiosity. Together, our findings provide further empirical evidence for a conceptual distinction between state vs trait curiosity and between interest vs deprivation type trait curiosity. Importantly, state curiosity appears to be the driving force behind formal education across the lifespan, which is in line with the notion of a strong link between state curiosity and cognitive abilities.

S15.2 - Curiosity is Not the Same Construct Across Disciplines

H. K. Jach[1], A. Frisvold[2], M. Grubb[3], C. A. Hartley[4], L. Hunter[5], R. Jia[6], F. d. Lange[7], R. Larisch[6], R. E. Lavelle-Hill[1], I. Levy[6], Y. Li[8], L. v. Lieshout[7], K. Nussenbaum[4], S. Ravaioli[9], R. Wilson[2], K. Murayama[1], J. Gottlieb[5]

[1] The University of Tübingen, Hector Research Institute of Education Sciences and Psychology
[2] University of Arizona, Psychology Department
[3] Trinity College, Department of Psychology
[4] New York University, Department of Psychology
[5] Columbia University, Neuroscience Department, Mortimer B. Zuckerman Mind Brain Behavior Institute
[6] Yale University, Comparative Medicine and Neuroscience
[7] Donders Institute of Brain, Cognition and Behaviour
[8] Yale University, Department of Psychiatry
[9] Columbia University, Economics Department

Curiosity is widely studied within neuroscience and personality psychology, but rarely have conceptions been compared between disciplines. The current study suggests that behavior measuring information seeking, sometimes referred to as "curiosity" in neuroscience, is not necessarily isomorphic with common measures of "curiosity" in personality psychology. Participants (N = 820, 44% female) completed nine cognitive tasks assessing information seeking. Shared variance across the tasks was captured by a dimension reflecting directed vs random exploration. Individual scores along this dimension were predicted significantly better than a baseline model from fifteen personality traits using three machine learning models. Extraversion and thrill seeking were the most important predictors of random exploration, and stress tolerance and need for cognition predicted more directed exploration. In contrast, neither interest/deprivation forms of curiosity, nor openness to experience, were important predictors. The results inform our emerging understanding of curiosity across disciplines.

S15.3 - Choosing the negative: The psychology of morbid curiosity

S. Oosterwijk[1]

Department of Social Psychology, University of Amsterdam, The Netherlands

In day-to-day life, people often seek out images, videos, and stories that detail death, violence, or harm. In this talk I discuss recent research that investigates this phenomenon, called morbid curiosity. First, I will discuss work using a behavioral paradigm that shows that people are particularly prone to explore negative social information. Then, I will present an fMRI study that investigated whether brain regions traditionally associated with curiosity, value computation and reward, are also involved when people deliberately expose themselves to intensely negative images (e.g., social scenes involving violence or physical harm). Here, we hypothesized that the conflicting, but relatively informative act of choosing to view a negative image, resulted in stronger activation of reward circuitry as opposed to the relatively uncomplicated act of choosing to view a positive image. As predicted, this study demonstrated stronger activation in the striatum, inferior frontal gyrus, anterior insula, orbitofrontal cortex and anterior cingulate cortex when people chose negative images as compared to positive images. Thus, brain regions that support extrinsic incentives (e.g., money) and regular curiosity, are also involved in "morbid curiosity". These results suggest that morbid curiosity might not be that different from regular curiosity and that knowledge acquisition may be inherently valuable, even when people choose to acquire knowledge about negative social situations. I end the talk with proposing a set of motives which may explain WHY people engage with intensely negative content.

S15.4 - How curiosity affects learning and information seeking via the dopaminergic circuit

M. Gruber[1]

Cardiff University, Vereinigtes Königreich

Over the last decade, research on curiosity – the desire to seek new information – has been rapidly growing. Several studies have shown that curiosity elicits activity within the dopaminergic circuit and thereby enhances hippocampus-dependent learning. However, given this new field of research, we do not have a good understanding yet of (i) how curiosity-based learning changes across the lifespan, (ii) why some people show better learning improvements due to curiosity than others, and (iii) whether lab-based research on curiosity translates to how curiosity affects information seeking in real life. In this talk, I will present a series of behavioural and neuroimaging studies that address these three questions about curiosity. First, I will present findings on how curiosity and interest affect learning differently in childhood and adolescence. Second, I will show data on how inter-individual differences in the magnitude of curiosity-based learning depend on the strength of resting-state functional connectivity within the cortico-mesolimbic dopaminergic circuit. Third, I will present findings on how the level of resting-state functional connectivity within this circuit is also associated with the frequency of real-life information seeking (i.e., about Covid-19-related news). Together, our findings help to refine our recently proposed framework – the Prediction, Appraisal, Curiosity, and Exploration (PACE) framework – that attempts to integrate theoretical ideas on the neurocognitive mechanisms of how curiosity is elicited, and how curiosity enhances learning and information seeking. Furthermore, our findings highlight the importance of curiosity research to better understand how curiosity can be harnessed to improve learning and information seeking in real life.

S16.1 - From then to now: Effects of childhood maltreatment on acquisition and generalization of conditioned fear

M. Klingelhöfer-Jens[1], K. Hutterer[2,3], M. A. Schiele[4], D. Schümann[1], J. Deckert[5], K. Domschke[3,4,6], M. Gamer[2,3], P. Pauli[2,3], A. Reif[3,7], M. Romanos[8], P. Zwanzger[9,10,11], T. B. Lonsdorf[1]

[1] Institute of Systems Neuroscience, University Medical Center Hamburg-Eppendorf, Hamburg, Germany
[2] Department of Psychology, University of Würzburg, Würzburg, Germany
[3] Center for Mental Health, University of Würzburg, Würzburg, Germany
[4] Department of Psychiatry and Psychotherapy, Medical Center - University of Freiburg, Faculty of Medicine, University of Freiburg, Freiburg, Germany
[5] Department of Psychiatry, Psychosomatics and Psychotherapy, Center for Mental Health, University Hospital Würzburg, Würzburg, Germany
[6] Center for NeuroModulation, Faculty of Medicine, University of Freiburg, Freiburg, Germany
[7] Department of Psychiatry, Psychosomatic Medicine and Psychotherapy, University Hospital Frankfurt, Frankfurt am Main, Germany
[8] Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Center for Mental Health, University Hospital Würzburg, Würzburg, Germany
[9] kbo-Inn-Salzach-Hospital, Wasserburg, Germany
[10] Department of Psychiatry, University of Münster, Münster, Germany
[11] Department of Psychiatry, Ludwig-Maximilian-University of Munich, München, Germany

Childhood maltreatment has been previously associated with the development of later psychopathology. However, underlying mechanisms linking early adverse experiences to the emergence of psychological disorders in adulthood are still largely unclear. Pronounced fear generalization across safety and danger cues as observed in maltreated individuals is one suggested underlying mechanism.
We analyzed skin conductance responses (SCRs) and different types of ratings in a large healthy sample (N > 1300) that underwent a differential fear conditioning and generalization paradigm. Here, we compared individuals exposed and not exposed to childhood maltreatment.
Preliminary results indicate generally blunted autonomic reactivity (i.e., SCRs) and reduced CS discrimination in SCRs in maltreated participants - driven by reduced responding to the CS+. This pattern was observed during both fear acquisition training and generalization. Exploratory analyses on the role of different adversity types suggest that this pattern was particularly pronounced in participants who experienced physical as opposed to emotional maltreatment. Ratings did not differ as a function of childhood maltreatment.
In sum, generally blunted sympathetic arousal has been linked to trauma exposure in previous work. As the ability to maintain discrimination between safety and danger cues is crucial to secure adaptive responding, our findings might indicate that exposure to childhood maltreatment serves as an important risk factor promoting the acquisition and maintenance of psychopathology. However, we suggest that blunted responding to the CS+ may in fact serve as a resilience factor as all individuals were healthy and free of life-time psychiatric diagnoses.

S16.2 - The impact of contingency awareness on the neurocircuitry underlying visceral pain-related fear and safety learning

F. Labrenz[1], A. Icenhour[1], N. Axmacher[2], E. Genc[3], S. Elsenbruch[1]

[1] Department of Medical Psychology and Medical Sociology, Ruhr University Bochum, Bochum, Germany
[2] Department of Neuropsychology, Institute of Cognitive Neuroscience, Ruhr University Bochum, Bochum Germany
[3] Department of Psychology and Neurosciences, Leibniz Research Centre for working environment and human factors (IfADo), Dortmund, Germany

Pain-related fear, shaped by associative learning and memory, drives maladaptive affective-emotional reactions and avoidance behavior in chronic pain. Fear conditioning with painful unconditioned stimuli (US) unraveled the neural mechanisms underlying pain-related fear learning to conditioned stimuli (CS), but the role of CS-US contingency awareness remains unknown. In a translational model of interoceptive pain-related fear, we assessed whether awareness of predictive cue properties is a prerequisite for successful associative learning.
Behavioral and fMRI data of 75 healthy individuals from two studies undergoing differential conditioning were analyzed. Visceral pain as US was repeatedly paired with a cue (CS+) while another (CS-) remained unpaired. CS valence and CS-US contingencies were assessed as behavioral markers. Participants were divided into low vs. high contingency awareness based on a median-split. Compared to the low contingency awareness group, highly aware individuals revealed increased CS+-aversiveness and enhanced activation in prefrontal cortex, anterior insula and inferior parietal lobule. For the CS-, the high contingency awareness group demonstrated increased positive valence and a network encompassing prefrontal and parietal cortices, amygdala and hippocampus. With increasing CS–US accuracy and CS- valence, activation increased in inferior frontal and supramarginal gyrus.
These findings underscore that contingency accuracy distinctly shapes learned emotional responses to interoceptive pain. While aversive learning seems to occur independently from CS-US awareness, safety learning relies on cognitive aspects including elaborate attentional and working memory processing. The interplay of cognitive and emotional factors underlying excitatory pain-related learning may contribute to altered pain processing, emphasizing its clinical relevance in gut-brain axis disorders.

S16.3 - Systematic investigation of the role of context in reinstatement induced return of fear

R. Sjouwerman[1,2], **T. Lonsdorf**[2]

[1] Maastricht University, The Netherlands
[2] University Medical Center Hamburg-Eppendorf, Institute for Systems Neuroscience, Germany

Context plays a crucial role in associative learning mechanisms and helps to retrieve memories– both fearful and safe ones. Context is critically involved in return of fear phenomena that are used to experimentally study the underlying mechanisms of clinical relapse of fear in fear conditioning paradigms. Renewal for example depends on contextual change after successful extinction and rodent work has shown that reinstatement-induced return of fear also depends on the specific contextual sequences during the experimental phases of the fear conditioning paradigm.
Yet, human studies adapting these reinstatement paradigms have yielded very mixed findings: Return of fear specific to— but also unspecific to the threat stimulus has been reported, as well as unexpected return of fear in reinstatement-free control groups. The role of context has often received little to no attention in these experiments.
Inspired by findings from rodent work, we present results from a large systematic investigation (N = 221) where we evaluate whether context might explain these mixed findings in the human field and whether the context dependency of reinstatement-induced return of fear holds for human reinstatement studies. We use Bayesian mixed model analyses to evaluate the response patterns of groups going through the fear conditioning phases with different contextual sequences. These are evaluated in a variety of outcome measures (SCR, startle, ratings). We demonstrate context effects in reinstatement groups, but remarkably observe similar response patterns in reinstatement-free control groups. This challenges our interpretation of reinstatement-research in humans generally and our understanding about the underlying mechanisms of reinstatement.

S16.4 - Corrugator and zygomaticus activity during imagery-based social conditioning

M. F. J. Sperl[1], **E. M. Mueller**[2], **C. Hermann**[1]

[1] University of Giessen (Germany), Department of Psychology, Clinical Psychology and Psychotherapy
[2] University of Marburg (Germany), Department of Psychology, Personality Psychology and Assessment

Aversive learning experiences are important factors in the etiology and maintenance of Social Anxiety Disorder. A central mechanism is Classical Conditioning, whereby a conditioned stimulus (CS) is paired with an unpleasant stimulus (US). Negative learning experiences (e.g., social rejection) are paired with environmental stimuli, which subsequently elicit threat and contribute to avoidance of social situations. However, many patients cannot explicitly recall a specific unpleasant learning experience. The question arises whether aversive imagery can also be paired with specific environmental stimuli. To investigate the influence of unpleasant and pleasant imaginations on social conditioning processes, we developed a novel imagery-based paradigm and validated it in healthy participants. During acquisition, three neutral faces (CS) were paired with an unpleasant, pleasant, or neutral socially relevant imagination. To measure the conditioned response, activity of facial mimic muscles was recorded using electromyography (EMG). Processing of unpleasant stimuli is typically associated with increased activity of the M. corrugator supercilii (frowning), whereas activity of the M. zygomaticus major (pulling up the corners of the mouth when smiling) is associated with pleasant stimuli. As expected, faces paired with a socially relevant unpleasant imagination elicited stronger corrugator activity. Conversely, faces paired with a pleasant imagination elicited stronger zygomaticus activity. Presentation of the faces was accompanied by the corresponding EMG activity, even when no imagination was to be performed at all. Our results show successful conditioning with imagined social stimuli, which was captured by mimic facial muscles. Social anxiety can be learned through imagination, opening perspectives for innovative imagery-based therapeutic approaches.

S16.5 - The impact of physical exercise on the consolidation and retention of extinction memories

V. L. Jentsch[1], **O. T. Wolf**[1], **C. J. Merz**[1]

Ruhr-Universität Bochum, Deutschland

Based on the mechanisms of fear extinction, exposure therapy is the most common behavioral therapy technique for anxiety- and trauma-related disorders. However, extinguished fear responses do not simply disappear but tend to reemerge even after successful treatment. Physical exercise can improve memory and cognition and has also been shown to enhance extinction processes in rodents, rendering it a promising candidate for augmenting long-term therapeutic efficacy. However, experimental studies in humans are scarce with exercise effects on return of fear phenomena being hardly studied to date. To address this issue, we subjected 60 healthy men to a differential fear conditioning paradigm with fear acquisition on day one and fear extinction on day two followed by a brief exercise session or resting control condition. On the third day, extinction memory was tested using a retention and reinstatement test with skin conductance responses (SCR) and pupillary responses (PR) as readouts of conditioned fear. Exercise significantly increased heart rate, salivary alpha amylase and cortisol levels relative to the control condition. Preliminary analyses of SCRs furthermore revealed that extinction retention was indeed modulated by exercise, while it seemed to leave reinstatement-induced return of fear largely unaffected. PR data are currently analyzed and will be presented along with SCR data at the conference. Our findings support a role for acute exercise in modulating fear and extinction memories that may have potential benefits for how anxiety disorders are treated.

S17.1 - Loneliness and diurnal cortisol levels during COVID-19 lockdown: the roles of living situation, relationship status and relationship quality

D. Hopf[1,2], E. Schneider[1,2], C. Aguilar-Raab[1,2,3], D. Scheele[4,5], B. Ditzen[1,2], M. Eckstein[1,2]

[1] Institute of Medical Psychology, Heidelberg University Hospital, Heidelberg, Germany
[2] Ruprecht-Karls University Heidelberg, Heidelberg, Germany
[3] Clinical Psychology, Institute of Psychology, University of Kassel, Germany
[4] Department of Psychiatry, University of Oldenburg, Bad Zwischenahn, Germany
[5] Section Medical Psychology, Department of Psychiatry, University of Bonn, Bonn, Germany

Objective: Loneliness has been associated with short-term neuroendocrine stress-reactions and physical and mental health problems. Lockdowns during COVID-19 pandemic have been linked to higher levels of loneliness. The aim of this study was to assess structural (living situation and relationship status) and psychological (relationship quality) factors as potential buffers for loneliness and cortisol as indicators of hormonal stress responses in every-day life during COVID-19 lockdown.
Methods: Demographics, relationship quality and self-reported trait loneliness were assessed online in 1242 participants during the first lockdown in Germany. A sub-sample (N = 247) participated in an ecological momentary assessment (EMA). Saliva samples were collected six times per day on two consecutive days and momentary loneliness levels were reported simultaneously via smartphone.
Results: Widower/widows and divorced participants scored highest in trait loneliness, followed by singles and participants with a partner. Living with others (vs. living alone), being in a relationship (vs. being single), and high relationship quality were associated with lower momentary loneliness levels. Being in a relationship was further related to lower mean cortisol levels. Having a partner and living alone was associated with similar levels of loneliness compared to being single and living alone.
Conclusions: This study provides evidence for structural and psychological factors in moderating the detrimental effects of social isolation. Whereas living arrangements only buffer momentary loneliness, being in a romantic relationship is also directly associated with cortisol levels. Societal and clinical implications are discussed.

S17.2 - Neurophysiological correlates of hugging and its behavioral effects on well-being

J. Packheiser[1]

Netherlands Institute for Neuroscience, Deutschland

Social touch is a ubiquitous human social interaction across life-time and cultures to communicate emotional states or intentions. One of the most widespread forms of social touch is hugging. Despite its prevalence, few studies have investigated its effects on physical or mental health. Furthermore, possible neurophysiological correlates of hugging other people remain elusive. In several studies, we investigated (1) the stress-buffering role of hugs, (2) their association with mental well-being and momentary mood before and after the pandemic using Ecological Momentary Assessments and (3) the neural basis of hugging romantic partners with respect to emotional asymmetries using mobile EEG. We found that hugs can attenuate the physiological stress response by preventing an increase in salivary cortisol if a partner hug tooke place prior to the stressor. Before the pandemic, we found that hugs were positively associated with daily mood and this association was tentatively moderated by loneliness with lonely individuals benefitting more strongly from hugs. During the pandemic, the association was much more pronounced indicating that social restrictions and isolation increase the value of hugs for mental well-being. Finally, we found that partner hugs elicit emotional responses as reflected by changes in oscillatory asymmetries on frontal electrodes. Overall, the results indicate that hugs are an important means to increase the physical and mental well-being, a result that is possibly mediated by the positive emotional response to the hug.

S17.3 - Associations between brain structure and parenthood – a community based imaging study with more than 900 individuals

A. Lischke[1], **M. Domin**[2], **H. Grabe**[2], **K. Wittfeld**[2], **C. O. Schmidt**[2], **N. Hosten**[2], **M. Lotze**[2]

[1] Medical School Hamburg, Germany
[2] University Medicine Greifswald, Germany

Becoming parents is one of the most challenging phases in life. Besides their own needs and existing responsibilities, parents have to master demands for care and protection of their first-born child. These demands become more complex with each subsequent child (e.g., breastfeeding a newborn while argueing with a preschooler). Even if these demands change throughout the development of the children (e.g., changing diapers in infanthood and taking care of broken hearts in adolescence), they nonetheless challenge parents in multiple ways. To navigate these challenges, parents have to develop a range of socio-affective skills that are necessary for successful parent-child interaction (e.g., controlling ones emotion during an argument with a stubborn teenager). Accumulating evidence suggest that the development of these skills is mediated by structural changes in brain regions that are implicated in socio-affective processes like empathy, emotion recognition and emotion regulation (e.g., insula, amygdala, prefrontal cortex). Most of this evidence has been gathered in imaging studies that investigated small and unrepresentative samples. To overcome this limitation, we performed an imaging study in a representative community sample of over 900 individuals. We found associations between the number of children and structural changes in the amygdala and insula, core regions of the so-called parental brain. Although these findings suggest that parenthood is associated with structural changes in brain regions that are relevant for empathy and emotion recognition, it remains to be investigated whether these structural changes improve empathy and emotion recognition in parent-child interactions.

S17.4 - Prospective associations between attachment style and neurostructural development from adolescence to early adulthood

L. M. Puhlmann[1,2], **M. Derome**[3,4], **L. Morosan**[3,4], **D. Kilicel**[4], **P. Vrticka**[1,5], **M. Debban**[3,4,6]

[1] Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany
[2] Leibniz Institute for Resilience Research, Mainz, Germany
[3] Developmental Clinical Psychology Research Unit, Faculty of Psychology and Educational Sciences, University of Geneva, Geneva, Switzerland
[4] Developmental Neuroimaging and Psychopathology Laboratory, Department of Psychiatry, University of Geneva, Geneva, Switzerland
[5] Centre for Brain Science, Department of Psychology, University of Essex, Colchester, UK
[6] Research Department of Clinical, Educational & Health Psychology, University College London, London, UK

Background: Secure attachment style, grounded in a reliable and flexible relationship with parents, fosters the cognitive and emotional autonomy necessary to form connections in the wider social context. Previous findings suggest that individual differences in attachment may be associated with differential trajectories of structural brain development, mostly pertaining to maturation during infancy and childhood. Adolescence is another important developmental period marked particularly by increasingly complex interpersonal relationships and significant neurostructural and functional plasticity.
Methods: In this longitudinal study, we investigated whether insecure attachment dimensions of anxiety (AX) and avoidance (AV) could prospectively predict cortical thickness and subcortical volume trajectories of 95 typically developing adolescents (aged 12–19 at study baseline) over four years. Self-reported AX and AV scores were obtained at study baseline; brain structure and psychiatric and cognitive covariates were measured at baseline and after one, two and four years.
Results: Both AX and AV were associated with steeper CT decreases in prefrontal cortical and cortical midline structures as well as the anterior temporal cortex, particularly in participants younger at study baseline. Only marginal associations with developmental trajectories in subcortical volumes of the accumbens area and caudate were observed.
Conclusion: Our study suggests that interindividual differences in attachment styles predict subsequent neurodevelopmental trajectories in several cortical areas during adolescence and young adulthood. Future research should investigate to what extend the presence and perceived quality of interpersonal relationships rely on the same neural substrates or mediate this association.

S17.5 - Lonely in the Dark: Trauma Memory and Sex-specific Dysregulation of Amygdala Reactivity to Fear Signals

M. Morr[1], J. Noell[1], D. Sassin[1], J. Daniels[1], A. Philipsen[2], B. Becker[3], B. Stoffel-Wagner[4], R. Hurlemann[5,6], D. Scheele[1,5]

[1] Division of Medical Psychology, Department of Psychiatry and Psychotherapy, University Hospital Bonn
[2] Department of Psychiatry and Psychotherapy, University Hospital Bonn
[3] Clinical Hospital of Chengdu Brain Science Institute, School of Life Science and Technology, University of Electronic Science and Technology of China
[4] Institute of Clinical Chemistry and Clinical Pharmacology, University Hospital Bonn
[5] Department of Psychiatry, School of Medicine & Health Sciences, University of Oldenburg
[6] Research Center Neurosensory Science, University of Oldenburg

Loneliness exacerbates psychological distress and increases the risk of psychopathology after trauma exposure. The prevalence of trauma-associated disorders varies between sexes, and accumulating evidence indicates sex-specific effects of loneliness. However, it is still unclear whether a lack of social connectedness affects trauma-induced intrusions and the neural processing of fear signals. Moreover, it is uncertain, whether loneliness plays a different role in women and men. Therefore, 47 healthy individuals with high loneliness and 35 low-lonely controls were recruited. Participants were exposed to an experimental trauma and evoked intrusive thoughts in daily life were monitored for three consecutive days. Functional magnetic resonance imaging was used to assess neural habituation to fearful faces and fear learning prior to trauma exposure. The results revealed a significant interaction between loneliness and sex such that loneliness was associated with more intrusions in men, but not in women. A similar pattern emerged at the neural level, with reduced amygdala habituation to repeated fearful faces and amygdala hyperreactivity during the conditioning of fear signals in lonely men, but not in women. These findings indicate that loneliness may confer vulnerability to intrusive memories after trauma exposure in healthy men and that this phenotype relates to altered limbic processing of fear signals.

S18.1 - Hippocampal volumes in middle childhood are developmentally sensitive and indirectly mediate the association of household income with value-based learning

J. Falck[1], **L. Raffington**[3], **C. Heim**[2], **Y. L. Shing**[1]

[1] Goethe University Frankfurt, Deutschland
[2] Charité Universitätsmedizin Berlin, Deutschland
[3] Max Planck Institute for Human Development

Middle childhood is a phase where protracted structural changes in areas, such as the hippocampus, are still ongoing, whereas earlier developing regions, such as the striatum, are relatively mature. We therefore hypothesized that hippocampal volumes are more sensitive to current socioeconomic status (SES) than the striatal volumes, and similarly, that SES is stronger linked to hippocampal-dependent value-based learning than to striatal-dependant value-based learning. We found that brain volumes of both regions were related to household income, however, only hippocampal volumes indirectly mediated the association between household income and value-based learning, such as that for larger hippocampal volumes, higher household income was related to more optimal hippocampal-dependent value-based learning.

S18.2 - Structural variation of the human genital somatosensory representation field

A. Knop[1], S. Spengler[1], C. Bogler[2,3], C. Forster[4], M. Brecht[3,5], J. Haynes[2,3,6], C. Heim[1,7]

[1] Charité-Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Humboldt-Universität zu Berlin, Institute of Medical Psychology, 10117 Berlin, Germany
[2] Charité-Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Humboldt-Universität zu Berlin, Berlin Center for Advanced Neuroimaging, 10117 Berlin, Germany
[3] Bernstein Center for Computational Neuroscience, 10115 Berlin,Germany
[4] Max Planck Institute for Human Cognitive and Brain Sciences, 04103 Leipzig, Germany
[5] Department of Biology, Humboldt-Universität zu Berlin, 10117 Berlin, Germany
[6] Department of Psychology, Humboldt-Universität zu Berlin, 10115 Berlin, Germany
[7] Department of Biobehavioral Health, The Pennsylvania State University, University Park, PA 16802

There is substantial plasticity of the human brain as a function of experience. Shaping our neural system, single synapses, neurons, and neural networks are able to adapt to changing environmental conditions. According to the cortical competition hypothesis, specific neural networks are strengthened with regular stimulation, while less frequently used networks decrease, leading to an expansion or narrowing of neural areas, respectively. Providing support for use-associated structural variation of the human genital cortex, we show thatfrequency of sexual intercourse is correlated with structural thickness of the individually-mapped left genital field.
The developing brain is especially susceptible to the organizing effects of experiences. According to the framework of developmental programming, maximal neuroplasticity may be assumed during sensitive developmental periods. Referring to the cortical competition hypothesis, neuroplastic reorganization might depend on both the nature and timing of experiences. While developmentally enriching experiences are assumed to strengthen neural networks, developmentally inappropriate events are associated to reduced cortical representation to limit detrimental effects on the developing organism.
Hence, we show that exposure to childhood sexual abuse is specifically associated with pronounced cortical thinning of the genital somatosensory representation in females. Such region-specific plastic reorganization may reflect an adaptive and protective mechanism of the developing brain, potentially serving to shield the child from an abusive environment by gating sensory experiences related to the respective type of abuse. Simultaneously, it may represent a direct neurobiological substrate for behavioral changes and disorders, such as sexual dysfunction, later in life, when the respective behavior would be expected.

S18.3 - Cortical thickness and childhood trauma in healthy women, women with borderline personality disorder and women with post-traumatic stress disorder

C. Rosada[1], M. Bauer[2], S. Golde[3], S. Metz[1], S. Roepke[1], C. Otte[1], C. Bu[2,4], K. Wingenfeld[1]

[1] Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin, Humboldt-Universität zu Berlin, and Berlin Institute of Health, Klinik für Psychiatrie und Psychotherapie, Campus Benjamin Franklin, Berlin, Germany
[2] Charité - Universitätsmedizin Berlin, Corporate Member of Freie Universität Berlin, Humboldt Universität zu Berlin, and Berlin Institute of Health, Institute of Medical Psychology, 10117 Berlin, Germany
[3] Clinical Psychology and Psychotherapy, Department of Education and Psychology, Freie Universität, Berlin, Germany
[4] Department of Pediatrics, University of California, Irvine, CA 92617, USA
[5] Development, Health and Disease Research Program, University of California, Irvine, CA 92617, USA

Heterogeneous structural brain alterations have been associated with childhood trauma (CT) and psychopathology. Disentangling whether specific alterations are rather related to CT or to psychopathologies remains difficult. In the present study, we investigated cortical thickness in three distinct groups with CT: healthy women with CT (HC+CT), women with PTSD and CT (PTSD) and women with BPD and CT (BPD). These three clinical groups were compared with healthy controls not exposed to CT (HC).
We recruited 129 women (N=70 HC, N=25 HC+CT, N=14 PTSD, and N=20 BPD) and acquired T1-weighted anatomical images. Whole-brain cortical thickness was measured using FreeSurfer. We conducted separate generalized linear models (GLM) to compare cortical thickness in each of the three CT-exposed groups with HC.
Compared with HC, HC+CT had lower cortical thickness in the right lingual gyrus and the left lateral occipital lobe. Compared with HC, BPD women had lower cortical thickness in bilateral superior frontal gyrus, the right lingual gyrus, and the bilateral isthmus, the right posterior, and the left caudal anterior of the cingulate cortex. We found no differences between PTSD women and HC.
The findings indicate that reduced cortical thickness in the right lingual gyrus is related to CT as it was found in CT-exposed individuals with and without psychopathology. Therefore, it may represent a vulnerability factor for rather than a consequence of psychopathology. Reduced cortical thickness in the cingulate cortex was limited to women with BPD. This substantiates the relevance of structural changes in the cingulate cortex in the psychopathology of BPD.

S18.4 - Interaction between maternal depression in pregnancy and a history of childhood maltreatment on newborn global brain microstructure

N. Moog[1], K. Al-Ali[2], J. Rasmussen[3], M. Styner[2], H. Simhan[4], P. Wadhwa[3], R. Miller[5], E. Barrett[6], S. Entringer[1,3], T. O'Connor[5], C. Buss[1,3]

[1] Charité - Universitätsmedizin Berlin
[2] University of North Carolina at Chapel Hill
[3] University of California Irvine
[4] University of Pittsburgh Medical Center
[5] University of Rochester Medical Center
[6] Rutgers University

Maternal depressive symptoms (MDS) during pregnancy are highly prevalent and have consequences for offspring cognitive and social-emotional development. These effects are likely mediated by variation in gestational biology. However, gestational biological correlates of MDS may differ depending on the presence or absence of a history of childhood maltreatment (CM). We aim to investigate the independent and interactive effects of MDS in pregnancy and maternal history of CM on newborn global brain microstructure.
In a sample of N=88 mother-infant dyads from two cohorts, MDS were assessed serially across pregnancy with the Edinburgh Postnatal Depression Scale. CM was assessed with the Childhood Trauma Questionnaire or the Adverse Childhood Experiences scale, respectively. Diffusion-weighted imaging was performed in the infants within 90 days of birth.
After adjusting for age, sex and study site, neither MDS nor CM were independently associated with global newborn white matter microstructure. There was a significant interaction effect of MDS and CM on newborn global fractional anisotropy (b=-.345, p=.015), radial diffusivity (b=.454, p=.005) and mean diffusivity (b=.231, p=.032), but not axial diffusivity (b=.207, p=.093). More specifically, in infants born to women with a history of CM, higher MDS was associated with lower fractional anisotropy, and with higher mean and radial diffusivity, a pattern suggesting lower microstructural integrity and myelination.
The present findings suggest that MDS may affect offspring brain development via different mechanisms depending on whether mothers were exposed to CM, which may inform future prevention strategies and highlights the importance of monitoring the psychosocial well-being of pregnant women.

S18.5 - Prenatal immune challenges and cognitive development in childhood

S. Schepanski[1,2], T. Zhang[1,3], S. Graute[4], D. Schoenberger[5], S. Bonn[3], J. Heeren[4], B. Roeder[5], A. Diemert[6], I. Hanganu-Opatz[2], P. C. Arck[1]

[1] Division for Experimental Feto-Maternal Medicine, Department of Obstetrics and Fetal Medicine, University Medical Center Hamburg-Eppendorf, Hamburg, Germany
[2] Institute of Developmental Neurophysiology, Center for Molecular Neurobiology (ZMNH), University Medical Center Hamburg-Eppendorf, Hamburg, Germany
[3] Institute of Medical Systems Biology, Center for Molecular Neurobiology (ZMNH), University Medical Center Hamburg-Eppendorf, Hamburg, Germany
[4] Department of Biochemistry and Molecular Cell Biology, University Medical Center Hamburg-Eppendorf, Hamburg, Germany
[5] Biological Psychology and Neuropsychology, Institute for Psychology, Faculty of Psychology and Human Movement, University of Hamburg, Hamburg, Germany
[6] Department of Obstetrics and Fetal Medicine, University Medical Center Hamburg-Eppendorf, Hamburg, Germany

The intrauterine period of life is a highly vulnerable developmental period, because complex cellular and molecular cyclic inflammatory interactions ensure healthy brain maturation. However, chronic inflammation has been identified as the most significant cause of mortality worldwide and is evidently associated with neurodevelopmental disorders when occurring in pregnancy. Surprisingly, maternal chronic low-grade inflammation occurs even more often, has barely been investigated and therefore specific mechanistic mediators for this association are still unknown.

To investigate the association between maternal chronic low-grade inflammation and neurocognitive performance of children aged 5 years, we quantified several maternal immuno-metabolic markersin plasma samples from an ongoing prospective birth cohort study called Prenatal Identification of Children's Health (PRINCE). Mothers were enrolled at gestational week 12-14, and once children were aged 5 years, their neurocognitive performance was assessed.

Within a sub cohort of 208 children, who have performed the neurocognitive testing to date, maternal BMI was inversely associated with self-regulation in boys, but not in girls. Maternal BMI was identified as the most important predictor for self-regulation. Among different immuno-metabolic markers, maternal phosphatidylethanolamine predicted self-regulation in both girls and boys, while maternal leptin was only predictive for boys. As demonstrated by multiple cohort studies showing the influence of maternal chronic inflammation and children's neurocognitive impairments, this study suggests that already maternal chronic low-grade inflammation can affect children's cognitive development.

S19.1 - The Reality of Virtual Reality

B. Schöne[1], J. Kisker[1], L. Lange[2], T. Gruber[1], R. Osinsky[2]

[1] Experimental Psychology I, Institute of Psychology, Osnabrück University, Germany
[2] Differential Psychology, Institute of Psychology, Osnabrück University, Germany

Virtual reality (VR) has become a popular tool for investigating human 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 self-reported presence measurements, defined as the feeling of being submerged in the experience. However, subjective measurements might be prone to bias and, most importantly, 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 (EEG, HRV), 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. Specifically, 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 further room for improving VR on a haptic level. In conclusion, the study shows that contemporary 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. For a video summary please see https://youtu.be/fPIrIajpfiA

S19.2 - Complex fear responses in Virtual Reality: A mobile EEG study

J. Kisker[1], L. Lange[2], K. Flinkenflügel[3], M. Kaup[3], N. Labersweiler[3], F. Tetenborg[3], P. Ott[3], C. Gundler[4], T. Gruber[1], R. Osinsky[2], B. Schöne[1]

[1] Experimental Psychology I, Institute of Psychology, Osnabrück University
[2] Differential Psychology & Personality Research, Institute of Psychology, Osnabrück University
[3] Institute of Psychology, Osnabrück University
[4] Institute of Cognitive Science, 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 neutral cave rather casually, participants in the frightful cave exhibited a broad spectrum of behavioral reactions, like hiding from fear cues or quickly passing them. These behavioral adaption indicate that participants felt sufficiently present within the VR cave to feel threatened by the unfolding events. Surprisingly, these strong behavioral reactions could only be partially reconciled with the established electrophysiological markers. However, as the VR environment facilitated non-mediated and realistic affective and behavioral responses, our results demonstrate VR's high potential to increase the ecological validity of scientific findings while maintaining experimental control.

S19.3 - A dynamic body illusion generated by perceptual organization

M. Dobricki[1]

PHBern, Schweiz

The locomotor illusion of walking may arise due to perception organizing sensory input into a perceptual structure that corresponds to a locomotor array of stimulation. In the present study it was examined whether locomotor illusions are generated by this perceptual formation of a locomotor structure. Seated human subjects were synchronously presented with environmental stimuli, such as trees passing by, and vibrations applied to the soles of their feet. They were exposed to these stimuli differently: In one condition, the stimuli elicited the perceptual formation of a locomotor structure (i.e., a structure corresponding to a body moving through an environment with footsteps); in another condition, the stimuli elicited the formation of a control structure (i.e., a structure corresponding to a body moving through an environmentwithout footsteps). The subjects experienced the distinct illusion of walking across an environment when they were exposed to environmental stimuli that elicited the perceptual formation of a locomotor structure. They did not experience such a distinct locomotor illusion when the stimuli instead elicited the perceptual formation of the control structure. These results suggest that locomotor illusions are a dynamic body illusion generated by perceptual organization.

S19.4 - Traces of Presence in Virtual Reality: Social Behavior and Source Memory Performance

M. Rubo[1]

Marius Rubo, Postdoc, University of Fribourg, Schweiz

In several research fields, Virtual Reality (VR) applications are emerging as a preferred form of stimulus presentation due to their capability to elicit as sense of "being there" (i.e. feeling present) in the virtual scenario. The sense of presence and its derivates (e.g., the social presence of agents) is typically assessed using questionnaires, but a growing body of research also documents on more implicit dimensions that individuals often respond to virtual experiences similarly as to real experiences. I will present two different examples from our own research and discuss them in the broader context of the value of explicit and implicit measures in VR research. Participants viewing a virtual social scene (Rubo & Gamer, 2021) more strongly reciprocated a conspecific's social gaze when immersed in VR compared to when viewing the scene on a computer monitor, hinting at a more naturalistic social behavior when being present in a (virtual) social situation. In a second experiment (Rubo, Munsch & Messerli, 2021), participants were more prone to confusing VR with reality compared to a computer monitor and reality as the source of a memory trace, highlighting a possible mechanism behind the observed generalization of treatment effects obtained in VR but also indicating a possible negative side-effect of VR use.

S20.1 - Reactivating real-world spatial context using targeted memory reactivation

T. Schreiner[1], **B. Griffiths**[1], **M. Kutlu**[1], **T. Staudigl**[1]

Ludwig-Maximilians-Universität München, Deutschland

Sleep's critical contribution to memory consolidation relies on reactivating information encoded during prior wakefulness. While studies in animals demonstrated replay of real-world spatial trajectories during sleep, research into human memory reactivation typically lacks real-world spatial components. Here, we set out to investigate the sleep related reactivation of real-world spatial context, using targeted memory reactivation (TMR), which has proven to be a powerful technique to experimentally trigger memory reactivation during sleep. Participants associated images with specific head-directions (HDs) and auditory reminder cues, with HDs providing the means for establishing distinguishable spatial contexts. Memory performance was tested before and after a night of sleep. During non-rapid eye movement sleep, participants were presented with half of the prior learned reminder cues to initiate contextual memory reactivation. Scalp EEG was recorded throughout the experiment. We show that TMR cues elicit characteristic increases in low frequency (< 5Hz) and sleep spindle activity (12 – 18Hz), putatively reflecting the presence of SO-spindle complexes. Critically, our results reveal that learning related HD signals can be readily decoded following the presentation of TMR cues. Furthermore, reactivation strength (i.e. classifier evidence in favor of the reminder cue related HD) is predictable by the levels of activity in the SO-spindle range, indicating a tight interplay between sleep related oscillations and memory reactivation. In sum, our results demonstrate that HD related information enriches memory traces with spatial context, which is reactivated during subsequent non-REM sleep. The results open up new lines of research into the neural processes underlying memory and navigation.

S20.2 - Slow oscillations are the pacemaker for sequential memory reactivation during sleep

M. Petzka[1], **B. P. Staresina**[2]

[1] Max Planck Institute for Human Development, Berlin, Germany
[2] Oxford Centre for Human Brain Activity, Wellcome Centre for Integrative Neuroimaging, Department of Psychiatry, University of Oxford, Oxford, UK

Consolidation of memories relies on their reactivation during post-learning sleep. While most memories incorporate a sequential order of events, the timescale on which sequential events are reactivated during sleep in humans is still elusive. To identify and characterise reactivation of sequential memories, we here employed a sequential memory task and recorded high-density scalp electroencephalography (EEG) during a post-learning nap. During the post-learning nap, we presented sounds associated with the encoded sequences (targeted memory reactivation, TMR) to induce sequential memory reactivation and applied multivariate pattern analysis (MVPA) to then capture reactivation. In response to the sequence-related sounds, we found reactivation of the first but not the second sequence element. Critically, when realigning the data to sound evoked slow oscillations, reactivation of the second sequence element was nested in their up-states. Our results provide evidence of forward sequential memory reactivation during sleep and moreover, attribute the timing of sequential memory reactivation to slow oscillations.

S20.3 - Closed-loop targeted memory reactivation during slow oscillation up- and down-states

H.-V. Ngo[1], **B. P. Staresina**[2]

[1] University of Lübeck, Germany
[2] University of Oxford, United Kingdom

Sleep constitutes a privileged state for new memories to reactivate and consolidate. Recent work has demonstrated that consolidation can be bolstered experimentally, either via delivery of reminder cues (targeted memory reactivation, TMR) or via non-invasive brain stimulation geared towards enhancing endogenous sleep rhythms. Here we combined both approaches, controlling the timing of TMR cues with respect to ongoing slow oscillation (SO) phases. Prior to sleep, participants learned associations between unique words and a set of repeating images (e.g., car) whilst hearing a prototypical image sound (e.g., engine starting). Memory performance on an immediate test vs. a test next morning quantified overnight memory consolidation. Importantly, two image sounds were designated as TMR cues, with one cue delivered at SO UP-states and the other at SO DOWN-states. A novel sound was used as a TMR control condition. Behavioral results revealed a significant reduction of overnight forgetting for words associated with UP-state TMR cue compared to words associated with DOWN-state TMR. Electrophysiological results showed that UP-state cueing led to enhancement of the ongoing UP-state and was followed by greater spindle power than DOWN-state cueing. This spindle power increase further distinguished memory-related cues from novel control sounds and correlated with multivariate cue decodability. Together, these results unveil the behavioral and mechanistic effects of delivering reminder cues at specific phases of endogenous sleep rhythms and mark an important step for the endeavor to experimentally modulate memories during sleep.

S20.4 - Real-world experiences shape neural activity and dream content in the sleeping brain

D. Kumral[1], **J. Palmieri**[1], **S. Gais**[2], **M. Schönauer**[1]

[1] Albert-Ludwigs-Universität Freiburg, Germany
[2] University of Tübingen, Tübingen, Germany

It is well-established that sleep is beneficial for memory consolidation. At the same time, memories of recent experiences appear in the content of our dreams, while recent research in humans demonstrated that pre-sleep experience is recapitulated at the neural level. However, the possible link between dream content and memory replay remains elusive. In this study, we investigated whether neural reactivation of memories contributes to the dreaming experience using naturalistic stimuli combined with high-density EEG. We find that electrical brain activity during REM sleep, particularly in the beta frequency range, is informative about the content of an audiobook that participants encoded before going to sleep. Beta activity during REM sleep correlated with how well participants retained the contents of the audiobook across the sleep period. Moreover, blind raters were able to predict which audiobook participants encoded based on dream reports we collected during the night. Interestingly, we observed that the amount of neural reactivation carried significant information about the classified dream content. Our results thus provide insight into how sleep-dependent memory consolidation is facilitated by offline reactivation of recently encoded real-world events, and that this is reflected in our dreaming experience.

S20.5 - Human REM sleep mediates memory consolidation through recalibration of neural homeostasis

R. Helfrich[1]

Universitätsklinikum Tübingen, Deutschland

Sleep oscillations during non-rapid eye movement (NREM) sleep are thought to reflect a key substrate of overnight synaptic downscaling supporting memory formation. However, the contribution of rapid eye movement (REM) sleep, governed by non-oscillatory activity, to memory consolidation and associated neural homeostasis remains poorly understood. Combining scalp and intracranial electroencephalography (EEG) in human sleep with memory assessment, sleep deprivation and novel population-based markers of neural excitability, revealed that REM sleep supports the homeostatic recalibration of optimal neural network balance. Moreover, the extent of homeostatic network recalibration predicted the success of memory consolidation linked to differential modulation of hippocampal—neocortical excitability. Such findings support a novel and fundamental role of REM sleep in maintaining neural homeostasis and enhancing long-term memory.

S21.1 - Exogenous estradiol and oxytocin modulate sex differences in hippocampal reactivity and episodic memory

M. Coenjaerts[1], I. Trimborn[1], B. Adrovic[1], B. Stoffel-Wagner[2], L. Cahill[3], A. Philipsen[4], R. Hurlemann[5,6], D. Scheele[1,5]

[1] Division of Medical Psychology, Department of Psychiatry and Psychotherapy, University Hospital Bonn, 53105 Bonn, Germany
[2] Institute for Clinical Chemistry and Clinical Pharmacology, University of Bonn, 53105 Bonn, Germany
[3] Department of Neurobiology and Behavior, University of California, Irvine, CA, 92697-3800, USA
[4] Department of Psychiatry and Psychotherapy, University Hospital Bonn, 53105 Bonn, Germany
[5] Department of Psychiatry, School of Medicine & Health Sciences, University of Oldenburg, 26129 Oldenburg
[6] Research Center Neurosensory Science, University of Oldenburg, 26129 Oldenburg

Considerable evidence supports sex differences in autobiographical and episodic memory which may translate to heightened vulnerability to stress- and trauma-related disorders in women. The hormones estradiol and oxytocin both affect episodic memory, but possible sex-specific effects and hormonal interactions have not been systemically tested in humans. We conducted a randomized, placebo-controlled, parallel-group functional magnetic resonance imaging (fMRI) study involving healthy women (n = 111) and men (n = 115). Participants were scanned under four experimental conditions: 1. estradiol gel (2 mg) and intranasal oxytocin (24 IU), 2. placebo gel and intranasal oxytocin, 3. estradiol gel and placebo spray, 4. placebo gel and placebo spray. During fMRI, participants viewed positive, neutral and negative scenes. A surprise recognition task three days later was used to classify encoding trials as remembered or forgotten. Under placebo, women showed a significantly better recognition memory and increased hippocampus responses to subsequently remembered items independent of the emotional valence compared to men. Separate treatments with either estradiol or oxytocin significantly diminished this mnemonic and hippocampal sex difference, whereas the combined treatment produced no significant effect. Collectively, our results suggest that estradiol and oxytocin play a crucial role in modulating sex differences in episodic memory. Furthermore, possible antagonistic interactions between estradiol and oxytocin could explain previously observed opposing hormonal effects in women and men. Thus, future clinical trials with oxytocin need to control for interactions with gonadal steroids such as estradiol.

S21.2 - Sex differences in the effects of oxytocin on trust

B. Schiller[1], J. Brustkern[1], M. Walker[2], A. Hamm[3], M. Heinrichs[1]

[1] Albert-Ludwigs-Universität Freiburg, Deutschland
[2] Social Psychology, Faculty of Psychology, University of Basel, Switzerland
[3] Physiological and Clinical Psychology and Psychotherapy, Institute of Psychology, University of Greifswald, Germany

While oxytocin seems to increase trust in men, it is unknown whether its effects are similar in women and in interactions involving additional personal information about interaction partners (e.g., sex, faces). Furthermore, oxytocin's effects on specific socio-cognitive processes are still largely unknown. Therefore, we studied the effects of administering intranasal oxytocin on trust decisions, and the temporal dynamics of underlying neurophysiological processes. Specifically, we were interested whether oxytocin might modulate behavior via affecting early, attention-related processes or rather late, valuation-related processes. After intranasal administration of either 24 IU oxytocin or placebo, 144 heterosexual, single men and women should decide whether they wanted to keep their monetary investment or transfer it to their interaction partner of the opposite sex whose facial features had been manipulated on attractiveness and threat. We observed that oxytocin, compared to placebo, had opposite effects on trust in men and women, tending to increase trust in men, but lower it in women. Furthermore, this sex difference was most pronounced when participants were interacting with unattractive and unthreatening interaction partners. Corresponding to our behavioral results, we found sex-specific oxytocin effects in the P100 amplitude: oxytocin, compared to placebo, tended to increase the amplitude in men but decrease it in women. Oxytocin thus seems to have sex-specific effects on both trust behavior towards opposite-sex interaction partners in a trust game with real faces and underlying neurophysiological processes. By affecting early attentional processing, oxytocin seems to strengthen approach behavior towards potential romantic partners in men, and reduce it in women.

S21.3 - Oxytocin and social learning in socially high anxious men and women

S. Levine[1], A. Flechsenhar[1], K. Ueltzhöffer[2], L. E. Müller[2], S. C. Herpertz[2], K. Bertsch[1,2]

[1] Department of Psychology, Ludwig-Maximilians-University München
[2] Medical Faculty, Heidelberg University

This study investigated the effects of intranasally administered oxytocin in socially anxious participants to examine associated learning processes with regard to social abilities. This was tested by pairing neutral faces with positively, neutrally, or negatively valenced self-referential sentences.
Behaviorally, oxytocin yielded an increase in sympathy ratings on positively conditioned faces in social high anxious compared to socially less anxious individuals. Furthermore, processing became less self-referential and emotional arousal sank in high socially anxious participants with oxytocin administration. Pupil dilation corroborates these changes in arousal physiologically.
Such altered behavioral parameters of socially anxious individuals under oxytocin may be interpreted as a "normalization" of learning in social contexts. Oxytocin therefore seems to ameliorate effects of appetitive conditioning and reduce those of averse conditioning in high socially anxious participants.
Neural activation patterns yield gender differences: highly anxious women reacted with an increase in regression coefficients over the course of the experiment in the posterior superior temporal gyrus for the positively conditioned faces and the amygdala for the neutrally conditioned faces, whereas their low anxious counterparts showed a corresponding decrease over time. Males did not yield this effect. Representational similarity analysis revealed a decrease in similarity of all face categories within the lateral occipital complex for the low-anxious oxytocin group, with respect to the other groups.
These preliminary neural findings shed light on how activity and activation patterns change in various brain regions as a function of social anxiety. Ongoing analyses will help to tease these apart further.

S21.4 - Effects of oxytocin on face processing in Borderline Personality Disorder

A. Lischke*[1,2], W. Zhao*[3], B. Becker[3], C. Berger[4], G. Domes[5], S.C. Herpertz[6]

[1] Medical School Hamburg, Deutschland
[2] Institute for Clinical Psychology and Psychotherapy, Medical School Hamburg, Hamburg, Germany
[3] Clinical Hospital of the Chengdu Brain Science Institute, MOE Key Laboratory for Neuroinformation, University of Electronic Science and Technology of China, Chengdu, China
[4] Department of Psychiatry, Neurology, Psychosomatics, Psychotherapy in Childhood and Adolescence, University Medical Center of Rostock, Rostock, Germany
[5] Department of Biological and Clinical Psychology, University of Trier, Trier, Germany
[6] Department of General Psychiatry, Medical Faculty, Heidelberg University

Borderline Personality Disorder (BPD) is a severe mental disorder associated with substantial morbidity and mortality, indicating a constant need for the development of novel treatment approaches. Recent treatment approaches focus on the neuropeptide oxytocin. Oxytocin has been shown to modulate important social processes. Some of these processes, like for example, emotion and gaze processing, are impaired in BPD. Oxytocin may, thus, be useful for restoring emotion and gaze processing in BPD. To test this possibility, we performed a pharmacological imaging study where we investigated emotion and gaze processing in a sample of BPD patients. Following the application of oxytocin or placebo, BPD patients and healthy controls (HC) viewed a series of faces with averted and direct gaze. BPD patients showed less amygdala reactivity to faces with averted gaze than HC under placebo, indicating pervasive impairments in gaze processing. These impairments were restored under oxytocin when BPD patients showed similar amygdala reactivity to faces with averted gaze as HC under placebo. The restoring effects of oxytocin were accompanied by changes in the functional coupling of the amygdala and prefrontal cortex. Given that oxytocin restored gaze processing in BPD patients, oxytocin may be useful for treating social impairments in BPD.

S22.1 - Inhibitory control and its modification in specific phobia – An antisaccade study

F. Breuer[1], A. Hildebrand[2], E. Leehr[1], J. Finke[2], L. Bucher[2], T. Klucken[2], U. Dannlowski[1], K. Roesmann[2]

[1] Universitätsklinikum Münster, Institut für tranlsationale Psychiatrie, Münster, Deutschland
[2] Universität Siegen, Lehrstuhl für klinische Psychologie und Psychotherapie, Siegen, Deutschland

The inability to inhibit bottom-up driven attentional biases towards fear-relevant stimuli is considered a relevant pathogenic factor in anxiety disorders. Inhibitory control performance can be investigated with the antisaccade task, in which participants are required to look into the opposite direction of a peripheral appearing visual stimulus. Longer latencies and error rates – a valid biopsychological measure of inhibitory control deficits – have been observed in subclinical anxiety. Yet, surprisingly little data are available on the antisaccade performance in patients with anxiety disorders.
The aims of this proof-of-concept study are, first, to characterize patients with spider phobia (as a model anxiety disorder) compared to healthy control participants regarding their antisaccade performance in response to phobia-related and unrelated stimuli. Second, associations of antisaccade performance and neurophysiological, behavioral and psychometric indices of fear will be investigated. Third, the potential of an antisaccade training to improve inhibitory control deficits will be piloted: Expected changes in antisaccade performance will be associated with changes in neurophysiological, behavioral and psychometric measures of fear.
The study has been preregistered (ISRCTN12918583) and data collection has been launched in March 2022. Methods and preliminary results will be presented at the conference.
This study contributes to a better understanding of neurocognitive underpinnings of pathological fear and might pave the way for neuroscientific informed and targeted interventions for anxiety disorders.

S22.2 - Intrinsic brain connectivity patterns as moderators of treatment response in spider phobia: a cross-site replication approach

U. Lueken[1,2], F. Seeger[2,3], E. Leehr[4], H. Schwarzmeier[2], N. Siminski[2], M. Herrmann[2], J. Böhnlein[4], B. Gathmann[5], T. Straube[5], K. Roesmann[5], M. Junghöfer[5], U. Dannlowski[4]

[1] Humboldt-Universität zu Berlin, Deutschland
[2] Universitätsklinikum Würzburg, Deutschland
[3] Universitätsklinikum Heidelberg, Deutschland
[4] Universitätsklinikum Münster, Deutschland
[5] Westfälische Wilhelms-Universität Münster, Deutshcland

Although exposure-based therapy is a first-line treatment for spider phobia, a significant amount of patients does not respond. Inhibitory fronto-limbic connectivity has been reported as a neural substrate and putative moderator of treatment response. We aimed to investigate the association between intrinsic brain connectivity via resting-state (rs) fMRI with treatment outcome towards a standardized one-session exposure protocol. Investigating the robustness of findings, an independent replication was conducted. Data stem from the SpiderVR study, which was conducted as a bicentric study in Würzburg and Münster as part of the CRCTRR 58 "Fear, Anxiety, Anxiety Disorders". Patients with a primary diagnosis of spider phobia underwent an 8 min pre-treatment rs-fMRI assessment followed by virtual reality-based exposure treatment (VRET). N = 148 quality-controlled datasets were included. ROI-to-ROI and seed-to-voxel analyses were conducted within CONN18a. The same acquisition and analysis pipeline was implemented at both sites. Clinically sufficient response was seen in 55% of patients. As predicted, we observed stronger inhibitory fronto-limbic connectivity in addition to more excitatory amygdala-occipital cortex and prefrontal crosstalk as a pre-treatment feature of treatment response in the Würzburg sample. Out-of sample replication on the Münster site was however not successful. Findings partly support current models on the neural substrates of treatment response in internalizing disorders. They do however emphasize that even with strong harmonization between sites, replication is difficult and point towards important sources of variance not controlled by standard multicenter protocols. Future studies should stronger focus on the replication of own findings.

S22.3 - Differentiation of neural activity between responder and non-responder of exposure-based therapy in spider phobic patients

M. Herrmann[1], N. Siminski[1], C. Lederer[1], H. Schwarzmeier[1], F. Seeger[1,2], K. Roesmann[3,4,5], E. Leehr[6], J. Böhnlein[6], B. Gathmann[7], M. Junghöfer[4,5], U. Dannlowski[6], U. Lueken[1,8], T. Straube[7]

[1] Department of Psychiatry, Psychosomatics, and Psychotherapy, Center for Mental Health, University Hospital of Würzburg, Germany
[2] Department of General Psychiatry, University of Heidelberg, Germany
[3] Institute for Clinical Psychology and Psychotherapy, University of Siegen, Germany
[4] Institute for Biomagnetism and Biosignalanalysis, University of Münster, Germany
[5] Otto-Creutzfeld Center for Cognitive and Behavioral Neuroscience, University of Münster, Germany
[6] Institute for Translational Psychiatry, University of Münster, Germany
[7] Institute of Medical Psychology and Systems Neuroscience, University of Münster, Germany
[8] Department of Psychology, Humboldt-Universität zu Berlin, Berlin, Germany

Background: Exposure therapy is the gold standard for the treatment of anxiety disorders, but still a relevant number of patients does not show adequate therapy response. To improve existing therapies, the knowledge about the neurobiological foundation of psychotherapy processes is highly relevant. Therefore, this study aimed to compare the neural activity of sustained fear in therapy responder and non-responder at baseline.
Methods: In this study, we analyzed data of 53 patients with spider phobia. They were the Wuerzburg part of a bi-centric clinical study investigating the effects of virtual reality exposure therapy (VRET). Before VRET, we explored brain activation employing fMRI in patients with spider phobia, while participants anticipated the presentation of either neutral or phobogenic visual stimuli. The sample was divided into therapy responders and non-responders based on the reduction in spider phobia questionnaire (SPQ) score of 30% and a reduction of 50% in a behavioral approach task (BAT) from baseline to 6-month-follow-up. The neural activity of both groups was statistically compared using SPM.
Results: The whole-brain analyses of sustained fear processes revealed significant group differences (for the contrast phobogenic vs neutral) between responder and non-responder during the anticipation period in the left and right insula. ROI analyses of the central amygdala and bed nucleus of stria terminalis (BNST) did not reveal any significant differences between responder and non-responder.
Conclusion: This study confirms the involvement of the insula in anticipatory anxiety. Furthermore, we could show that task-specific activation might be a neural marker for exposure therapy response.

S22.4 - Neural Correlates of Psychotherapy: A systematic review and meta-analysis of functional brain activation studies in anxiety disorders

L. M. Cybinski[1], **A. Busch**[1], **F. Sauerhammer**[1], **M. Metzulat**[1], **A. E. Lehmann**[1,2], **M. J. Herrmann**[1]

[1] Center of Mental Health, Dept. of Psychiatry, Psychosomatics, and Psychotherapy, University Hospital of Wuerzburg, Margarete-Hoeppel-Platz 1, D-97080 Wuerzburg, Germany
[2] Department of Translational Research in Psychiatry, Max Planck Institute of Psychiatry, Munich, Germany

Cognitive-behavioral psychotherapy is considered the gold standard for the treatment of anxiety disorders, but there is a need for improvement as only 50% of treated patients show clinically significant improvements (Loerinc et al., 2015). Improving our fundamental understanding of the neural mechanisms underlying psychotherapy is thus crucial to define new targets for additional therapeutic approaches. However, existing meta-analyses on this topic do not focus on anxiety disorders in a narrow sense or have methodological shortcomings. Therefore, we conducted a systematic literature review according to the PRISMA criteria as well as two coordinate-based meta-analyses of functional whole-brain activation studies. These examined neural changes induced by psychotherapy in anxiety disorders (including group x time analyses: 13 studies, n patients = 349; and including pre vs. post analyses: 14 studies, n patients = 319), using effect size signed differential mapping (ES-SDM). We found significant deactivation of the left inferior frontal gyrus from pre- to post-treatment, consistent with a recent meta-analysis that included depressive patients. Additional meta-analyses on the interaction between group x time, and subgroup analyses for diagnostic entities did not yield significant results. In conclusion, further longitudinal studies of functional whole-brain imaging in the course of psychotherapy for anxiety disorders are needed to provide reliable results. Future studies should establish interaction analyses as the standard for treatment effects. In addition, the inclusion of region-of-interest analyses in meta-analyses might be useful.

S22.5 - Neural plasticity of the amygdala: does psychotherapy for anxiety disorders modulate amygdala responsiveness to fearful stimuli?

Y. Yang[1], U. Lueken[2], A. Wittmann[3], A. Wroblewski[1], I. C. Ridderbusch[1], J. Richter[4], M. J. Herrmann[5], K. Kölkebeck[6], A. Jansen[1], A. Ströhle[3], T. Suslow[7], C. Konrad[1,8], B. Pfleiderer[9], M. Lotze[10], A. Hamm[4], J. Deckert[5], T. Fydrich[2], A. L. Gerlach[11], P. Pauli[12], W. Rief[13], J. Margraf[14], K. Domschke[15], V. Arolt[16], H. Wittchen[17], B. Straube[1], T. Kircher[1]

[1] Department of Psychiatry and Psychotherapy, Philipps-University Marburg, Marburg
[2] Department of Psychology, Humboldt-Universität zu Berlin, Berlin
[3] Department of Psychiatry and Psychotherapy, Campus Charité Mitte, Charité - Universitätsmedizin Berlin, Berlin
[4] Department of Biological and Clinical Psychology, University of Greifswald, Greifswald
[5] Department of Psychiatry, Psychosomatics and Psychotherapy, University of Würzburg, Würzburg
[6] Department of Psychiatry and Psychotherapy, LVR-Hospital Essen, University of Duisburg-Essen, Essen
[7] Department of Psychosomatics, University of Leipzig, Leipzig
[8] Department of Psychiatry, Agaplesion Diakonieklinikum Rotenburg, Wümme
[9] Department of Clinical Radiology, University of Münster, Münster
[10] Functional Imaging Unit, Institute for Diagnostic Radiology and Neuroradiology, University of Greifswald
[11] Klinische Psychologie und Psychotherapie, Fachbereich Psychologie, Universität zu Köln, Köln
[12] Department of Biological Psychology, Clinical Psychology, and Psychotherapy, University of Würzburg, Würzburg
[13] Clinical Psychology and Psychotherapy, Philipps-Universität Marburg, Marburg
[14] Mental Health Research and Treatment Center, Ruhr-Universität Bochum, Bochum
[15] Department of Psychiatry, Universitätsklinikum Freiburg, Freiburg
[16] Department of Psychiatry, University of Münster, Münster
[17] Institute of Clinical Psychology and Psychotherapy, Technische Universität Dresden, Dresden

Animal and human studies have consistently demonstrated that the amygdala plays a central role in threat detection, fear associative learning, fear expression, and defensive responses. Regarding abnormal fear processing in patients with anxiety disorders, theoretical etiological models postulated, in line, aberrant amygdala functionality as its underpinning causal mechanism. However, studies using functional magnetic resonance imaging (fMRI) revealed inconsistent findings of abnormal amygdala activities in anxiety patients compared to healthy controls. Furthermore, the neural plastic changes of the amygdala underlining the clinical improvement of patients after treatment remain largely undiscovered. The Federal Ministry of Education and Research (BMBF) funded multicenter psychotherapy studies (2006-2019) applied 8 experimental paradigms during fMRI scanning and measured patients before and after a manualized exposure-based psychotherapy. These paradigms used various disorder-related visual, auditory, interoceptive, semantic, subliminal, somatosensory stimuli and involved diverse cognitive processes including passive viewing, associative and extinction learning, counting, matching, expectation, rating, and decision making. From these experiments we extracted over 30,000 neural responses in the amygdala from 563 patients and 395 healthy controls and are going to conduct a mega-analysis, which would answer the following

research questions: which quality of experimental stimuli and cognitive tasks 1) trigger reliably amygdala activities; 2) differentiate patients with healthy controls; 3) demonstrate sufficient test-retest reliability and 4) detect psychotherapy related changes in amygdala responsiveness. The limitations of current fMRI studies investigating amygdalae dysfunctions in patients with anxiety disorders will also be discussed.

S23.1 - A novel attempt to improve replicability of EEG-Personality associations: The CoScience Project

C. A. Short[1], **K. Paul**[1], **J. Wacker**[1]

University of Hamburg, Germany

The issues at the centre of the replicability crisis, such as low statistical power and undisclosed flexibility in data analysis, are amplified in research aiming to link individual differences in EEG markers to variations in personality due to between-subjects research designs and high complexity of data processing. The CoScience Team, a collaboration of ten EEG-personality laboratories, employs the principles of cooperative forking paths analysis for the first time, aiming to address this unsatisfactory state of affairs by (1) significantly increasing sample size (and statistical power) through sharing the load of data collection across laboratories, and by (2) eliminating undisclosed flexibility in data analysis. The latter is achieved through collaborative identification of both the most appropriate and all defensible pre-processing and analysis paths, and documentation of the resulting multiverse of millions of alternative analyses and results. Being at the data analysis stage of the CoScience project, the presentation will, after a conceptual overview of this novel approach, focus on the challenges encountered as well as solutions under development to overcome them. The discussion will compare our approach with other ongoing initiatives and recommendations with similar goals and provide practical guidance for researchers in the field interested in taking steps aimed at increasing the replicability of their findings.

S23.2 - How Robust is the Relationship between Neural Processing Speed and Cognitive Abilities?

A. Schubert[1], **C. Löffler**[1,2], **D. Hagemann**[2], **K. Sadus**[2]

[1] Johannes Gutenberg-Universität Mainz, Deutschland
[2] Ruprecht-Karls-Universität Heidelberg, Deutschland

Individual differences in processing speed are consistently related to individual differences in cognitive abilities, but the mechanisms through which a higher processing speed facilitates reasoning remain largely unknown. To identify these mechanisms, researchers have been using latencies of the event-related potential (ERP) to study how the speed of cognitive processes associated with specific ERP components is related to cognitive abilities. Although there is some evidence that latencies of ERP components associated with higher-order cognitive processes are related to intelligence, results are overall quite inconsistent. These inconsistencies likely result from variations in analytic procedures and little consideration of the psychometric properties of ERP latencies in relatively small sample studies. Here we used a multiverse approach to evaluate how different analytical choices regarding references, low-pass filter cutoffs, and latency measures affect the psychometric properties of P2, N2, and P3 latencies and their relations with cognitive abilities in a sample of 148 participants. Latent correlations between neural processing speed and cognitive abilities ranged from -.49 to -.79. ERP latency measures contained about equal parts of measurement error variance and systematic variance, and only about half of the systematic variance was related to cognitive abilities, whereas the other half reflected nuisance factors. We recommend addressing these problematic psychometric properties by recording EEG data from multiple tasks and modeling relations between ERP latencies and covariates in latent variable models. All in all, our results indicate that there is a substantial and robust relationship between neural processing speed and cognitive abilities when those issues are addressed.

S23.3 - The model is bend but never broken: Evidence for a situational induction strength based quadratic extension to the capability model

J. Rodrigues[1], **J. J. B. Allen**[2], **M. Müller**[1], **J. Hewig**[1]

[1] Julius-Maximilians Universität Würzburg, Deutschland
[2] University of Arizona, Tucson, United States of America

The capability model of anterior asymmetry integrates trait-related and state-related frontal asymmetry research by proposing that frontal asymmetry is dependent on relevant traits if they are activated by a situation. Hence, it emphasizes the importance of a relevant situation in contrast to resting state to find trait related behavior. However, differences in experimental design, and EEG recording methods and the strength of the induced situational context have been neglected so far. We investigated 56 participants under three different situational paradigms (virtual T-maze, mental imagery, movies), varying the stimulus, strength of motivational induction and type of measurement concerning frontal asymmetry. We predicted that "strong" situational manipulations (virtual T-maze, frontal asymmetry measured as event-related desynchronization) would eclipse relationships between frontal asymmetry and relevant traits, whereas "weaker" task manipulations, measured during longer time periods, would enhance relationships to relevant traits compared to frontal asymmetry at rest.
The results confirmed these expectations, stressing the importance of stimulus characteristics, and recording methods concerning the trait relations of frontal asymmetry to personality traits with respect to the capability model. Additionally, a revision of the capability model to an inverse U-shaped quadratic relationship might be advisable.

S23.4 - More than noise? A multi-level EEG approach for the investigation of neural variability and its relation to human cognitive performance

J. C. García Alanis[1], M. D. Nunez[2], C. Löffler[1], G. T. Frischkorn[3], K. Oberauer[3], C. J. Fiebach[4], A. Schubert[1]

[1] Johannes Gutenberg University Mainz
[2] University of Amsterdam
[3] University of Zürich
[4] Goethe University Frankfurt

Behavioral adaption and, by extent, behavioral variability is necessary for successful day-to-day functioning. However, individual variability in the brain's response to internal and external demands has long been regarded as "noise" (e.g., unmeaningful intraindividual or interindividual variance). However, a growing body of research suggests that neural variability is key for understanding brain-behavior relationships across individuals. In the present study, we computed estimates of neural variability across three levels of analysis. First, we focused on distributional characteristics of electroencephalographic (EEG) recordings (e.g., amplitude variation in terms of signal standard deviation). Second, we computed oscillatory and non-oscillatory estimates of variability (e.g., low vs. high frequency ratios, 1/f spectral exponent) for the power spectrum evoked during task performance and at baseline. Third, we aimed to describe patterns of regularity in trial-by-trial EEG signal using entropy estimates. These neural variability estimates were computed for data from 145 subjects recorded while they performed a speeded task-switching paradigm. Here, we discuss how these EEG measures of neural variability relate to each other, showing their theoretical and empirical commonalities, functional overlap, and individual advantages for understanding variability in behavioral performance. This work will extend our understanding of the relationship between neural and behavioral variability as well as their relevance for individual differences in cognitive abilities.

S23.5 - A Multi-Modal Approach to Individual Differences in Brain Signal Complexity

J. Thiele[1], A. Richter[2], K. Hilger[1,3]

[1] Department of Psychology I, Würzburg University, Germany
[2] Department of Biology, Würzburg University, Germany
[3] Department of Psychology, Frankfurt University, Germany

Individual differences in general cognitive ability have been linked to variations in spontaneous brain activity. Resting-state fMRI was used in a majority of neuroscientific investigations. However, such research is inherently limited by low temporal resolution, thus, preventing conclusions about neural fluctuations within the range of milliseconds. Entropy measures and EEG microstate analyses are two approaches developed to gain insights into the complexity of neural signals. The selection of the "best" measure to reliably map individual differences is, however, as difficult as their interpretation. In our preregistered study, we used resting-state electroencephalographical (EEG) recordings of 144 adults and compared different operationalizations of brain signal complexity (Multiscale entropy, Shannon entropy, Fuzzy entropy, and specific characteristics of microstates) concerning their collinearity and their ability to capture individual differences in intelligence. Exploratory factor analyses resulted in 17 latent factors and the inspection of factor loadings informed about similar versus distinct neural properties captured by different measures. Overall, the associations between brain signal complexity measures and intelligence were of small effect sizes (rho ~.20) suggesting that large samples are required to reliably detect significant associations with sufficient statistical power. However, by combining multiple measures within a multivariate prediction model, we showed that intelligence scores of unseen participants can significantly be predicted from multi-modal brain signal dynamics within the same sample (k-fold internal cross-validation) and in an independent sample (external replication). In sum, our study proposes multi-modal approaches as promising means for individual difference research – especially when sample sizes are limited.

S24.1 - Observational learning in intergroup contexts

P. Kang[1], **C. J. Burke**[1], **P. N. Tobler**[1], **G. Hein**[2]

[1] Department of Economics and Laboratory for Social and Neural Systems Research, University of Zurich
[2] Translational Social Neuroscience Unit, Department of Psychiatry, Psychosomatic and Psychotherapy, University of Würzburg

Observing others alleviates the need to learn only from own trials and errors. This talk will introduce how observational learning is affected when observed others belong to another rather than our own group. In our globalized world, "the others" often are people from a different social group (outgroup). There is evidence that people learn less from observing outgroup individuals compared with individuals from their own group (ingroup). However, the source of this outgroup deficit in observational learning remained unknown, which limits our chances to improve intergroup learning. Here, we investigated the outgroup deficit in observational learning in situations where humans could learn from the actions or outcomes of ingroup and outgroup members. Our results showed that participants rely less on observed outgroup actions compared with ingroup actions, while learning from outgroup outcomes is not impaired. At the neural level, lateral prefrontal (inferior frontal gyrus) activity reflected the impact of computationally modelled action prediction errors on the behavioral difference between groups. These findings imply that outgroup learning may be preserved when we observe outcomes, rather than actions.

S24.2 - Biases in learning about the self and their association with affect

A. V. Mayer[1], **L. Müller-Pinzler**[1]

University of Lübeck, Germany

Feedback from others influences how a person thinks about him or herself, for example, about his or her ability to accomplish a particular task. How this feedback is integrated into a self-concept might be biased by its subjective value, as well as the person's current affective state. We investigated the neural and computational mechanisms of learning about one's own performance in an estimation task using fMRI, pupillometry, and computational modeling, and analyzed individual differences in affective experience. Results showed that biases in self-related learning were associated with the degree of experienced affect during the task, as well as pupil dilation and neural activity within the anterior insula, amygdala, ventral tegmental area, and medial prefrontal cortex. Specifically, participants who tended to update their self-related beliefs more negatively had stronger neural and pupil responses to negative prediction errors, and experienced more embarrassment and less pride. Our results provide evidence for neural and computational mechanisms that integrate affect into the process of belief formation.

S24.3 - How do humans learn about other people? Incorporating social knowledge structures into reinforcement learning

K. M. M. Frolichs[1,2], **G. Rosenblau**[3], **C. W. Korn**[1,2]

[1] Section Social Neuroscience, Department of General Psychiatry, University of Heidelberg, Heidelberg, Germany
[2] Institute for Systems Neuroscience, University Medical Center Hamburg-Eppendorf, Hamburg, Germany
[3] Department of Psychological and Brain Sciences, George Washington University, Washington DC, USA

To navigate social interactions successfully, humans continuously need to learn about the personality traits of other people (e.g., how helpful or aggressive is the other person?). However, formal models that capture the complexities of social learning processes are currently lacking. That is, standard reinforcement learning (RL) models only capture part of the learning process because they neglect inherent knowledge structures and omit previously acquired knowledge. We introduced a framework that specified specific strategies that humans could employ for learning about others. To do so, we formalized two social knowledge structures and implemented them in novel hybrid RL models to test their usefulness across multiple social learning tasks. We named these concepts granularity (knowledge structures about personality traits that can be utilized at different levels of detail during learning) and reference points (previous knowledge formalized into representations of average people within a social group). In five behavioural experiments, results from model comparison and model-free analyses indicated that participants efficiently combined the concepts of granularity and reference points—with the specific combinations depending on the people and traits that participants learned about. Overall, our experiments demonstrate that variants of RL algorithms, which incorporate social knowledge structures, describe crucial aspects of the dynamics at play when people interact with each other. In future studies we aim to test the scope of this framework (i.e., test its applicability outside of personality learning). Furthermore, we plan to investigate if and how these knowledge structures are represented in the mPFC.

S24.4 - Learning prosocial motives: Modelling empathy and reciprocity driven closeness

A. Saulin[1], **C. Ting**[2,3], **J. B. Engelmann**[3], **G. Hein**[1]

[1] Center of Mental Health, Department of Psychiatry, Psychosomatic and Psychotherapy, Translational Social Neuroscience Unit, University of Würzburg, Würzburg, Germany
[2] Department of Psychology, University of Hamburg, Hamburg, Germany
[3] CREED, Amsterdam School of Economics (ASE), Universiteit van Amsterdam, Amsterdam, the Netherlands

Empathy (sharing another's feelings) and reciprocity (reciprocating kindness) are two strong motives for prosocial behavior and prosocial approach. Here we apply theoretical learning models to investigate how empathy-driven and reciprocity-driven closeness ratings develop and persist in the absence of further reinforcement. The respective motives were reinforced with high (80%; acquisition block), and low (20%; extinction block) and equal probability (50%; control blocks). We observed that the reciprocity-driven closeness mirrored the frequencies of reinforcement in the respective block, i.e., increased during acquisition and decreased during extinction. In contrast, empathy-driven closeness increased during the acquisition block and persevered in the extinction block. When modelling closeness over time using a variant of the Rescorla-Wagner model, this difference in motive-driven closeness was reflected by a key model parameter that quantifies the individual calibration of the learning signal. Follow-up analyses revealed that this parameter is likely to capture the motive-dependent influence on motive-driven closeness. Additionally, in the case of weak recalibration, negative emotion ratings were associated with increased closeness, and for strong recalibration, positive emotions were associated with increased closeness. On the neural level, the individual calibration of the learning signal was related to the activation in brain areas that are associated with mentalizing and reward learning and are implicated in social learning (temporo-parietal junction, superior temporal sulcus, dorso-medial prefrontal cortex, precuneus, and striatum). Together, these results indicate that the sustainability of empathy-driven closeness relies on an emotion-dependent calibration of social learning circuitries.

S24.5 - A causal role of temporoparietal junctions in computing social influence during goal-directed learning

L. Zhang[1,2], F. I. Kandil[3,4], C. C. Hilgetag[3,5], J. Gläscher[1]

[1] Institute of Systems Neuroscience, University Medical Center Hamburg-Eppendorf, Hamburg, 20246, Germany
[2] Social, Cognitive and Affective Neuroscience Unit, Department of Cognition, Emotion, and Methods in Psychology, Faculty of Psychology, University of Vienna, Vienna, 1010, Austria
[3] Institute of Computational Neuroscience, University Medical Center Hamburg-Eppendorf, Hamburg, 20246, Germany
[4] Department of Neurology, Campus Benjamin Franklin, Charité – Universitätsmedizin Berlin, Berlin, 12200, Germany
[5] Department of Health Sciences, Boston University, Boston, MA 02115, USA

The human temporoparietal junction (TPJ) is a crucial brain area for processing social information, and we have previously identified the neurocomputational function of bilateral TPJ in computing social information during goal-directed learning (Zhang & Gläscher, 2020, Science Advances). Their causal relationship, however, remained unclear and yet to be explored. Here, leveraging non-invasive continuous theta-burst stimulation (cTBS) and reinforcement learning models under the hierarchical Bayesian framework, we tested whether bilateral TPJ causally supports the computation of social influence in a social learning task, where participants (N = 31) were able to adjust their decisions after observing choices from four other players. Behaviorally, we show that disruption of the left TPJ (as opposed to either the right TPJ or the vertex serving as a non-active control site) weakened participants' choice adjustment and delayed their response speed when confronted with dissenting social information. Computationally, down-regulating activity in the left TPJ lesioned the degree of computing social influence during choice adjustment (i.e., comparing others' choices in relation to participants' own decision), whereas the extent to which vicarious value updating through social learning (i.e., computing value via tracking the others' performance) remained intact. Together, our results provide evidence for the causal role of left TPJ in social influence during goal-directed learning and shed light on the relational function of the TPJ in social cognition.

S25.1 - Empathy and Negative Reciprocity Under Stress

N. Schürmann[1], **A. Pützer**[1], **O. T. Wolf**[1]

Ruhr-Universität Bochum, Deutschland

Stress is known to affect social cognition and behavior, such as empathy and social decision making. Social cognitive processes also appear to respond to exposure to chemosensation. Therefore, in the present study, we examined interactive effects of psychosocial stress and the odorant Hedione on emotional and cognitive empathy, as well as negative reciprocity. We tested 88 healthy, free-cycling female participants in dyads. They were exposed to a group variant of the Trier Social Stress Test (TSST-G) or a control version in a laboratory scented with either Hedione, a control odorant or no odorant. Stress responses were captured via subjective and physiological (salivary cortisol, salivary alpha amylase) measures over the course of the session. After stress induction, participants completed an empathy paradigm as well as a game of negative reciprocity. Our results show enhanced negative reciprocity in response to acute psychosocial stress, characterized by increased punishment during low cooperation and reduced punishment during high cooperation. Emotional and cognitive empathy remained unaffected by stress. The odorant did not affect any of the dependent variables. Taken together, our results highlight acute psychosocial stress as an important factor in social interaction and maintenance of fairness. In contrast, Hedione appears less influential than initially assumed. Future research should investigate potential influences of sex and menstrual cycle phase on the effects of stress on social cognition.

S25.2 - Effects of Social Exclusion on Social Cognition in Healthy Individuals and Patients with Borderline Personality Disorder

L. Graumann[1], A. B. Cho[1], E. Kulakova[1], O. T. Wolf[2], S. Röpke[1], C. Otte[1], K. Wingenfeld[1]

[1] Klinik und Hochschulambulanz für Psychiatrie und Psychotherapie, Charité Universitätsmedizin Berlin, Campus Benjamin Franklin (CBF)
[2] Institut für Kognitive Neurowissenschaft, Ruhr-Universität Bochum

In one of our previous studies, psychosocial stress induced with the Trier Social Stress Test (TSST) diminished social cognitive abilities, namely emotional empathy, in individuals with Borderline Personality Disorder (BPD). In healthy controls (HC), however, there is evidence that psychosocial stress enhances prosocial behavior. This difference might be due to that fact that BPD patients react highly sensitive to social rejection and easily feel excluded. We investigated whether social exclusion results in differences in social cognition between women with BPD and HC. We hypothesized a switch from prosocial "tend-and-befriend" behavior to "fight-or-flight" behavior, i.e. reduced prosocial behavior in BPD patients after social exclusion.
To induce social exclusion, we randomized 98 women with BPD and 98 HC women to either an exclusion or an overinclusion condition of the Cyberball game. Subsequently participants underwent the Multifaceted Empathy Test (MET), assessing cognitive and emotional empathy and monetary games to measure sharing and punishment behavior.
Women with BPD reported lower emotional empathy and shared more money than HC, regardless of condition. Exploratory analyses revealed that BPD patients exhibited lower empathy for positive emotions than HC, but not for negative emotions. Punishment and cognitive empathy did not differ between groups or conditions.
Our results neither showed reduced prosocial behavior in BPD patients nor enhanced prosocial behavior in HC after exclusion. This differs from previous studies using the TSST, which reliably induces a pronounced biological stress response, typically not seen after cyberball. Future studies should identify moderators between stress and social cognition beyond feeling excluded.

S25.3 - The impact of physical distancing during the Corona pandemic on stress, interpersonal relationships and social wellbeing

P. Forbes[1], F. Nitsch[2], M. Falkenstein[2], A. Ling[3], H. Plassmann[2], T. Kalenscher[1]

[1] Heinrich-Heine-Universität Düsseldorf, Deutschland
[2] INSEAD Fontainebleau, France
[3] University College Dublin, Ireland

The COVID-19 pandemic, and in particular the physical distancing policies put in place to contain its spread, has the potential to change the nature of our interpersonal relationships. Its adverse impact on our social wellbeing is aggravated by elevated stress levels triggered by the threats and uncertainties of the disease as well as the dramatic reduction in social contact. We have generated a comprehensive trans-national and trans-cultural panel database on maladaptive social and non-social decision-making in times of crisis, covering data from Germany, France and China, as well as mood, state, trait and cultural variables and subjective and objective measures of acute and chronic stress. Our study provides the basis for designing and testing interventions to arbitrate the negative impact of life-transforming adverse events on interpersonal relationships, health behaviors and, ultimately, general social well-being.

S25.4 - Impact of distinct contemplative mental training elements on daily life stress, thoughts and affect

V. Engert[1]

Universitätsklinikum Jena, Deutschland

Mindfulness-based mental training interventions are a popular means to buffer stress and reduce stress-associated health risks. To evaluate the implementation of mental training content into daily life, previous research emphasizes the importance of studying the effects of such interventions in naturalistic settings. We examined the effects of three distinct mental training modules on a range of measures of daily life experience in the the ReSource Project, a 9-month longitudinal mental training study comparing modules targeting capacities such as attention and interoception (Presence), socio-affective (Affect) or socio-cognitive abilities (Perspective). Ecological momentary assessment (EMA) were used to repeatedly probe stress levels and stress-coping efficacy combined with cortisol levels, and further explore arousal, affective states, and thought patterns in the daily lives of 289 healthy adults (172 women; 20–55 years). We found increased presence-focused thought as well as heightened arousal after 3-6 months of training duration. This effect was independent of the type of prior mental training. Increased coping efficacy emerged specifically after socio-cognitive Perspective training, following 6-9 months of training duration. No training effects were found for subjective stress, stress-reactive cortisol levels, or daily life affect. Our findings extend and add ecological validity to previous ReSource findings by showing that they replicate in participants' everyday environment. Regarding cortisol and subjective stress experience, our results suggest caution in generalizing laboratory findings to the daily life context. Overall, our study provides important insights into how contemplative practice effects translate to everyday experience, enhance stress-coping, and may ultimately support the maintenance of good health.

S26.1 - The gut microbiota in depression

J. F. Vazquez-Castellanos[1]

VIB-KU Leuven, Belgium

The gut microbiota is a complex community of bacteria, archaea, viruses and eukaryotes that coexist in the gastrointestinal tract (GIT), particularly in the large intestine. These microbes have tremendous potential to impact our physiology, both in health and disease. The role of the microbiome encompasses pathogen protection, immune regulation, and cross-feed the colonocytes by short-chain fatty acid production. However, different environmental perturbations might cause the microbiome to move to a disease state known as dysbiosis. Dysbiosis refers to an imbalance of the microbiome commensal species and its replacement by a pathogen or opportunistic bacteria. The gut microbiome dysbiosis has been related to numerous diseases, including depression.
The microbial community of depressed subjects shows a reduction in butyrate-producing bacteria, which are generally associated with a higher quality of life indicators and an increase in the dysbiotic-associated Bacteroides 2 enterotype. Therefore, the healthy gut-brain axis communication might be broken, leading to the deterioration of the condition in depressing subjects. Consequently, it opens the opportunity to use bacteriotherapy strategies such as faecal microbial transplant or probiotics as adjuvant therapy in depressed patients.

S26.2 - Role of adult hippocampal neurogenesis in the antidepressant effects of lactate

A. Carrard[1]

CHUV, Centre de Neurosciences Psychiatriques (CNP), Switzerland

Previous studies on the antidepressant effects of lactate have shown that chronic administration of lactate improved depressive-like behavior in different animal models (Carrard et al., 2018). The antidepressant effects of lactate are associated with changes in the expression of specific target genes among which Hes5 and p11 are involved in adult hippocampal neurogenesis. These findings led us to investigate the role of adult hippocampal neurogenesis in the antidepressant effects of lactate in the corticosterone model of depression.

We found that chronic peripheral injection of lactate counteracted the decreased neural progenitor proliferation and survival induced by corticosterone. In contrast, chronic administration of pyruvate, the oxidized form of lactate, did not produce antidepressant effects and did not prevent the inhibition of neural progenitor proliferation and survival induced by corticosterone. Importantly, depletion of adult hippocampal neurogenesis by the antimitotic drug temozolomide suppressed the antidepressant effects of lactate on behavioral despair and anhedonia in animals chronically treated with corticosterone.

In vitro studies on hippocampal stem cell cultures revealed that corticosterone decreased cell proliferation and increased ROS production. Consistent with our in vivo observations, lactate but not pyruvate suppressed the effect of corticosterone on ROS production and partially counteracted the effect of corticosterone on stem cell proliferation. Similarly to lactate, NADH prevented ROS production elicited by corticosterone and partially reversed the inhibition of stem cell proliferation induced by corticosterone. Together, these data suggest that conversion of lactate to pyruvate with the concomitant production of NADH is necessary for the neurogenic and antidepressant effects of lactate.

S26.3 - Microbial Regulation of Tryptophan Metabolism

C. E. Gheorghe[1,2,3], **J. F. Cryan**[1,2,3], **G. Clarke**[1,3,4]

[1] Department of Psychiatry and Neurobehavioral Science, University College Cork, Cork, Ireland
[2] Department of Anatomy and Neuroscience, University College Cork, Cork, Ireland
[3] APC Microbiome Ireland, University College Cork, Cork, Ireland
[4] INFANT Research Centre, University College Cork, Cork, Ireland

The gut-brain axis is a bidirectional communication system between the central nervous system and the gastrointestinal tract. It has become increasingly clear that the gut microbiota influences not only gastrointestinal physiology but also central nervous system (CNS) function by modulating the signalling pathways of the gut-brain axis. One example is serotonin (5-HT), which functions as a key neurotransmitter at both terminals of this axis. Microbial regulation of tryptophan metabolism has become a focal point in this regard, with dual emphasis on the regulation of serotonin synthesis from tryptophan and the control of kynurenine pathway metabolism. Recent research has increasingly concentrated microbial-specific pathways that generate bioactive tryptophan metabolites. Taken together, this broad portfolio of bioactives have the potential to exert a substantial impact on host behaviour and brain function. Here, we critically assess recent progress made towards a mechanistic understanding of the microbial regulation of tryptophan metabolism and microbiota-gut-brain axis homeostasis. This research field highlights the role tryptophan metabolism plays in preclinical and clinical neuroscience and embraces the challenge to improve our understanding of how perturbed tryptophan metabolism contributes to stress-related psychiatric disorders.

S26.4 - Clinical and gut microbial effects of a probiotic add-on therapy in depressed patients: A randomized controlled trial

A. Schaub[1], J. F. Vazquez-Castellanos[2], E. Schneider[1], J. Raes[2], U. E. Lang[1], A. Schmidt[1]

[1] Department of Psychiatry (UPK) Basel, University of Basel, Switzerland
[2] Department of Microbiology and Immunology, Rega Institute for Medical Research, KU Leuven, Belgium

Depression is a highly prevalent and burdensome psychiatric disorder. Even though antidepressants are widely applied, up to 30% of patients experience residual symptoms when receiving optimized treatments. Therefore, the development of novel treatment approaches is urgently needed. The manipulation of the gut microbiota as part of the microbiota-gut-brain axis has emerged as promising novel target for the treatment of depression. We conducted a randomized controlled trial in depressed patients investigating the effect of a four-week high-dose probiotic add-on therapy on depressive symptoms and the composition of gut microbiota. In addition to the Hamilton Rating Scale for Depression (HAM-D), secondary clinical measures were assessed at baseline, after the intervention and at an 8-weeks follow-up. Furthermore, state-of-the-art quantitative microbiome profiling was conducted to investigate effects of probiotics on microbiota composition. Out of 60 included patients, 47 completed the intervention. A decrease of HAM-D scores over time and interactions between time and group were found, indicating a greater decrease in the probiotics group compared to placebo. No significant interaction effects were shown in secondary clinical measures. In the gut microbiome, alpha-diversity measures were increased after the intervention compared to placebo. Furthermore, the genus Lactococcus increased in the probiotics group but not in placebo. Probiotics ameliorated depressive symptoms compared to placebo with a strongest effect after 8 weeks. Probiotics maintained alpha-diversity and increased specific health-related bacteria in the gut. Compared to many currently available treatments, probiotic interventions might be an accessible, pragmatical and non-stigmatizing adjuvant therapy for patients with depression.

S26.5 - Effect of short-term, high-dose probiotic supplementation on cognition, related brain functions and BDNF in depressive patients: A secondary analysis of a randomized controlled trial

E. Schneider[1], **J. Doll**[1], **A. Schaub**[1], **U. E. Lang**[1], **A. Schmidt**[1]

Universitäre Psychiatrische Kliniken Basel, Schweiz

In depression, cognitive dysfunctions strongly contribute to functional impairments but are barely addressed in current therapies. Hence, novel treatment strategies addressing cognitive symptoms in depression are needed. As the microbiome-gut-brain-axis is tightly linked to depression and cognition, we investigated the effect of a four-week high-dose probiotic supplementation on cognitive symptoms in depression. In a randomized controlled trial, 60 depressive patients with current depressive episodes took a probiotic supplement or indistinguishable placebo containing maltose over 31 days additionally to their standard antidepressant treatment. Their cognitive performance in the Verbal Learning Memory Test , Corsi Block Tapping Test, both Trail Making Test versions as well as their brain-derived neurotrophic factor levels were assessed at three different time points: before, immediately after and four weeks after intervention. Additionally, brain activation changes during a working memory task were investigated before and immediately after intervention. Comparing both groups, we found a significantly improved verbal episodic memory for the probiotic group immediately after intervention and a trend for a time-group-interaction considering all time points. On the neural level, we found a time-group-interaction in the hippocampal activation during the working memory task, revealing a remediated hippocampus function in the probiotic group. Other measures did not reveal any significant changes. Our data, therefore, imply that an adjuvant probiotic supplementation enhances verbal episodic memory and directly affects neural mechanisms underlying impaired cognition in depression. The present findings support the importance of the microbiome-gut-brain-axis in depression and emphasize the potential of microbiota-related regimens to treat cognitive symptoms in depression.

S27.1 - Influence of voice context on vowel perception

H. Blank[1]

University Medical Center Hamburg-Eppendorf, Germany

Different speakers produce the same intended vowel with very different physical properties. Fundamental frequency (F0) and formant frequencies (FF), the two main parameters that discriminate between voices, also influence vowel perception. While it has been shown that listeners comprehend speech more accurately if they are familiar with a talker's voice, it is still unclear how such prior information is used when decoding the speech stream. In three pre-registered online experiments, we examined the influence of speaker context via F0 and FF shifts on the perception of /o/-/u/ vowel contrasts. Participants perceived vowels from an /o/-/u/ continuum shifted towards /u/ when F0 was lowered or FF increased relative to the original speaker's voice and vice versa. This shift was reduced when the speakers were presented in a block-wise context compared to random order. Conversely, the original base voice was perceived shifted towards /u/ when presented in the context of a low F0 or high FF speaker, compared to a shift towards /o/ with high F0 or low FF speaker context. These findings demonstrate that F0 and FF jointly influence vowel perception in speaker context.

S27.2 - Predictive pre-activation of orthographic and lexical-semantic representations facilitates visual word recognition

S. Eisenhauer[1,2], **C. J. Fiebach**[1], **B. Gagl**[1]

[1] Goethe University Frankfurt
[2] University of York, UK

Predictive context strongly facilitates word recognition during reading. As potential mechanism underlying this facilitation, predictive coding models suggest (i.) a pre-activation of predictable stimulus features across multiple representational levels before stimulus onset, (ii.) which causes a subsequent suppression ('explaining away') of the predicted features during stimulus processing. Still, we do not sufficiently understand at which level of linguistic representation – visual, orthographic, phonological, and/or lexical-semantic – predictable word features are pre-activated and how this influences subsequent stimulus processing. In two repetition priming experiments, including words and pseudowords (i.e., meaningless pronounceable nonwords), we investigated the effects of a predictive context on behavioral response times (N = 49) and magnetoencephalography (MEG)-measured brain responses (N = 38). Linear mixed modeling of behavioral response times revealed that a predictive context (i.e., presence of a prime stimulus) facilitated orthographic and lexical-semantic, but not visual or phonological processes. Linear mixed modeling of MEG data indicated sustained activation of orthographic and lexical-semantic representations in the interval before processing the predicted stimulus. This finding supports the assumption that representations at multiple linguistic levels are pre-activated in a predictive context. During stimulus processing, predictability suppressed orthographic features, further supporting predictive coding models. In contrast, predictability enhanced lexical-semantic representations. This finding challenges the 'explaining away' proposed by predictive coding while favoring a 'sharpening' of predictable stimulus features. In conclusion, our findings suggest a pre-activation of orthographic and lexical-semantic representations, followed by predictive coding and sharpening mechanisms, as crucial factors underlying efficient visual word recognition.

S27.3 - Modelling N400 amplitudes as an internal temporal difference prediction error

M. Rabovsky[1]

University of Potsdam, Germany

The N400 ERP component seems to reflect the brain's default response to incoming language. Using a neural network model of predictive sentence comprehension, the Sentence Gestalt (SG) model, we simulate N400 effects across a broad range of experimental conditions as the change in the model's hidden layer activation induced by new incoming words, corresponding to an internal temporal difference prediction error at the level of meaning. In the model, the magnitude of the simulated N400 also corresponds to the error signal driving learning. In line with this correspondence we found empirically that larger N400s entail enhanced adaptation. In recent work training the SG model on a large-scale corpus we demonstrate that the model's capacity to predict N400 amplitudes extends to naturalistic comprehension conditions. These results show that a widely observed language-related brain potential emerges naturally within a predictive comprehension system that probabilistically maps from linguistic input to events in the world.

S27.4 - Multi-level prediction during reading and listening

M. Heilbron[1,2]

[1] Donders Institute, Nijmegen, The Netherlands
[2] Max Planck Institute for Psycholinguistics, Nijmegen, the Netherlands

Language understanding unfolds over a hierarchy of stages, from recognizing speech sounds and letter shapes to constructing abstract meaning. In this talk, I will present work combining computational modelling with fMRI, M/EEG and eye-tracking, to test for effects of linguistic prediction on neural processing at each of these levels, in both experimental and naturalistic conditions. We find that predictions can enhance visual representations in areas as early as V1, and that simply listening to audiobooks spontaneously evokes a hierarchy of predictions across disparate processing levels (phonemes, syntax, semantics). Interestingly, high-level contextual predictions appear to inform low-level predictions during speech perception, but not during reading, where they operate independently. Together, these results reveal how prediction pervades language processing, and highlight that even though prediction occurs at multiple levels, predictions are not always passed 'all the way down'.

S28.1 - A possible framework of internal time processing and strategic time monitoring in time-based prospective memory

G. Laera[1,2,3], **A. Hering**[1,2,4], **M. Kliegel**[1,2,3]

[1] Cognitive Aging Lab (CAL), Faculty of Psychology and Educational Sciences, University of Geneva, Switzerland
[2] Centre for the Interdisciplinary Study of Gerontology and Vulnerability, University of Geneva, Switzerland
[3] LIVES, Overcoming Vulnerability: Life Course Perspective, Swiss National Centre of Competence in Research, Switzerland
[4] 4Department of Developmental Psychology, Tilburg School for Social and Behavioral Sciences, Tilburg University, The Netherlands

Several studies have shown that people monitor time strategically during time-based prospective memory (TBPM) tasks. However, there is still a debate on the cognitive processes underlying time monitoring. Some authors suggest that attentional resources are essential for strategic time monitoring, whereas others argue that internal time processes may support strategic time monitoring, too. Although there are several models in the literature that explain the role of attention in time perception, it is currently unclear whether and how such models can be applied to TBPM. Furthermore, it is unknown if the neural basis associated with specific components of a model are plausible and can explain well strategic time monitoring and TBPM performance. Thus, we propose a possible theoretical framework of strategic time monitoring in TBPM by integrating the more recent models of time perception – derived from animal and human data – within the context of TBPM. We provide behavioral data to support such model, and we discuss further future neurobehavioral experiments to test specific cognitive components within the model. Given the lack of strong theoretical account and empirical evidences in the literature, this theoretical framework can provide a better understanding of the cognitive processes underlying TBPM and strategic time monitoring.

S28.2 - Acute stress and prospective memory

G. Miknevičiūtė[1], R. Doekemeijer[2], M. Kliegel[1], N. Ballhausen[3]

[1] University of Geneva, Switzerland
[2] Ghent University, Belgium
[3] University of Tilburg, The Netherlands

Little attention has been given to the combined effects of acute stress and aging on cognition by comparing these effects in young and older adults. In this study we focus particularly on stress effects on prospective memory (PM). PM has been shown to be a key predictor of older adults' functional independence and to have a positive impact on their quality of life. Thus, knowledge on how stress modulates PM in older age is of high relevance for the scientific and clinical evaluation of cognitive health. Only one study has examined acute stress effects on PM in both young and older adults showing that acute stress impaired PM in young, but not in older adults (Schnitzspahn et al., 2022). The absence of stress effects in older adults is surprising given that stress is known to impair functions underlying PM – such as working memory – in young adults. Besides, the effect of stress on PM has never been investigated using the Stop-signal task as an ongoing PM task. Thus, here we compare the effects of acute stress on PM in young and older adults by randomly assigning participants to either the stress (induced by the Trier Social Stress Test) or the control condition, followed by a computerized PM task. Salivary cortisol was collected at 6 timepoints during the laboratory session to ensure an effective stress induction and to explore potential associations between cortisol concentrations and PM performance. Data collection is ongoing and preliminary results will be presented at the symposium.

S28.3 - The neural correlates of remembering intentions in light of gains and losses

A. Hering[1], **S. Horn**[2], **M. Kliegel**[3]

[1] Tilburg University, Netherlands
[2] University of Zurich, Switzerland
[3] University of Geneva, Switzerland

Remembering delayed intentions (i.e. prospective memory) is an important ability for functional independence and wellbeing. In everyday life, our intentions are often influenced by previous positive or negative experiences. In the present study, we aim to investigate the impact of motivational factors on intention encoding. More specifically, we manipulated the prospective memory cues during encoding to be associated with either gains or losses. Forty-eight younger and 20 older participants were tested for the experiment, data collection of the older adults was limited due to the pandemic. All participants saw four pictures that were associated with either winning or losing a certain number of points. Participants had to gain as many points as possible. In the actual prospective memory task, these pictures were used as prospective memory cues. Participants worked on a 2-bak picture ongoing task, where they had to decide whether the picture presented is the same as two before. Additionally, we asked them to press space, whenever they encountered one of the images from the first task. Besides the behavioral performance, we assessed ERPs for cue detection and retrieval. Results are discussed in light of implicit encoding and the impact of value-added intentions in younger and older adults.

S28.4 - Neural substrates of prospective memory in old age and their interplay with financial reward

M. Menéndez Granda[1,2], **S. Horn**[3], **M. Kliegel**[4,5,6], **J. Peter**[1]

[1] University Hospital of Old Age Psychiatry and Psychotherapy, University of Bern, Switzerland
[2] Graduate School for Health Sciences, University of Bern, Switzerland
[3] Department of Psychology, University of Zurich, Switzerland
[4] Faculty of Psychology and Educational Sciences, University of Geneva, Switzerland
[5] Center for the Interdisciplinary Study of Gerontology and Vulnerability, University of Geneva, Switzerland
[6] Swiss National Centre of Competence in Research, Lausanne and Geneva, Switzerland

Prospective memory is the ability to remember to carry out intentions at a certain time (time-based prospective memory) or when a specific event occurs (event-based prospective memory) [1]. In an ongoing study, we currently investigate the neural correlates of prospective memory in old age and at the same time, we test whether financial reward may enhance prospective memory. As it has been shown that older adults respond better to losing a reward than to achieving it [2], the participants in the experimental condition will start with an initial amount of money that may be lost depending on their task performance. There will also be a control group, who will not receive a reward. All experiments will be done in a MR scanner. We expect difficulties in older adults in the time-based prospective memory task, accompanied by a reduction of activity in brain regions such as the rostral prefrontal cortex [3]. Furthermore, we expect increased task performance when a reward is provided accompanied by increased activity in regions, such as the ventral tegmental area or the nucleus accumbens [4].

S28.5 - Adult Age Differences in Time- and Event-Based Prospective Remembering with Motivational Incentives

J. Brummer[1], **S. Horn**[1], **A. Freund**[1]

University of Zurich, Schweiz

Prospective-memory (PM) tasks can be event-based (e.g., remembering to buy bread when you pass a supermarket) or time-based (e.g., remembering to take medication at 7pm). In event-based PM tasks, motivational incentives can affect whether age differences in performance are large or small: Whereas younger adults tend to be more motivated by gains, older adults focus more on preventing losses, resulting in larger age differences in gain than loss conditions in event-based PM tasks. However, little is known about the role of motivational incentives in time-based PM. Time-based PM has high requirements of monitoring that may depend more strongly on motivational processes than in event-based PM. In the present research, older and younger adults were instructed to perform a PM task at regular time intervals, while making lexical decisions as ongoing activity. Participants could request a virtual clock for time-monitoring. In a gain condition, correct PM responses within a specific time window led to monetary gains; in a loss framing, missing a time window led to deductions from an initial endowment. We expected higher PM performance in younger than older adults, Age $\times$ Incentive interactions, and positive correlations between clock checking and PM performance. Our findings add to the understanding of how motivational incentives affect PM across the lifespan in time- and event-based tasks.

S29.1 - Social Touch and Self-Touch in Autism, ADHD and Anorexia

R. Boehme[1], **A. J. Capusan**[1], **M. F. Karlsson**[1], **M. Zetterqvist**[1], **H. Olausson**[1]

Linköping University, Schweden

The clearest experience of the self and its physical borders is the experience of being touched. It is also the earliest sensory experience of the self. Touch is crucial for the sensation of having a body and for learning how to distinguish between self and other. Throughout our lifetime, social touch plays a foundational role for both our bodily self and our interaction with others.
My group and I use self-touch and affective touch by others during functional brain imaging to understand how we differentiate between self and other, and how dysfunctions of this process can contribute to an altered sense of self. In this talk, I will discuss studies on the neural and behavioral processing of tactile self-other-distinction in neurotypical and neurodiverse populations (autism, ADHD, and anorexia).

S29.2 - Stroking in preterm babies – C-tactile activation promotes autonomic regulation

Y. Friedrich[1], **I. Püschel**[1,3], **J. Reichert**[2], **I. Croy**[1]

[1] Friedrich Schiller University Jena, Institute of Psychology, Department for Clinical Psychology, Jena, Germany
[2] Technische Universität Dresden, University Hospital and Medical Faculty Carl Gustav Carus, Department of Pediatrics, Dresden, Germany
[3] Technische Universität Dresden, University Hospital and Medical Faculty Carl Gustav Carus, Department of Psychotherapy and Psychosomatics, Dresden, Germany

Touch is an important component of preterm infant care and has shown positive effects on mother-infant bonding and the infant's development.
Microneurography studies suggest that a subtype of nerve fibers, so-called C-tactile afferents, have a special role in mediating affective touch. C-tactile fibers are activated by slow stroking and present with a calming effect on the autonomic nervous system: Heart rate decreases and heart rate variability increases.
This effect is especially interesting for preterm infant care. Preterm infants often experience difficulties regulating their autonomic functions. Resulting heart rate dysregulations can lead to clinical complications and life-threatening conditions. In term-born babies, a C-tactile typical calming effect of stroking has already been observed. However, it is unclear at what time C-tactile fiber connections mature in preterm infants.
In a series of experiments with preterm infants, we tested whether
a) mothers intuitively use stroking velocities that are suited to target C-tactile fibers.
b) the infantile heart rate declines in response to C-tactile optimal stroking.
c) the infantile behavior appears less stressed in response to C-tactile optimal stroking.
Up to now, we tested n = 36 preterm infants (gestational age: 24th to 36th week) and recorded their physiological as well as their behavioral responses to stroking.
Analyses suggest that mothers used stroking velocities within the optimal range and preterm babies showed a significant but delayed calming response to stroking. This indicates that the maturation process is still ongoing and could potentially be promoted by C-tactile activation strategies like stroking.

S29.3 - Social self-touch in embodied rescripting

M. R. Lesur[1], R. Baumann[1], B. Lenggenhager[1,2], B. Kleim[1]

[1] Department of Psychology, University of Zuirch
[2] Department of Psychology, University of Konstanz

Social affective touch is an important aspect of comforting. In the current study, we investigated self-comforting during imagery rescripting of aversive memories in two groups of healthy participants. One group underwent a traditional imagery rescripting procedure which involves reimagining the distressing event. This includes an imagery self-comforting section in which participants imagine, from the perspective of their past self, being comforted by their current self. The other group could experience themselves comforting themselves in a multisensory way from the perspective of a child manikin using prerecorded immersive videos and virtual reality. Importantly, during this experience, participants could not only see and hear themselves talking from a third person perspective but could also directly feel the affective touch, being at the same time the person who applied and who received the affective touch. Subjective (questionnaire-based) and objective (electrocardiogram) measures of emotional arousals as well as phenomenal aspects about the illusory experience were measured. While study is still ongoing, the results will give first evidence on the potential use of immersive settings involving affective touch in future clinical settings. The results will also be discussed in the broader context of VR-mediated social touch to foster embodiment as well as interpersonal connectedness in various contexts.

S29.4 - Cortisol and Oxytocin Concentrations during Covid-19 lockdown: Associations with affectionate touch and individuals' wellbeing

E. Schneider[1,2], D. Hopf[1,2], C. Aguilar-Raab[1,2], D. Scheele[3,4], A. Neubauer[5,6], U. Sailer[7], R. Hurlemann[3,4], M. Eckstein[1,2], B. Ditzen[1,2]

[1] Institute of Medical Psychology, Center for Psychosocial Medicine, Heidelberg University Hospital, Heidelberg, Germany
[2] Heidelberg University, Heidelberg, Germany
[3] Department of Psychiatry, University of Oldenburg, Bad Zwischenahn, Germany
[4] Section Medical Psychology, Department of Psychiatry, University of Bonn, Bonn, Germany
[5] Department for Education and Human Development, DIPF | Leibniz Institute for Research and Information in Education, Frankfurt/Main, Germany
[6] Center for Research on Individual Development and Adaptive Education of Children at Risk (IDeA), Frankfurt/Main, Germany
[7] Department of Behavioural Medicine, Faculty of Medicine, Institute of Basic Medical Sciences, University of Oslo, Oslo, Norway

Background: Social interactions and particularly social affectionate touch are vital for mental and physical health. Potential neuroendocrine mechanisms for these salubrious social effects include the release of oxytocin and its regulation of the stress axes. However, to date, no study probed the association between diurnal and momentary endogenous oxytocin levels and stress responses during the Covid-19 pandemic.
Methods: During the first wave of the Covid-19 pandemic in a large cross-sectional online survey (N = 1,050) anxiety and depression symptoms were measured with the Hospital Anxiety and Depression Scale (HADS), loneliness with the University of California, Los Angeles Loneliness scale (UCLA Loneliness) and attitude towards social touch with the Social Touch Questionnaire (STQ). Additionally, N = 247 participants completed ecologically momentary assessments (EMA) over two days with six daily assessments by answering smartphone-based questions on affectionate touch and their momentary mental state as well as providing concomitant saliva samples for cortisol and oxytocin assessment.
Outcomes: Analyses from hierarchical multilevel models (HLM) show that affectionate touch was associated with lower momentary anxiety, Covid-19 related burden, stress and cortisol as well as with higher oxytocin levels and happiness.
Interpretation: Our results suggest that in times of pandemic and lockdown affectionate touch is linked to higher endogenous oxytocin and might buffer stress on a subjective and hormonal level. The results of these large-scale daily hormone and mood assessments have immediate implications for preventing mental burden during social contact restrictions.

S30.1 - The longitudinal Relationship Between Physical Factors and ADHD

V. Brandt[1], **C. Reed**[1], **D. Golm**[1], **S. Cortese**[1]

University of Southampton

Associations between physical factors, such as asthma and obesity, and attention deficit hyperactivity disorder (ADHD) have been reported. Data from the millennium cohort study was used to assess which physical factors across development were significantly related to ADHD symptoms at age 17, in N = 9419 participants.
Disorders were reported by a parent at ages 9 months, 3, 5, 7, 11, 14 and 17 years, 93% of respondents were mothers.Physical factors were clustered into a) Immune disorders (eczema, asthma, hay fever), b) Sensory disorders (eyesight problems, hearing problems), c) Neurological disorders (fits and epilepsy, neurological disorders, sleeping problems, stutter, movement problems), and d) Cardio-metabolic factors (obesity, diabetes, any reported heart or circulation condition including congenital heart disease). A number of control variables were entered into the analysis, such as child sex, household income, maternal employment, maternal BMI, high blood pressure, birthweight, maternal depression/anxiety, and child taking medication for ADHD. The longitudinal association between weight and ADHD was investigated in a follow-up analysis.
All physical clusters significantly predicted ADHD at age 17. When all control variables were entered, only neurological disorders (ß = .07) and sensory disorder (ß = .07) predicted ADHD significantly. While children with ADHD were lighter at birth compared to controls, this relationship changed over the course of development and children with ADHD were significantly more likely to be obese by age 5 compared to the control group.
The data suggest common pathways for certain physical factors and ADHD.

S30.2 - The interplay between experiences of childhood maltreatment, memory problems and ADHD symptoms

D. Golm[1], **L. Douglas**[1], **J. Kreppner**[1]

University of Southampton, Vereinigtes Königreich

Almost 9% of UK children experience one instance of maltreatment before their 11th birthday (i.e., abuse or neglect). These experiences constitute a major risk factor for the development of psychiatric problems. Children with neurodevelopmental problems are overrepresented in maltreated populations with childhood maltreatment having a negative effect on symptom load.
Our research on adoptees with a history of early severe institutional deprivation as part of the longitudinal English and Romanian Adoptees Study showed a pattern of persistently higher ADHD symptoms from childhood into young adulthood in adoptees who had spent at least 6 months in Romanian institutions. We further showed an initial negative impact on general cognitive ability followed by catch-up into young adulthood. In young adulthood, brain volume statistically mediated the effects of early deprivation on general cognitive functioning and ADHD symptoms. ADHD symptoms were further predicted by lower general IQ and prospective memory problems.
We are currently conducting two studies to further explore the relationship between experiences of childhood maltreatment, memory problems and ADHD symptoms. In study 1, parents of children with and without a history of maltreatment experiences completed measures on their child's memory function and neurodevelopmental symptoms.
Study 2 is a systematic review on the link between memory problems and (i) a history of childhood maltreatment and (ii) psychopathology (Prospero: CRD42021288744). Results from both studies will be presented.

S30.3 - Bidirectional Associations Between Childhood Head Injuries and Conduct Problems from 3 to 17 years in the UK Millennium Cohort Study

H. Carr[1], **J. Hall**[1], **H. Eisenbarth**[2], **V. Brandt**[1]

[1] University of Southampton, United Kingdom
[2] Victoria University of Wellington, New Zealand

Conduct problems increase the risk of aggression and criminality and are a well-known correlate with childhood head injury. However, the direction and timing of this association and the role of their demographic risk factors remain unclear.
The current study investigated the bidirectional links between head injuries and conduct problems from 3 to 17 years whilst revealing common and unique demographic risks. Millennium Cohort Study data was analysed from 7,140 participants (51% female). Head injuries were parent-reported for ages 3 to 14 and conduct problems for ages 3 to 17 using the Strengths and Difficulties Questionnaire (SDQ). A cross-lagged path model estimated the bidirectional longitudinal effects between the two. Demographic risks were modelled cumulatively at the three ecological levels of child, mother, and household. These risks included sex, unemployment, and household income.
Conduct problems at age 7 promoted head injuries between ages 7 and 11 (Z = .07; SE = .03; 95% CI, .01-.13), and head injuries between ages 7 to 11 promoted conduct problems at age 14 (ß = .08; SE = .03; 95% CI, .03-.13). Head injuries were associated with early child-level risk whereas conduct problems were associated with risks from all ecological levels.
The findings suggest a critical period from 7 to 11 years whereby head injuries and conduct problems promote one another. They suggest that child-level risk have an earlier role for increased head injuries whilst risks of conduct problems are more widespread across ecological levels. These have implications for intervention timing.

S30.4 - How neurodevelopmental disorders fit into the research domain criteria: an umbrella review

R. Seneviratne[1], **V. Brandt**[1], **H. Carr**[1], **D. Golm**[1]

University of Southampton, United Kingdom

The research domain criteria (RDoC) provide a research framework that allows the investigation of specific domains of psychological functioning from normal to abnormal. The domains can be investigated on different levels, one of these levels is behavioural. There are currently six domains that can be assessed via tasks or questionnaires: negative valence, positive valence, cognitive systems, social processes, arousal and regulatory systems, and sensorimotor systems. The current study searched for meta-analyses in neurodevelopmental disorders across all domains to investigate which disorders are characterized by vulnerabilities in which domains, and to identify gaps in research.
Autism spectrum disorder was characterized by deficits in the negative valence domain but not the positive valence domain, deficits in the cognitive domain (short-term memory, long-term memory), the social domain (biological motion perception, social attention, social understanding and communication), arousal domain, and the sensorimotor domain. Attention deficit hyperactivity disorder was characterized by deficits in the positive valence domain (no meta-analysis was identified for the negative valence domain), arousal, the cognitive, (memory), social, and the sensorimotor domain. Tourette syndrome was characterized by deficits in the sensorimotor domain, and the arousal domain but evidence in other domains was lacking. Learning disabilities were characterized by deficits in the cognitive domain, social domain, and the arousal domain.
Children with neurodevelopmental disorders showed deficits in more than one domain if several domains were assessed. Overall, positive and negative valence domains are under-researched. Due to the lack of data, it is unclear if different neurodevelopmental disorders show specific profiles on the RDoC.

S30.5 - Social Functioning and Resilience in Young People with Conduct Problems and Callous-Unemotional Traits

H. Eisenbarth[1], **C. Heesterman**[1], **J. Hadwin**[2]

[1] Victoria University of Wellington, New Zealand
[2] University of Birmingham, UK

Resilience and social bonds might play a buffering role for conduct problems and callous-unemotional traits, which are both considered as neurodevelopmental problems with strong neurophysiological correlates. This cross-sectional study in a UK school's sample of 347 year 7 to 9 students (f=191) showed that self-reported social functioning variables (collaboration, prosocial behaviour and peer relationships) related to higher resilience across groups varying on conduct problems and callous-unemotional traits, independent of gender. However, collaboration was especially relevant in the context of callous-unemotional traits for resilience, while prosocial behaviour was particularly relevant in those high on both difficulties. Considering callous-unemotional traits and conduct problems as dimensional variables, both had direct negative effects on resilience and indirect effects through collaboration as well as prosocial behaviour. These results indicate that self-reported resilience in young people independent of gender varies based on neurodevelopmental characteristics and social bonds cannot better explain that negative effect. Implications for improving resilience are to target conduct problems and callous-unemotional traits directly.

S31.1 - Emotional self-referential processing in event-related potentials

L. Kaltwasser[1], **M. Palazova**[2], **B. Stürmer**[2], **V. Gallese**[3]

[1] Humboldt-Universität zu Berlin, Deutschland
[2] International Psychoanalytical University, Berlin, Deutschland
[3] University of Parma, Italy

Substantial behavioral evidence suggests that self-related processes are different from those of others. Evidence that self-face recognition is dissociable from general face recognition has important implications for social cognition and face cognition. The former requiring self-other distinction during social interaction such as for example in empathy. The latter suggesting that there are different cognitive modules involved in structural encoding compared to familiarity or emotion related processes. Aim of this study is the investigation of the integration of autonomous (electrocardiogram, ECG) and central neuronal (electroencephalogram, EEG) signals while the participants are stimulated with their own face as well as with the faces of familiar and unfamiliar others. Importantly faces differ in their emotionality (anger, happy, neutral), allowing to study the integration of emotional signals into the representation of the self. Results suggest independent emotion and self-effects ranging from the P1, over the N170 into the late positive complex (LPP), with largest effect sizes in the P3 window. The findings will be discussed in the light of the somatic marker hypothesis and recent accounts of duplex models of the self in affective and cognitive neuroscience.

S31.2 - How do we read affective mental states in others and the self? Influences of heart rate feedback and autistic traits on mindreading

K. Bögl[1], M. Bayer[1], H. Walter[2], I. Dziobek[1]

[1] Department of Psychology, Berlin School of Mind and Brain, Humboldt-Universität zu Berlin
[2] Research Division of Mind and Brain, Charité-Universitätsmedizin Berlin

Mindreading is an important prerequisite for successful interactions in our complex social world. Current research within this domain suggests overlapping neural and mental processes for self- and other-related mindreading, thus supporting so called one-mechanism theories. To further scrutinize these theories, clinical conditions with well-established alterations in inferring others' mental states can be investigated. We argue that autism spectrum condition (ASC) could serve as a suitable model, since ASC is associated with alterations in reading others' mental states, but also in reading own mental states.
A proposed underlying mechanism to a common mindreading faculty is the interpretation of sensory signals originating in self or in others. Motivated by this hypothesis, we investigated in 59 participants if self and other mindreading can be altered through manipulation of sensory feedback. We established a new paradigm which creates emotionally arousing contexts in combination with both realistic and accelerated heart rate feedback. Autism spectrum quotient (AQ) scores were used to examine whether varying degrees of the broader autistic phenotype relate to different mindreading strategies and performances. We hypothesize that mindreading in self and others relies on the interpretation of sensory signals and can therefore be influenced through manipulated sensory feedback. Further, we assume that due to altered mindreading capacities, mainly individuals with low autistic traits will focus on internal cues, such as heart rate, to infer their own and their partner's affective states. We suggest that cardiac signal interpretation affects social emotion-regulation for self and others thus stressing the link between interoception and affective states.

S31.3 - Regulating negative emotions of others reduces own stress: Neurobiological correlates and the role of individual differences in empathy

S. Guendelman[1], **M. Bayer**[1], **K. Prehn**[2], **I. Dziobek**[1]

[1] Clinical Psychology of Social Interaction, Berlin School of Mind and Brain, Institute of Psychology. Humboldt-Universität zu Berlin, Unter den Linden 6, 10117, Berlin, Germany
[2] Department of Psychology, MSH Medical School Hamburg – University of Applied Sciences and Medical University, Am Kaiserkai 1, 20457 Hamburg, Germany

Background While witnessing the suffering of other people results in personal distress, it is not clear whether regulating others' emotions in such situations also comes at an emotional cost for the observer.
Methods This study included 62 subjects and used a newly developed functional Magnetic Resonance Imaging (fMRI) paradigm to investigate mechanisms of self and other emotion regulation via reappraisal while the subject and an interaction partner outside the scanner were facing the same distressing situation simultaneously. The relationship between distress levels and individual differences in emotional and cognitive empathy were also assessed.
Results We found that individuals exhibited especially high levels of personal distress when relating with a partner while both being exposed to aversive photographs and that especially highly empathetic individuals were prone to such personal distress. Moreover, when engaging in social emotion regulation, personal distress was reduced in the observer at a similar rate as in self emotion regulation. FMRI analyses revealed increased activation for other vs. self emotion regulation in the precuneus and the left temporo-parietal junction, which are commonly engaged in social cognition. Furthermore, this activation was associated with lower self-reported stress and decreased sympathetic autonomic activity. While regulating others, precuneus activation exhibited a distinctive functional connectivity profile with parietal emotion regulation regions.
Conclusions This study demonstrates benefits of actively regulating another person's emotions for reducing one's own distress and identifies the precuneus as an important node for social emotion regulation. Given the novelty of the study design, the results are of exploratory and preliminary nature.

S31.4 - Interoception, stress and stress-associated diseases

A. Schulz[1]

Clinical Psychophysiology Laboratory, Department of Behavioural and Cognitive Sciences, University of Luxembourg, Esch-sur-Alzette, Luxembourg

The brain and peripheral bodily organs continuously exchange information. Interoception refers to the processing of afferent signals from the body to the brain. Stress activates peripheral bodily organs via neural and endocrine pathways and can thus be seen as an example of efferent signal transmission between the brain and the body. The interaction of interoception and stress, therefore, implies bi-directional communication on the brain-body axis. Ten studies are presented to address the following objectives: To reveal 'normal' bi-directional communication on the brain-body axis (i.e. interoception and stress) in healthy individuals and mechanisms of potentially altered brain-body communication in stress-associated diseases. With regard to interoception, the studies focus on different interoceptive facets, including early stages of CNS representation of visceral-afferent signals, attention focused on visceral sensations and their interpretation. Concerning stress, both physiological stress axes, the sympatho-adreno-medullary (SAM) axis and the hypothalamic-pituitary-adrenocortical axis, are addressed. An activation of the SAM axis does not only stimulate the cardiovascular system, but it also enhances attention focused on bodily sensations. Cortisol seems to selectively amplify the brain-body communication at cortical level, without affecting peripheral cardiovascular activation. Stress-associated disorders, such as depersonalization/derealization, somatic symptom, post-traumatic stress, major depression or borderline personality disorder, are characterized by a highly-specific patterns of alterations of interoceptive signal transmission and physiological stress axis dysregulations. In conclusion, new intervention methods should be developed that enhance the communication between the brain and the body to improve mental health. These may be based on nerve or brain stimulation, perceptual learning or neurofeedback.

S32.1 - Is frontal alpha asymmetry an index of trait approach motivation in motivational contexts? Evidence from a large-scale dataset

K. Paul[1], **J. Wacker**[1]

Universität Hamburg, Deutschland

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.

S32.2 - The Late-Positive-Potential only to motivationally relevant facial expressions is a correlate of empathy and extraversion

A. Hildebrandt[1], **M. Özyagcilar**[1], **K. Paul**[1]

Carl von Ossietzky Universität Oldenburg, Deutschland

The late-positive-potential (LPP) is an event related brain response manifested as a sustained positivity around 250 ms following the onset of emotionally arousing stimuli. The LPP has been also evoked by emotional facial expressions, but associations with personality traits such as extraversion and empathy are not yet well understood. Theoretically, because extraverts are known to interact intensely with their environment and empathetic individuals are skilled in understanding thoughts and feelings of others, a relationship between LPP evoked facial expressions and these traits can be predicted. But is such a relationship invariant across emotion categories with different motivational significance? Participants (N=93) completed an emotion classification task while viewing dynamic facial expressions. The NEO Personality Inventory and the Trait Emotional Intelligence Questionnaire-Short Form were used to assess the traits extraversion and empathy, respectively. Linear mixed effects analysis revealed a positive LPP association with trait empathy in case of fear expressions, but not for others. Implications will be discussed.

S32.3 - Cognitive effort investment under varying demand: Results from event related potentials and pupil dilation

C. Kührt[1], **A. Strobel**[1]

TU Dresden, Deutschland

Contrary to the law of less work, individuals with high levels of need for cognition and self-control tend to choose harder tasks more often. While both traits can be integrated into a core construct of cognitive effort investment (CEI), the underlying mechanisms behind this tendency remain unclear. A plausible explanation is that these individuals intend to avoid the feeling of boredom during easy tasks. If this were the case, they would be less likely to increase their effort based on expected payoff, but rather based on increasing demand. In the present study, we aimed at measuring effort exertion objectively: the N2 amplitude derived from electroencephalogram has been found to be more negative and pupil dilation to be larger for higher cognitive demand. In a sample of N = 145, we examined the relationship of CEI and N2 amplitude and pupil dilation during a flanker and an n-back task with varying demand and payoff. In both tasks, indices were sensitive to demand and partly payoff. While there were effects of CEI x payoff on performance, we neither found a main nor an interaction effect for CEI regarding N2 amplitude and pupil dilation. Taken together, our results do not support the notion that individuals with high levels of CEI exert less effort and exert it regardless of payoff. This may further our understanding of the conditions under which person x situation interactions occur vs. the conditions under which situations determine effort investment in goal-directed behavior more than personality, and vice versa.

S32.4 - Frontal theta oscillations as an index for unexpected monetary reward vs. non-reward processing and its associations with individual differences in instrumental learning and dispositional neuroticism/anxiety

C. Stolz[1,2,3], **A. D. Pickering**[3], **E.M. Mueller**[1]

[1] University of Marburg, Germany,
[2] Leibniz Institute for Neurobiology, Germany
[3] Goldsmiths, University of London, UK

In The Adaptive Control Hypothesis (TACH) it has been stated that frontal midline theta (FMθ) signals the activity of a system involved in cognitive control scenarios such as instrumental learning from feedback and prediction errors, as well as being associated with dispositional neuroticism/anxiety. To test these assumptions further, here n = 105 participants underwent a three-armed bandit task with probabilistic feedback signalling monetary reward (+10 Cent) vs. non-reward (+0 Cent). Two different types of prediction errors were assessed: self-reported prediction errors (sPE) which were calculated based on single-trial expectation ratings and estimated prediction errors (ePE) which were derived using model-free reinforcement learning algorithms. Replicating previous studies, FMθ power and event-related potentials (FRN/RewP, P300) were amplified following negative vs. positive feedback. The feedback valence effect on FMθ was also stronger in individuals showing high vs. low learning rates. Additionally, single-trial regression analyses revealed that FMθ was amplified following high vs. low levels of better than expected (ePE+) and worse than expected (ePE-) estimated prediction errors, but not with sPE. Importantly, while this effect was stronger for ePE- vs. ePE+ in all participants, the association between ePE+ and FMθ was particularly stronger in individuals scoring high in trait neuroticism/anxiety. In line with the TACH, the present results suggest that FMθ is sensitive to events indicating (unexpected) non-reward but also better than expected scenarios in highly neurotic/anxious individuals. These results and the role of FMθ as an index for successful learning and implicit vs. explicit prediction error processing will be further discussed.

S32.5 - Follow your heart: Cardiac defensive reactions and orienting responses correspond to virtual avoidance behavior choices in a virtual T-maze, while frontal asymmetry is linked to approach and avoidance

J. Rodrigues[1], **M. Müller**[1], **J. Hewig**[1]

Julius-Maximilians Universität Würzburg, Deutschland

Frontal asymmetry has shown to be related to approach and avoidance patterns in a virtual T-maze without further differential relations to the type of avoidance behavior or traits, leading to a quadratic extension of the capability model of anterior asymmetry. 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. Concerning the behavior, two specific avoidance response types could be identified in previous studies: a backwards withdrawal and a forward approach to safety. The short-term heart rate change was differentially 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 they faced the negative entity while withdrawing backwards. Interestingly, these differences were found independently of the stimuli used in the two paradigms (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 as possible reasons for variance in heart rate pattern across gender. Additionally, the different sensitivity and specificity of different psychophysiological measurements is emphasized.

S33.1 - Getting to know someone. How facial familiarity and identity representation emerges in the human brain

G. Kovács[1]

Inst. Psychol. Friedrich Schiller Univ., Deutschland

The neural basis of the process how an originally unfamiliar person becomes gradually more and more familiar to us is largely unknown. Here we summarize the results of a series of EEG and fMRI experiments where we used multivariate analysis techniques to elucidate the emergence of the face representations for faces with various degrees of familiarity. Participants viewed highly variable face images of well-known celebrities, as well as originally unfamiliar persons before and after a perceptual learning task, an extensive, personal familiarization, or an elaborate media familiarization phase. Time-resolved representational similarity analysis of EEG data revealed that familiarization quality has a profound impact on representations of face familiarity and identity. The application of a novel multimodal approach by fusing the neuronal responses recorded in fMRI and EEG experiments shows that the image invariant face identity information prevails over an extended time in the representational geometry of a broadly distributed network of parietal, temporal, and frontal areas with overlapping temporal profiles. Overall, these results challenge current hierarchical models of face perception. Therefore, we propose a novel model of familiarity and identity processing, where the concerted and parallel activation of multiple nodes (related to long-term memory and emotion processing) is essential for correct face identification in the brain's identity coding network.

S33.2 - Neural distinguishment between visual outgroup faces and generalization of threat and safety learning

N. Willscheid[1], **F. Bublatzky**[1]

Central Institute of Mental Health

Different persons of a visual outgroup ("racial" outgroup) are often misperceived as looking more alike than persons of the visual ingroup (outgroup homogeneity effect). On the neural level, face-selective cortical areas seem to be more sensitive to the facial identity of ingroup faces. Here, we examined whether identity-specific threat and safety learning generalizes more across visual out- than ingroup faces, and whether this is associated with lower neural face distinguishment as indicated by absence of identity-sensitive N170 repetition suppression. Forty light-skinned German participants performed a combined threat-of-shock and adaptation paradigm. To this end, light- and dark-skinned faces were presented in 12 sequences of 40 adaptor-target pairs of visual in- or outgroup faces (Stimuli 600 ms, ISI 500 ms, ITI 1700 ms). To examine the identity sensitivity of N170 repetition suppression, adaptor and target depicted either the same face or two different faces. Importantly, prior to each sequence, one in- or outgroup face was verbally instructed as a threat-of-shock cue while all other faces indicated safety. Results replicated that identity-sensitive N170 repetition suppression is present for visual in- but not outgroup faces. Moreover, for visual out- but not ingroup faces, safety faces elicited more pronounced LPP amplitudes after a facial identity of the same visual group was instructed as threat-of-shock cue. In face and person perception, ingroup individuation and outgroup categorization might me associated with threat generalization over a visual outgroup, possibly reflecting a precursor of stereotyping.

S33.3 - Perceiving significant others: Are loved familiar face pictures prepared safety signals?

F. Bublatzky[1], **P. Guerra**[2]

[1] Central Institute of Mental Health, Germany
[2] University of Granada, Spain

Attachment figures are highly familiar people who provide individuals with a sense of security and help in times of threat. However, the mechanisms underlying attachment-induced safety are poorly understood. Recent research has shown that viewing pictures of one's romantic partner leads to a reduction of pain perception and defensive responding. Here, we present a series of four studies examining the inhibitory capacity of loved familiar faces on fear acquisition, reversal, and extinction learning. In all studies, participants viewed pictures of their loved ones (romantic partner, parents, best friends) as well as pictures of unknown people. In Study 1, specific face identities were verbally instructed as cues for threat-of-shock or safety. Moreover, threat/safety contingency was modified by reversal instructions. In Study 2, a similar design was used, but face identities were presented with either happy, neutral, or angry expressions. In Study 3, contextual background colors served as threat/safety signals, and faces were presented to test whether loved figures reduced defensive responding in a threatening context. All studies assessed psychophysiological measures (e.g., startle-EMG, ratings). The results confirm previous findings showing pronounced defensive responses to instructed threat compared to safety cues (e.g., threat-potentiated startle). Moreover, reversal instructions readily changed threat to safety (and vice versa), and extinction learning was indicated by a slow reduction of threat effects across time. Importantly, no significant interactions between threat/safety instructions and face category occurred for none of the studies and measures. In summary, a long-term learning history of beneficial relationships did not interfere with verbal threat learning.

S33.4 - Personal relevance and emotional face perception in Autism Spectrum Conditions

M. Bayer[1], **I. Dziobek**[1]

Humboldt-Universität zu Berlin, Deutschland

Difficulties in social interaction are one of the core features of Autism Spectrum Conditions (ASC). Neuroimaging research has shown that these difficulties might be accompanied by neural alterations in the processing of faces in general, and of emotional facial expressions in particular, although previous results are heterogeneous. In this study, we investigate the role of personal relevance in face processing in ASC. We hypothesize that personal relevance might boost engagement of the face processing network and enhance face processing and emotion processing in ASC.
Participants with ASC and matched controls (N=46) were presented with photographs of a personally relevant person and a matched stranger, displaying fearful, happy, and neutral facial expressions, while we recorded simultaneous EEG-fMRI.
Both groups showed significantly increased hemodynamic activity for relevant faces compared to stranger's faces in the core and extended face processing network, including fusiform gyrus, medial PFC and precuneus, with no significant group differences. In EEG data, group differences were evident in early sensory processing, with increased P1 amplitudes to relevant vs. stranger's faces being observed only for the non-autistic group. Later processing showed effects of personal relevance and emotion without any group differences.
Our results indicate preserved processing of faces in ASC, especially of personally relevant faces, rather than a general processing dysfunction or alteration. They also speak to the importance of accounting for personal relevance in face processing, in order to allow for an ecologically valid investigation of real-life social information processing.

S33.5 - Neural Reponses to Infant- and Partner Faces in Postpartum Bonding Disorder

M. Eckstein[1], **M. Krauch**[1], **A. Zietlow**[2], **B. Ditzen**[1]

[1] Institut für Medizinische Psychologie, Universitätsklinikum Heidelberg, Deutschland
[2] Institut für Psychologie, Universität Greifswald, Deutschland

Mothers with postpartum bonding problems typically report experiencing their own baby as less rewarding and delighting than healthy mothers - particularly few months after birth. Research focusing on postpartum depression suggests that this is paralleled by hypoactive brain activity. Yet, it is unclear whether such deficits are limited towards the own infant or whether this extents towards other close persons or contexts.
In the present fMRI study, we have assessed mothers with bonding problems and a broad range of comborbid disorders (N=36) as well as healthy controls (N=30) during the postpartum period (3-4months after birth). Using an fMRI passive viewing task, we have recorded their neural response towards facial stimuli of their own infant, their romantic partners and unknown faces. Preliminary results point to a differential involvement of the neural reward system and high variance in subjective burden.
We will discuss the results and their implications for innovative therapeutic interventions targeting specifically the rewarding aspects of motherhood. With its high prevalence and long-term consequences for child development, a better understanding of neurobiological mechanisms underlying bonding disorders is of high relevance.

S34.1 - TSST-VR: Induction of acute stress in virtual reality

G. Domes[1], **A. Vehlen**[1], **B. v. Dawans**[1]

Universität Trier, Deutschland

In recent years, virtual reality (VR) technology has found its way into nearly all fields of psychology. Previous studies suggest that virtual reality adaptations of the Trier Social Stress Test (TSST) are less potent in stimulating HPA-axis responses, with lower salivary cortisol responses recorded as compared to the original in-vivo TSST. In a series of experiments, we tested the stress-induction potential of another TSST-VR adaptation. Overall, the TSST-VR induces significant increases of endocrine, autonomic and self-reported stress markers in both stress conditions. Notably, we found a robust rise in salivary cortisol to the TSST-VR largely comparable to that observed in the classical TSST. However, there are still subtle differences between virtual and in vivo settings, regarding both the environment and the psychobiological responses, which need to be considered while designing and conducting studies with the TSST-VR. Although VR adaptations of the TSST provides unique opportunities, future studies are needed to also determine the potential confounds and limitations associated with these VR settings.

S34.2 - Inducing and Recording Acute Stress Responses on a Large Scale with a Smartphone-based Digital Stress Test

M. Norden[1,2,4], F. Balzer[2], O. T. Wolf[3], E. Böttinger[4,5], H. Drimalla[1]

[1] CITEC - Center for Cognitive Interaction Technology, Bielefeld University, Bielefeld, Germany
[2] Institute of Medical Informatics, Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin, Humboldt-Universität zu Berlin, and Berlin Institute of Health, Berlin, Germany
[3] Department of Cognitive Psychology, Institute of Cognitive Neuroscience, Faculty of Psychology, Ruhr University Bochum, Bochum, Germany
[4] Digital Health Center, Hasso Plattner Institute, University of Potsdam, Germany
[5] Hasso Plattner Institute for Digital Health at Mount Sinai, Icahn School of Medicine at Mount Sinai, New York City, New York, U.S.A. *Corresponding

Background: Standardized stress induction plays a crucial role in the investigation of acute psychosocial stress. The consequences of the global pandemia have demonstrated the relevance of research methods that can be conducted remotely. Additionally, machine learning methods for stress detection require high quality and representative datasets collected in standardized stress experiments. However, most current stress paradigms are limited to laboratory settings, are labor-intensive and do not scale to large cohorts.
Methods: We have developed a smartphone-based Digital Stress Test (DST) that can be administered via internet without any direct communication to researchers or additional resources required. It incorporates well-known stress induction principles adapted to a digital setting. In a large online study, we compared the self-reported affective responses and stress-related feelings of DST participants (n = 103) and participants of an adapted control version (C-DST, n=181) before, during and after the test. Finally, we set the results in context with data previously collected in studies using the classical stress test paradigm Trier Social Stress Test (TSST).
Results: DST participants reported significantly higher stress-related feelings and negative affect than C-DST participants at all time points after baseline measurements. The effect size of the increase in negative affect was within the range of effect sizes for the increases in negative affect in previously conducted TSST experiments.
Conclusion: We provide initial evidence that a remotely feasible smartphone-based stress paradigm can be applied for standardized stress induction. Implications for outside-the-lab studies, large-scale multimodal stress data collection, feasibility aspects and subsequent validation will be discussed.

S34.3 - Automatic Detection of Stress in the Trier Social Stress Test

H. Drimalla[1], M. Norden[1,2,3], K. Langer[4], D. Pomrehn[4], L. Lehmann[2], C. Lippert[2], O. T. Wolf[4]

[1] Cognitive Interaction Technology (CITEC), Bielefeld University, Bielefeld, Germany
[2] Digital Health – Machine Learning, Hasso Plattner Institute, University of Potsdam, Germany
[3] Institute of Medical Informatics, Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin, Humboldt-Universität zu Berlin, and Berlin Institute of Health, Berlin, Germany
[4] Department of Cognitive Psychology, Institute of Cognitive Neuroscience, Faculty of Psychology, Ruhr University Bochum, Germany

Background: Automatic detection of stress allows for monitoring and feedback of stress, as well as tailoring systems to the specific needs of a stressed individual. In the last decade, machine learning algorithms have made progress in detecting stress from nonverbal behavior. However, understanding of the accuracy and generalizability of such models is still limited.
Methods: We present two studies using recordings of the Trier Social Stress Test (TSST). In the first study, we recorded voices of 63 participants who completed either the TSST or a control version. Stress levels were assessed by salivary hormone concentrations and self-report of affect. In the second study, we video-recorded 40 male participants performing the TSST and focused on detecting different aspects of stress using vocal parameters and facial expressions. The participants' stresslevels were additionally assessed by the TSST committee and annotators who viewed the videos.
Results: In the first study, machine learning models trained on participants' voice features detected the stress condition with 74% accuracy. In the second study, machine learning models, based on either facial expressions or voice parameters, achieved prediction that was associated with the stress level assessed by the committee. Similarly, it was possible to partially predict participants' self-reported stress based on their facial expressions.
Conclusion: The studies demonstrate the potential of detecting stress based on a person's voice or facial expressions. Furthermore, they show that different aspects of the stress response are not equally predictable with similar models and point to the importance of the stress definition underlying a model.

S34.4 - Attentional, affective and physiological correlates of stress coping within a VR-TSST

T. Wechsler[1], **L. Brunner**[1,2], **M. Pfaller**[1], **A. Mühlberger**[1]

[1] Universität Regensburg, Institut für Psychologie, Lehrstuhl für Klinische Psychologie und Psychotherapie, Regensburg, Deutschland
[2] Universität Regensburg, Lehrstuhl für Psychiatrie und Psychotherapie, Regensburg, Deutschland

Background: While emotion regulation is regarded as core factor in mental disorders, little knowledge exists about behavioral, affective and physiological correlates of stress coping during acute psychosocial stress. Especially visual attention patterns seem of interest since evidence exists on associations to fear related stimuli. The aim of the current study was to investigate relationships between stress coping styles and gaze behavior as well as self-report and physiological measures.
Methods: We used a Virtual Reality Trier Social Stress Test (VR-TSST) to induce psychosocial stress in healthy female participants (N = 32). With an eye tracking system integrated in the Head Mounted Display, we detected fixations on areas of interest. We moreover assessed the perceived stress level, state anxiety, positive and negative affect, heart rate, skin conductance level, cortisol level and stress coping styles (Stressverarbeitungsfragebogen; SVF). Correlation coefficients were calculated to detect association especially to gaze behavior variables.
Results: We found significant associations between coping styles and fixations on stress associated and neutral objects during VR-TSST as well as affective and physiological variables. As examples, distraction and downplaying were associated with fixations on the camera, and distraction was furthermore related to lower electrodermal activity during math task ($p<.010$).
Conclusion: To our knowledge, this is the first study to show associations between stress coping styles during acute psychosocial stress within a VR-TSST and visual attention assessed via VR based eye tracking. Findings on gaze behavior related to coping strategies could prospectively be useful in diagnostics, prevention and therapy of stress related mental-health problems.

S34.5 - Reducing stress through the social support of virtual others

A. Felnhofer[1], **O. Kothgassner**[2]

[1] Medizinische Universität Wien, Univ.-Klinik für Kinder- und Jugendheilkunde, Klinische Abteilung für Pädiatrische Pulmologie, Allergologie und Endokrinologie, Österreich
[2] Medizinische Universität Wien, Univ.-Klinik für Kinder- und Jugendpsychiatrie, Österreich

Face-to-face social support and social inclusion have repeatedly been shown to increase resilience and decrease psychophysiological stress. Yet, as social interactions increasingly take place online, it is of essence to understand whether digitally provided support and inclusion may exert a comparable stress buffering effect.
A study series was conducted with different groups of healthy young adults who – prior to being exposed to a face-to-face evaluative stressor (Trier Social Stress Test, TSST) – were either supported by another person or were included in a Cyberball-Game by two other players. Social support and social inclusion were provided in real-life by a confederate, or virtually by an avatar (purportedly human controlled), or by an agent (computer controlled).
Results show that, similar to face-to-face interactions, a virtual character's non-verbal social support has buffering effects on subsequent heart rate and self-reported stress, particularly if support is provided by a purportedly human controlled avatar (vs. a computer agent). Similarly, being included in a game by a virtual character that is supposedly steered by a real person is associated with a blunted cortisol response to a subsequent real-life TSST.
Hence, it is safe to state that digitally provided support and inclusion are equally effective as their face-to-face counterparts with regards to stress buffering. A prerequisite, however, seems to be that the user has the impression that s/he is actually interacting with another human (via an avatar). Both treatment and research may profit from purposefully deploying virtual characters for stress reduction.

S35.1 - Akuter Stress und kardiale interozeptive Genauigkeit in einer Herzschlagzählaufgabe

G. Hansen[1], C. Vögele[1], S. Bellingrath[2], A. Lutz[1], A. Sauder[1], A. Schulz[1]

[1] Universität Luxemburg, Luxemburg
[2] Universität Duisburg-Essen, Deutschland

Interozeption, d.h. die Wahrnehmung und Verarbeitung körperinnerer Signale, hängt mit der Aktivität eines Körperorgans (z.B. kardiale Aktivierung) zusammen. Die Organaktivität wird maßgeblich durch Stress beeinflusst, der beispielsweise durch soziale Situationen oder Schmerz ausgelöst wird. Auch wenn erste Erkenntnisse implizieren, dass Stress die bewusste Ebene der Interozeption („interozeptive Genauigkeit"/IG) beeinflussen könnte, sind der Zeitverlauf dieses Effekts und die Rolle von Organaktivierung bislang unklar. Anhand eines Gruppenexperiments mit gesunden Versuchspersonen (je n=33 Stress- und Kontrollgruppe, w=48) wurde die Auswirkung von akutem Stress (sozial-evozierter Kaltwassertest) auf IG in einer Herzschlagzählaufgabe zu vier unterschiedlichen Zeitpunkten (pre-Stress/post-Stress-1/2/3) untersucht. Der Stressor führte zu einem Anstieg von selbstberichtetem Stress (sowie Speichelcortisol). Die Herzrate (Organaktivität) sowie die IG blieben jedoch, entgegen der Erwartungen, sowohl zwischen den Gruppen als auch über die Zeit, unverändert. Unabhängig von der Bedingung und den Zeitpunkten zeigte sich außerdem eine Tendenz, die tatsächlichen Herzschläge zu 56% zu unterschätzen. Bei konstanter Herzrate (M=81.5 bpm) über alle Versuchsbedingungen hinweg konnten die gezählten Herzschläge alleine (M=28.55) somit die IG (M=.43) vorhersagen ($r=.962$, $p<.001$). Diese Ergebnisse legen nahe, dass sowohl die zentrale Rolle der gezählten Herzschläge auf die IG, als auch jene Organaktivierung, die durch akuten Stress verändert wird und sich in einer Veränderung der gezählten Herzschläge widerspiegelt, bei Anwendung der Herzschlagzählaufgabe, berücksichtigt werden muss.

S35.2 - Gastrische Interozeption und gastrische myoelektrische Aktivität bei chronisch-entzündlichen Darmerkrankungen und Reizdarmsyndrom

A. Schulz[1], S. K. Welsch[1], S. Etringer[1], G. Hansen[1], L. Milbert[1], J. Schneider[2,3,4], G. Taddei[4], R. G. Bravo[1], C. Lygidakis[1], Z. v. Dyck[1], A. Lutz[1], P. Wilmes[3], C. Vögele[1]

[1] Clinical Psychophysiology Laboratory, Department of Behavioural and Cognitive Sciences, University of Luxembourg, Esch-sur-Alzette, Luxembourg
[2] Saarland University Medical Center, Department of Internal Medicine II, Homburg/Saar, Germany
[3] Luxembourg Centre for Systems Biomedicine, University of Luxembourg, Esch-sur-Alzette, Luxembourg
[4] Department of Gastroenterology, Centre Hospitalier Emile Mayrisch, Esch-sur-Alzette, Luxembourg

Viszerale Hypersensitivität wird als zentraler Mechanismus bei chronisch-entzündlichen Darmerkrankungen (CED) und Reizdarmsyndrom (RDS) diskutiert, welche beide mit einer erheblichen Einschränkung der Lebensqualität einhergehen. Bisherige Studien verwenden zumeist invasive Verfahren, die jedoch typischerweise mit der Messung viszeraler Wahrnehmung interferieren. Diese Studie untersucht daher, ob CED und RDS mit einer veränderten Wahrnehmung „natürlicher" (nicht-invasiver) gastrischer Dehnungen assoziiert sind („Interozeption"). Zwanzig CED-Patienten in Remission (13 Morbus Crohn, 7 Colitis Ulcerosa), 12 RDS-Patienten, sowie 20/12 parallelisierte gesunde Kontrollprobanden absolvierten den 2-stufigen Water-Load-Test, bei dem eine beliebige Menge Wasser getrunken wird, bis die subjektiven Schwelle der Sättigung (Stufe 1) und des Völlegefühls (Stufe 2) erreicht sind. Gastrische Motilität wurde mittels Elektrogastrographie untersucht. CED-Patienten tranken signifikant mehr Wasser bis zur Sättigungsschwelle als RDS-Patienten, während es keine Unterschiede zu den Kontrollgruppen gab. Die getrunkene Wassermenge bis zur Schwelle des Völlegefühls unterschied sich nicht zwischen den Gruppen. Die elektrogastrographischen Muster zeigten ebenfalls keine Gruppenunterschiede, was impliziert, dass es keine Pathologien in der gastrischen Motilität gab. Die getrunkene Wassermenge bis zur Sättigung korrelierte negativ mit darmbezogener Lebensqualität bei CED-Patienten, aber positiv mit emotionalem Wohlbefinden bei RDS-Patienten. Diese Ergebnisse legen eine relative gastrische Hypersensitivität bei RDS und eine relative gastrische Hyposensitivität bei CED nahe, was jeweils mit spezifischen Facetten der wahrgenommenen Lebensqualität assoziiert ist.

S35.3 - Dimensionen der kardialen und gastrischen Interozeption und ihr Zusammenhang mit gestörem Essverhalten

A. Tiemann[1,2], **J. Ortmann**[2], **M. Rubo**[1], **S. Munsch**[1], **Z. v. Dyck**[2]

[1] Universität Fribourg, Schweiz
[2] Universität Luxemburg, Luxemburg

Gestörte Interozeption (d. h. die Verarbeitung interner Körpersignale) wurde als transdiagnostischer Faktor für Essstörungen vorgeschlagen (Martin et al., 2019). Es bleibt jedoch unklar, wie verschiedene Dimensionen der kardialen und gastrischen Interozeption mit gestörtem Essverhalten zusammenhängen. In der vorliegenden Studie werden diese Zusammenhänge daher sowohl in einer gesunden (n = 90) als auch in einer klinischen Stichprobe (Bulimie (n = 13) und Binge-Eating Störung (n = 25)) untersucht. Wir erwarten, dass kardiale und gastrische Interozeption über dieselben Dimensionen hinweg positiv miteinander (Hypothese 1) und mit gestörtem Essverhalten assoziiert sind (Hypothese 2). Für Hypothese 1 deuten Ergebnisse auf eine signifikante positive Assoziation zwischen kardialer und gastrischer Interozeption hin, die mit behavioralen Tasks (Heartbeat Perception Task; HBPT; Schandry, 1981, und Water Load Test; WLT-II; van Dyck et al., 2016) gemessen wurden. Für Hypothese 2 waren mehrere Dimensionen der Interozeption mit emotionalem Essen (Dutch Eating Behaviour Questionnaire; DEBQ; van Strien et al., 1986) assoziiert. Dazu gehörten physiologische Messungen der Herz- (mittlere Herzfrequenz) und Magenaktivität (% der Normogastrie), behavioral gemessene kardiale Interozeption (HBPT; Schandry, 1981), und selbstberichtete interozeptive Fähigkeit (Sicherheitsangaben im HBPT und Fragebogen Multidimensional Assessment of Interoceptive Awareness; Mehling et al., 2012). Die Studie zielt darauf ab, das Verständnis der zugrunde liegenden physiologischen Mechanismen des gestörten Essverhaltens zu vertiefen und könnte die Grundlage für neuartige Trainingsinterventionen in diesem Bereich bilden. Aus diesem Grund stellen wir zusätzlich ein neu entwickeltes gastrisches Biofeedback-Paradigma in virtueller Realität (VR) als Intervention bei reduzierter gastrischer Interozeption vor und präsentieren erste Daten einer Pilotstudie.

S35.4 - Vagale neurophysiologische Verarbeitung bei Frauen mit Borderline-Persönlichkeitsstörung: Herzschlag-evozierte Potentiale, Herzratenvariabilität und Effekte pharmakologischer Intervention durch Oxytozin Vergabe

S. N. Back[1], **M. Schmitz**[1], **K. Bertsch**[1,2]

[1] Lehrstuhl für Klinische Psychologie, Ludwig-Maximilians-Universität München, Deutschland
[2] Klinik für Allgemeine Psychiatrie, Zentrum für Psychosoziale Medizin, Ruprecht-Karls-Universität Heidelberg

Die neurophysiologische Verarbeitung bi-direktional involvierter afferenter bzw. efferenter Korrelate von Interozeption kann bereits früh durch den Einfluss traumatischer Erfahrungen gestört werden, sodass diese einen Risikofaktor für Psychopathologie, insbesondere der Borderline-Persönlichkeitsstörung (BPS), darstellt. Bisherige Studien könnten aufzeigen, dass Frauen mit Borderline-Persönlichkeitsstörung Defizite in der bi-direktionalen Verarbeitung vagaler Prozesse (Herz-evozierte Potentiale; HEP und Herzratenvariabilität; HRV) aufweisen, welche mit früher Traumatisierung assoziiert waren. Hinsichtlich reduzierter Herzratenvariabilität konnten potenziell förderliche Effekte durch pharmakologische Gabe von Oxytozin herausgestellt werden. Die Heterogenität und geringe Anzahl an Befunden erfordern jedoch weitere Untersuchungen, um die Richtung und potenzielle Moderatoren der Effekte differenzierter zu erschließen.
In der ersten Studie (1) werden die veröffentlichten Ergebnisse einer randomisierten, plazebokontrollierten Stichprobe (N= 53 BPS und N = 60 Kontrollstichprobe) reduzierter basaler HRV bei Frauen mit BPS präsentiert, relevante traumatische Entwicklungsfaktoren (Frühe Traumatisierung; CTQ und unsicherer Bindungsstil; ECR-S), die diesen Zusammenhang moderieren, und die fehlenden Effekte von Oxytozin auf die HRV.
In der zweiten Studie (2) werden vorläufige Ergebnisse einer experimentellen Laborstudie zu HEP bei Frauen mit Borderline Persönlichkeitsstörung (N = 32 BPS und N = 32 Kontrollstichprobe) in Ruhe, sowie während einer Herzschlagzählaufgabe präsentiert. Wir erwarten, dass der Fokus der Aufmerksamkeit die Effekte reduzierter HEP bei BPS moderiert.
Die Studien zielen darauf ab, das Verständnis der Integration zugrunde liegender interozeptiver Mechnismen der BPS, Moderatoren dieser Effekte, sowieso differentieller Indikation pharmakologischer Interventionen durch Oxytozin, zu vertiefen.

S35.5 - Interozeption in der Genese von Psychopathologie am Beispiel trauma-assoziierter Erkrankungen

M. Schmitz[1]

Department of General Psychiatry, Center for Psychosocial Medicine, University of Heidelberg, Germany;

Interozeption, die Verarbeitung und Wahrnehmung körpereigener Prozesse, steht in Zusammenhang mit einer Vielzahl psychischer Grundfunktionen, darunter auch der Emotionswahrnehmung und Emotionsregulation. Veränderungen in der Interozeption werden als ein häufiger Risikofaktor für die Entwicklung von Psychopathologie diskutiert und finden sich gehäuft in psychischen Erkrankungen. Die vermittelnden Mechanismen für diesen Zusammenhang sind bislang nicht abschließend geklärt. Das Konzept der interozeptiven Inferenz könnte einen Interpretationsrahmen darstellen, um bisherige inkonsistente Befunde einzuordnen.
Interozeptive Inferenz bezeichnet den Vorgang, dass das Gehirn zukünftige Zustände des Körper vorhersagt und versucht Abweichungen, d.h. Vorhersagefehler, zu minimieren. Eine fehlende Anpassung und das Fortbestehen von Vorhersagefehlern können dazu führen, dass sich die Gewichtung aufsteigender körperlicher Signale ändert und diese nicht mehr effizient für regulatorische Prozesse genutzt werden können.
Der Vortrag gibt einen Überblick über interozeptive Dysfunktionen am Beispiel trauma-assoziierter Erkrankungen. Ätiologische Modellannahmen werden mit Schwierigkeiten in der Emotionsregulation als einen wichtigen transdiagnostischen psychopathologischen Prozess verknüpft. Außerdem wird ihre Bedeutung unter Bezugnahme auf interozeptive Inferenz für das weitere Forschungsfeld diskutiert.

S36.1 - Somatosensory omission reveals action-related predictive processing

T. Dercksen[1,2], **A. Widmann**[1,3], **T. Noesselt**[2,4], **N. Wetzel**[1,2,5]

[1] Leibniz Institute for Neurobiology, Germany
[2] Center for Behavioral Brain Sciences, Germany
[3] Wilhelm Wundt Institute for Psychology, Germany
[4] Otto-von-Guericke-University Magdeburg, Germany
[5] University of Applied Sciences Magdeburg-Stendal, Germany

The intricate relation between action and somatosensory perception has been studied extensively in the past decades. Generally, forward models are thought to predict the somatosensory consequences of an action. These models propose that when an action is reliably coupled to a tactile stimulus, unexpected stimulus omission should result in prediction error elicitation. Although such omission responses have been demonstrated in the auditory modality, it was unknown whether this mechanism generalizes to other modalities. Here, a study is presented that recorded action-induced somatosensory omission responses using EEG. Self-paced button presses were coupled to a somatosensory stimulus either reliably in 88% of trials, allowing a prediction, or 50% of trials, not allowing a prediction. In a predictable context, stimulus omission resulted in a neural response consisting of multiple components. Temporal principal component analysis revealed components analogous to previous auditory studies, as well as additional components. Topography and latency of oN1 responses suggest similar sensory sources as stimulus-evoked activity, but an origin outside primary cortex. Subsequent oN2 and oP3 responses-as previously observed in the auditory modality-presumably reflect modality-unspecific higher order processes. Finally, three additional components were identified (oN3, oP3-4, oP3-5) possibly reflecting somatosensation-specific responses. Together, these findings straightforwardly demonstrate the presence of somatosensory predictions when actions are performed and provide evidence for a partially amodal, general mechanism signalling predictive coding outside the auditory modality.

S36.2 - Action intentions shape the auditory sensory predictions

B. Korka[1,2], **A. Widmann**[1,3], **E. Schröger**[3]

[1] Leibniz Institute for Neurobiology, D-39118 Magdeburg, Germany
[2] Department of Neurology, Otto-von-Guericke University, D-39120 Magdeburg, Germany
[3] Institute of Psychology – Wilhelm Wundt, Leipzig University, D-04109 Leipzig, Germany

Human action is led by expected action effects. Perception is commonly described in terms of sensory predictions arising from environmental regularities. This presentation will focus on the action-perception relationship, based on a series of studies investigating the processing of auditory stimuli that either followed specific action-effect associations, stimulation regularities, or both. Auditory event-related potentials (ERPs) were recorded following key-press – sound associations for the left and right hands, which triggered predictable or unpredictable sounds or sound omissions. The results consistently indicated that predictions based on action intention alone determine brain responses that are similar to those following stimulation regularities, while the two prediction sources may have individual or joint effects. That is, violations of the expected sounds determined early prediction error signals (i.e., the mismatch negativity or comparable omission-related responses), but also, later control and evaluation-related ERP components (N2, P3, or comparable omission responses). These were elicited with, and importantly, without sound regularity, indicating that mismatch detection is not limited to sensory predictions formed and adjusted by bottom-up means, but may be driven entirely by top-down intention-based generative models. Finally, I will present an integrative theoretical model, the extended Auditory Event Representation System, that explains the individual and joint contributions of intention and regularity and brings forward the critical role of prediction errors for both action-related as well as environmental-related sensory processing.

S36.3 - The role of predictions in tactile suppression

D. Voudouris[1]

Justus Liebig University Giessen, Germany

A seemingly paradoxical, yet robust psychophysical phenomenon is that tactile stimuli on a moving limb are suppressed compared to the same stimuli that arise on the same but static limb. What are the underlying mechanisms of this tactile suppression? Prevailing ideas include peripheral masking and central predictive processes. According to the first notion, afferent signals from the moving limb are masking the relatively weaker external sensations that occur on that limb. On the other hand, central mechanisms, possibly through the generation of motor commands, predict the upcoming sensory states of the limb and downregulate the noisy and delayed sensory feedback from that limb. However, the latter explanation has been recently criticized because the externally-generated tactile sensations cannot be predicted by any motor command. I will present behavioral and psychophysiological work from human upper limb movements that demonstrates core contributions of predictive processes in the regulation of tactile suppression. In detail, I will show that tactile suppression is stronger when humans perform movements within worlds of predictable dynamics, wherein downweighing somatosensory feedback can be tolerated. Meanwhile, tactile suppression is weaker when sensory guidance of the movement is important for the task at hand, and thus somatosensory sampling serves an important purpose. I will finish the talk by showing that the suppression of externally-generated probes is indeed specific to sensorimotor predictions, demonstrating core contributions of predictive mechanisms on this phenomenon.

S36.4 - Brain correlates of perceptual and semantic prediction and resolution

L. Grisoni[1,2]

[1] Brain Language Laboratory, Department of Philosophy and Humanities, Freie Universität Berlin.
[2] Cluster of Excellence 'Matters of Activity. Image Space Material', Humboldt Universität zu Berlin

Much has been written pertaining to predictive mechanisms supporting perception and language processing. This contrasts with a sparseness of studies reporting brain measures that directly reflects specific aspects of prediction. The present talk shows recent EEG studies on a brain correlate of prediction, the Prediction Potential (PP), a slow negative shift observed before the presentation of visual, acoustic, and spoken or written verbal stimuli that can be predicted from their context. For example, sentence fragments that strongly predict subsequent words induced a slow potential shift before the expected words; this potential was weaker if the preceding fragments were unpredictable. Subjective reports of certainty about upcoming words and objective corpus-based measures correlated with the size of the anticipatory signal, thus establishing its status as a predictive signal. That the PP indexed semantic predictive processing was further demonstrated by the observation of cortical sources also in specific sensorimotor brain areas for action-related (e.g., action verbs, tool nouns) words but in posterior, visual, areas for visual-related words (e.g., animal nouns). Furthermore, inverse correlations between the PP and the well-known brain index of semantic processing, N400, suggest that these two responses have a similar semantic discriminatory function, thus leaving open the possibility that the N400 may causally depend on the mechanisms underlying the preceding PP. Overall, these data show that the PP may be of interest for future neurocognitive research on predictive processing.

Posters

Session I

Topic 1: Computational and Neuroimaging Methods

P1.001 - Detecting changes of emotional facial expressions in children and adolescents induced by emotional videos: results on the suitability of the FaceReader facial coding software

K. Hagelweide[1], A. Luczejko[2], A. Werner[2], J. Fahrer[2], V. Seipp[2], L. Krüger[2], R. Stark[2], C. Schwenck[2], S. Weigelt[1]

[1] Technical University Dortmund
[2] Justus Liebig University Gießen

Automatic facial coding promises to measure emotional expressions of participants in an effortless and unobtrusive manner. Several studies found that the results of facial coding algorithms are comparable to classifications of trained human observers or measurements of facial muscle activity (Kulke et al., 2020; Lewinski, den Uyl, et al., 2014; Lewinski, Fransen, et al., 2014; Skiendziel et al., 2019; Terzis et al., 2010). Nevertheless, these studies often analysed videos or pictures of participants deliberately giving prototypical emotional expressions. On the contrary, some studies that used videos of participants reacting naturally to emotional stimuli found that the algorithms cannot reliably indicate specific emotions or subjective emotional assessments (Abdel-Rahman et al., 2020; Danner et al., 2014; Höfling et al., 2020; Suhr, 2017).
We examined if the FaceReader 8 (Noldus, 2020) is able to differentiate facial expressions of children and adolescents (age 7 to 15 years), who either viewed neutral video clips or emotionally intense excerpts from a children's TV series. If so, we expected the FaceReader to detect more happy expressions during joyful videos, and less happy/more negative expressions during videos showing sadness, fear, or anger. Indeed, results (N = 56) show that the scales of happy and angry expressions differed between positive and negative videos in the hypothesized way. Nevertheless, other scales either did not vary with emotional content or tended in an unexpected direction. In conclusion, the FaceReader seems suitable to measure natural emotional expressions in young participants when considering some caveats.

P1.002 - EEG Frequency-Tagging in Developmental Cognitive Neuroscience: Methodological Considerations

S. Peykarjou[1]

Heidelberg University

Frequency-tagging, the process of associating a cognitive process with a frequency tag through external stimulation, has elicited growing interest in cognitive neuroscience during the last years. By recording scalp EEG while stimulating at a fixed frequency, e.g. using visual stimuli, the brain's capacity at processes such as categorization or rule learning can be examined and compared across development. Still, EEG research with infants poses challenges that require consideration and adaptations of analyses. These challenges include limits to attentional capacity, variation in looking times, and presence of artefacts in the EEG signal. Moreover, potential differences between age-groups must be carefully evaluated and may include the general response strength, distribution of responses on the scalp and across harmonics, and reliability of the signal.
This presentation evaluates these challenges theoretically and empirically by combining and re-analyzing data sets from infants (N = 93) and adults (N = 20) collected in a categorization task with artifical, unfamiliar stimuli. Specifically, different criteria for inclusions of trials and selection of harmonics, the influence of bins considered for baseline correction, the relation between FPVS responses and looking time, and re-test reliabilities are analyzed.
Overall, analyses indicate that decisions should be tailored based on age-group to optimally capture the observed signal. Based on these considerations and analyses, recommendations for developmental frequency-tagging studies are developed, which will help select appropriate analysis strategies in future work.

P1.003 - Survey on Open Science Practices in Functional Neuroimaging

C. Paret[1], N. Unverhau[1], F. Feingold[2], R. Poldrack[2], C. Schmahl[1], M. Sicorello[1]

[1] Zentralinstitut für Seelische Gesundheit, Deutschland
[2] Department of Psychology, Stanford University, Stanford, CA

Replicability and reproducibility of scientific findings is paramount for sustainable progress in neuroscience. Preregistration of hypotheses and methods of an empirical study before analysis, data sharing, and compliance with data standards such as the Brain Imaging Data Structure (BIDS), are considered effective practices to secure progress and to substantiate quality of research. We investigated the current level of adoption of open science practices in neuroimaging and the difficulties that prevent researchers from using them.
Email invitations to participate in the survey were sent to addresses received through a PubMed search of fMRI studies that were published between 2010 and 2020. 283 persons completed the questionnaire.
Although half of the participants were experienced with preregistration, the willingness to preregister studies in the future was modest. The majority of participants had experience with the sharing of primary neuroimaging data. Most of the participants were interested in implementing a standardized data structure such as BIDS in their labs. Based on demographic variables, we compared participants on seven subscales, which had been generated through factor analysis. It was Exploratory analyses found that experienced researchers at lower career level had higher fear of being transparent and researchers with residence in the EU had a higher need for data governance. Additionally, researchers at medical faculties as compared to other university faculties reported a more unsupportive supervisor with regards to open science practices and a higher need for data governance.
The results suggest growing adoption of open science practices but also highlight a number of important impediments.

Topic 2: Individual Differences and (Epi)Genetics

P1.004 - Risk-Taking Under Threat: Women Remain Hesitant Where Men Get Bold

K. U. Siebenhaar[1], **G. W. Alpers**[1]

Lehrstuhl für Klinische und Biologische Psychologie und Psychotherapie, Universität Mannheim

Background and objective: Emotions influence many of our decisions. Therefore, it is highly plausible that the experience of threat may influence the way individuals make risky decisions. However, current findings are heterogeneous, which may be due to the paradigms used to induce stress and measure decision-making. Gender differences could also be an important contributor to heterogeneity. Therefore, we combined a well-established threat induction with an ecologically valid risk-taking paradigm and explicitly examined gender differences to disentangle these effects.
Methods: Seventy-five participants (57% female; mean age = 23.14, SD = 3.73) completed an adapted version of the Balloon Analog Risk Task (BART), in which they were exposed to six alternating threat or safety conditions. In addition to task risk-taking, the amount of money earned, reaction times, skin conductance level, and
skin conductance responses were recorded as outcome variables.
Results: Threat had no effect on task risk-taking, but significant gender differences emerged. Under threat, women took significantly fewer risks and had slower reaction times than men. On the other hand, men took more risks under threat and reacted equally fast under threat and safety conditions. Interestingly, there were no gender differences in the amount of money earned; women's higher risk aversion (or men's risk-taking) was not maladaptive in this task. Also, skin conductance level and responses were elevated in threat conditions, but there were no gender differences.
Conclusion: Our results indicate that gender may crucially determine how individuals respond to threats.

P1.005 - Testing the Effects of Intolerance of Uncertainty on the Error-Related Negativity in a Randomized Controlled Trial

H. P. Carsten[1], **K. Härpfer**[1], **A. Riesel**[1]

Universität Hamburg, Deutschland

Background: The error-related negativity (ERN) has been linked to individual differences in intolerance of uncertainty (IU). Specifically, previous findings imply a bidirectional association between the subconstructs of IU (prospective and inhibitory IU) and the ERN, which we ought to replicate and extend by testing for causal relationships.
Method: This preregistered randomized-controlled trial tested associations between IU and the ERN cross-sectionally and longitudinally: N = 120 university students underwent an Eriksen flanker task to measure their baseline ERN via electroencephalography. Next, 60 participants of the initial sample were randomly assigned to one of 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. Then, participant's ERN was assessed again (T1). Self-reported uncertainty was assessed before and after T0 and T1.
Results: Cross-sectionally no effects of IU on the ERN emerged. Longitudinally, the intervention group displayed increased uncertainty after the intervention, but no evidence emerged for ERN alterations attributable to the intervention.
Discussion: 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.

P1.006 - Multi-Modal Brain Signal Complexity Predicts Human Intelligence

J. A. Thiele[1], **A. Richter**[2], **K. Hilger**[1,3]

[1] Würzburg University, Department of Psychology I, Germany
[2] Würzburg University, Department of Biology, Germany
[3] Frankfurt University, Department of Psychology, Germany

Spontaneous brain activity builds the foundation for cognitive processing during various external demands. A huge number of neuroimaging studies identified specific characteristics of intrinsic brain dynamics to be associated with individual differences in general cognitive ability, i.e., intelligence. However, respective research is inherently limited by low temporal resolution, thus, preventing any conclusions about the complexity of fast neural fluctuations. Here, we used resting-state electroencephalographical (EEG) recordings from 144 healthy adults to investigate the preregistered question whether individual differences in intelligence (Raven's Advanced Progressive Matrices scores) can be predicted from the complexity of temporally highly resolved intrinsic brain signals. We compared different operationalizations of brain signal complexity (Multiscale entropy, Shannon entropy, Fuzzy entropy, and specific characteristics of microstates) concerning their relation to intelligence. The results indicate that associations with intelligence are of small to medium effect sizes and vary across different spatial and temporal scales. Specifically, higher intelligence scores were associated with lower complexity in local but higher complexity in global aspects of neural processing, and related to greater inter-hemispheric lateralization as well as to less activity of task-negative brain regions. Finally, we combined multiple measures of brain signal complexity to show that intelligence scores of unseen participants can significantly be predicted with multi-modal complexity models within the sample (k-fold internal cross-validation) as well as in an independent sample (external replication, N = 57). In sum, our results highlight the temporal and spatial dependency of associations between intelligence and intrinsic brain dynamics, proposing multi-modal approaches as promising means for future neuroscientific investigations.

P1.007 - Geschlechtsunterschiede im mimischen Schmerzausdruck

P. Schneider[1], **S. Lautenbacher**[2], **M. Kunz**[1]

[1] Medizinische Psychologie und Soziologie, Medizinische Fakultät, Universität Augsburg
[2] Physiologische Psychologie, Universität Bamberg

Die mimische Schmerzreaktion spielt eine wichtige Rolle für die Schmerzdiagnostik. Es gibt Hinweise darauf, dass Männer und Frauen sich in ihrem mimischen Schmerzausdruck unterscheiden. Die Datenlage hierzu ist jedoch noch sehr heterogen. Ein Grund dafür könnte sein, dass in den meisten Studien nur kleine Stichproben untersucht wurden.
Für die vorliegende Studie wurden die Daten aus 7 vorangegangenen Studien fusioniert. Insgesamt gingen die Daten von 392 Proband*innen (männlich: 192, weiblich: 200; mittleres Alter = 32,3 Jahre; Std. Abw. = 13,1) ein. Dadurch besteht eine ausreichende Datenbasis, um zuverlässig Geschlechtsunterschiede finden zu können. In den 7 fusionierten Studien wurden phasische Hitzereize von schmerzhafter und nicht-schmerzhafter Intensität (5 Sekunden Dauer) verabreicht und von den Studienteilnehmer*innen hinsichtlich ihrer Schmerzintensität eingeschätzt. Die mimischen Reaktionen wurden auf Video aufgezeichnet und offline mithilfe des Facial Action Coding (FACS) manuell analysiert. Das FACS ist der Goldstandard zur Analyse von Gesichtsausdrücken. Geschlechtsunterschiede in den subjektiven und mimischen Schmerzreaktionen wurden mithilfe von hierarchischen linearen Modellen untersucht.
Obwohl sich Frauen und Männer hinsichtlich ihrer Schmerzschwelle unterschieden, schätzen sie die – an die Schmerzschwelle angepassten Reize – als gleich schmerzhaft ein. Mimisch zeigten Frauen jedoch stärkere Reaktionen auf die verabreichten Schmerzreize. Post-hoc Analysen zeigten, dass alle schmerzrelevanten Mimikreaktionen bei Frauen im Vergleich zu Männern signifikant stärker ausgeprägt waren. Zudem zeigte sich der Zusammenhang zwischen subjektiven und mimischen Schmerzreaktionen bei Frauen deutlicher als bei Männern.
Somit konnte gezeigt werden, dass Frauen mimisch stärker als Männer auf Schmerzreize reagieren und ihr subjektives Schmerzerleben kongruenter über ihre Mimik zu encodieren scheinen.

P1.008 - How peak alpha frequency (PAF) and intelligence work together: An EEG study on the association of PAF and intelligence measured with an advanced matrices test

L. M. Makowski[1], **S. J. Troche**[1]

University of Bern, Bern, Switzerland

Individuals with higher intelligence scores show higher information processing speed than those with lower intelligence scores. Psychophysiological research revealed that the peak alpha frequency (PAF), a neurophysiological component within the alpha frequency band, is a stable index of cognitive speed. Studies on the relationship between PAF and intelligence, however, are highly inconsistent. This inconsistency could be due to different methodological procedures.
In the present study, the PAF scores of 91 women and 39 men (mean age: 22.8 years; SD = 2.8 years) were measured eight times during resting states with eyes open and eyes closed just before four different cognitive tasks. From these measures, four dissociable latent variables were extracted representing PAF at parietooccipital and at frontocentral areas in the eyes-open (EO) and in the eyes-closed (EC) condition, respectively. None of these four latent variables were related to intelligence as measured by an adapted version of Raven's Advanced Progressive Matrices (RAPM). In a hierarchical confirmatory factor analysis, an overarching general PAF latent variable was identified, which, again, was unrelated to RAPM scores (β = -.073, p = .411).
Our results confirmed the stability of PAF across different time points and highlighted an internal structure of individual differences in PAF. However, even at the level of latent variables and differentiating between frontal and parietal brain areas as well as EO and EC conditions, PAF does not contribute to our understanding of the relation between speed of information processing and intelligence.

P1.009 - Revealing Mechanisms Underlying Individual Differences in Multitasking: An EEG study

M. Mückstein[1], **J. Brüning**[2], **D. Manzey**[2], **K. Gramann**[2]

[1] International Psychoanalytic University; Universität Potsdam
[2] Technische Universität Berlin

Research on individual differences in multitasking has shown that individuals either prefer a more serial or more parallel (overlapping) mode of task processing, which can be identified in the task switching with preview (TSWP) paradigm. This variant of a task switching paradigm allows but does not oblige individuals to pre-process the stimulus of the next task switch in a predictable task switching procedure [AAABBB...]. We investigated the mechanisms underlying these different processing modes with a neurophysiological approach. Specifically, we examined at which processing stage during task switches potential differences occur, focusing on the visual-attentional stage and the response-selection stage. In a first session with the TSWP paradigm, 26 participants with a clear preference for serial or overlapping processing (n=13) were identified. In a second session, they repeated the TSWP paradigm and additionally performed a classical task switching paradigm without a preview option. In addition to reaction times and errors, event related potentials (ERPs) were analyzed. In terms of the latter, we found no differences in the posterior-contralateral negativity in switch trials between the two different processing modes in either paradigm, indicating comparable attentional deployment strategies. Strikingly, however, overlapping processors showed a significantly earlier onset of the lateralized readiness potential in switch trials only during TSWP. This provides strong evidence that overlapping processors already selected an upcoming switch response and prepared response execution while they were still completing the previous trial of the other task. These results may pave the way for a better understanding of individual differences in cognitive control.

P1.010 - Higher fronto-parietal upper alpha synchronization in divergent as compared to convergent thinking beyond the impact of working memory

V. Eymann[1], A. Beck[1], S. Jaarsveld[1], T. Lachmann[1,2,3], D. Czernochowski[1]

[1] Center for Cognitive Science, University of Kaiserslautern, Germany
[2] Centro de Investigación Nebrija en Cognición (CINC), Universidad Nebrija, Madrid, Spain
[3] University of Leuven, Leuven, Belgium

Although the relationship between creativity and fluid intelligence has been studied extensively with divergent and convergent thinking tasks, the underlying neural mechanisms of this relationship are still under debate. As both creativity and fluid intelligence depend on working memory (WM), a direct comparison might overestimate shared underlying mechanisms of both processes due to the impact of WM-related activity. Hence, we controlled for WM-related activity when assessing divergent and convergent thinking, as measured by the Creative Reasoning Task and Raven's Advanced Matrices, respectively, and the associated EEG oscillatory modulations in the upper alpha band (10 – 12 Hz). We separated processing phases according to predominantly divergent and convergent thinking processes, and assessed WM within the same knowledge domain and by using highly comparable stimulus material. By introducing this methodological approach, we observed upper alpha band modulations beyond WM-related activity in both divergent and convergent thinking processes, and thus provide evidence for a higher fronto-parietal alpha synchronization in divergent as compared to convergent thinking. Hence, we demonstrate that creativity and fluid intelligence measured within the same knowledge domain share underlying mechanisms beyond task demands associated with WM.

P1.011 - The relationship between chronotype and pain sensitivity in a sample of young adults

G. Zerbini[1], **P. J. Göller**[1], **P. Reicherts**[1], **S. Lautenbacher**[2], **M. Kunz**[1]

[1] Faculty of Medicine, Department of Medical Psychology and Sociology, University of Augsburg, Augsburg, DE
[2] Physiological Psychology, University of Bamberg, DE

Chronotype is the preferred biological timing for activity and sleep, and it varies greatly in the population, ranging from very early (larks) to very late sleepers (owls). Chronotype has been linked to several aspects of human life, such as academic and athletic performance, physical and mental health. Late chronotypes are usually in disadvantage in our society because of early school and work starting times, which clash with their preferred late sleep times.
Given the close relationship between sleep and pain, the aim of this study was to explore whether chronotype might also be linked to pain perception. We assessed chronotype with the micro Munich ChronoType Questionnaire (micro MCTQ) in a sample of (N=62) medical students (33 females, mean age: 21.8, age range: 19-28). Additionally, we assessed other aspects of sleep, such as sleep duration (micro MCTQ) and sleep quality (single item). Furthermore, participants visited the laboratory to determine their heat pain threshold. Experimental pain sessions were held between 9 am and 4 pm.
Regression analyses showed a significant association between chronotype and pain threshold, independent of time of day of testing, with later chronotypes displaying a lower pain threshold (i.e. higher pain sensitivity) compared to earlier chronotypes. Sleep duration and sleep quality were not significantly associated with pain threshold.
Our results suggests that late chronotypes are more sensitive to pain. Further studies targeting more extreme chronotypes and with a wider range of testing times are needed to clarify the mechanisms (sleep duration, sleep quality, time of day) through which chronotype influences pain perception.

Topic 3: Learning, Memory, and Sleep

P1.012 - Virtual reality experiences promote autobiographical retrieval mechanisms: Electrophysiological correlates of laboratory and virtual experiences

J. Kisker[1], **T. Gruber**[1], **B. Schöne**[1]

Experimental Psychology I, Institute of Psychology, Universität Osnabrück, Deutschland

Recent advances in memory research indicate that memories of conventional laboratory experiences are qualitatively different from memories of virtual reality (VR) experiences. Unlike the former, VR experiences are highly immersive, preserving characteristics of real-world experiences. Therefore, VR could significantly contribute to the re-evaluation of results from conventional laboratory setups, and to identifying memory processes underlying personally experienced events. To investigate the electrophysiological correlates of memory retrieval underlying VR experiences compared to conventional laboratory experiences, participants were presented with either conventional 2D videos on a screen or immersive 3D-360° videos using a VR headset, followed by an unannounced recognition task. As expected, the established theta old/new effect was replicated for the PC condition. However, this effect was absent in the VR condition. Accompanied by stronger alpha-band responses compared to the VR condition, the theta-band response in the PC condition may reflect higher retrieval effort. Consistently, lower alpha-band responses in the VR condition reflect the characteristics of effortless retrieval. Our results provide evidence that the retrieval of VR experiences differs significantly from retrieval of conventional laboratory events. Specifically, retrieval of VR experiences is effortless and spontaneous, whereas retrieval of conventional laboratory events involves higher effort, which might be uncharacteristic of everyday experience.

P1.013 - The forward testing effect is robust to psychosocial retrieval stress

B. Pastötter[1], **B. v. Dawans**[1], **G. Domes**[1], **C. Frings**[1]

Universität Trier, Deutschland

The forward testing effect (FTE) refers to the finding that testing of previously studied information enhances memory for subsequently studied new information. Previous research demonstrated that the FTE is a robust phenomenon that generalizes across different materials and populations. More recent research showed that the FTE is immune to acute psychosocial encoding/retrieval stress, i.e., stress that is induced before encoding of items. The present study followed up on this research and investigated whether the FTE is also robust under acute psychosocial retrieval stress, i.e., stress that is induced before retrieval of items. Participants (N=128) studied three lists of words in anticipation of a final cumulative recall test. In the testing condition, participants were tested immediately on lists 1 and 2, whereas in the restudy condition, they restudied lists 1 and 2. After study of list 3 and before the criterion test of list 3, acute psychosocial stress was induced in half of the participants (stress group) using the Trier-Social-Stress-Test-for-Groups (TSST-G) protocol, whereas no stress was induced in the other half of the participants (control group). Salivary cortisol, alpha amylase, and subjective stress were repeatedly measured. The results of the criterion test showed that list 3 recall was generally lower in the stress group than in the control group. More importantly, the FTE on list 3 recall was significant and equally present in both groups. These results suggest that that the FTE is immune to psychosocial retrieval stress. The findings are discussed with respect to current theories of the FTE.

P1.014 - Mnemonische Mechanismen in der virtuellen Realität – Vergleich ereigniskorrelierter Potentiale des Repetition-Suppression Effektes zwischen VR und konventionellen Laborbedingungen

M. Johnsdorf[1], J. Kisker[1], M. Sagehorn[1], T. Gruber[1], B. Schöne[1]

Universität Osnabrück, Deutschland

Virtuelle Realität (VR) ermöglicht die Erforschung kognitiver Prozesse unter realistischen Bedingungen, wobei wenig über die funktionalen Eigenschaften dieser Prozesse im Vergleich zum klassischen zweidimensionalen Labor-Setup bekannt ist. Bisherige Forschung bezüglich mnemonischer Prozesse zeigt, dass Erfahrungen in VR anders als im Labor Teil des autobiographischen Gedächtnisses werden. Um zu differenzieren, ob sich die dem autobiographischen Gedächtnis zugrunde liegenden Prozesse bereits während der Enkodierungsphase unterscheiden, untersuchten wir den Repetition Suppression (RS)-Effekt. RS wird mit einer geschärften neuronalen Objektrepräsentation assoziiert und stellt die früheste Instanz von Enkodierungsprozessen dar. Der RS-Effekt zeigt sich in einer Verringerung der neuronalen Antwort bei wiederholter Stimuluspräsentation. In einem Within-Subject Design präsentierten wir den Versuchspersonen 180 Objekte, entweder unter herkömmlichen Laborbedingungen oder in einer realistischen virtuellen Umgebung über ein Head-Mounted Display. Die vorläufige Analyse ereigniskorrelierter Potenziale (EKPs) für fünf unter Laborbedingungen typische Zeit- und Elektrodenfenster zeigt, dass die Amplituden der EKPs an posterioren Elektroden in VR im Vergleich zur PC-Bedingung niedriger waren. Dies weist auf eine optimierte Verteilung kognitiver Ressourcen in realistischen Kontexten hin. Der RS-Effekt konnte in beiden Bedingungen an posterioren und anterioren Elektroden für späte Zeitfenster (220 – 690ms) repliziert werden. Zusätzlich wurde ein spezifischer VR-RS-Effekt in VR an anterioren Elektroden für ein späteres Zeitfenster (800 – 1200ms) gefunden. Hierbei war die Amplitude bei der ersten Objekt-Präsentation signifikant negativer, was auf differenziertere Enkodierungsprozesse in VR im Vergleich zum Labor hindeutet. Speziell implizieren elektrotomographische Ergebnisse (VARETA) eine Miteinbeziehung somatosensorischer Areale in VR und somit die Bildung einer stärker vernetzten autobiographischen Gedächtnisspur.

P1.015 - Behavioral and computational evidence for compositional reuse of experience in humans

L. Luettgau[1,2], R. Moran[1,2], K. L. Stachenfeld[3], Z. Kurth-Nelson[1,4], R. J. Dolan[1,2,4]

[1] Max Planck UCL Centre for Computational Psychiatry and Ageing Research, University College London, United Kingdom
[2] Wellcome Centre for Human Neuroimaging, University College London, United Kingdom
[3] DeepMind, London, United Kingdom
[4] equal contribution

Our everyday experiences are produced by several interacting processes, e.g., meeting friends in the park in summer is the product of community structures and the cycle of the seasons. Representing factors underlying experience enables reusing knowledge and adapting to similarly structured environments. We tested this ability in humans with a paradigm featuring two cyclic graph factors (4 and 6 states), each state represented by distinct images. Participants observed trajectories through compositions of two graph factor states, experiencing 12 of the 24 possible product states. However, agents representing graph factors could infer the 12 unexperienced compositions by recombining knowledge. We assessed knowledge of both graph factors by asking participants to predict upcoming states (Sequence Probes) and transitions between unexperienced states (Inference Probes). Across four studies, we found above-chance performance that increased over time – with Sequence Probe accuracy greater than Inference Probe accuracy. Inference accuracy was higher for the 4-state than the 6-state graph. Computational simulations showed that a successor feature model, learning predictions about unique product states performed at chance during Inference. Another successor feature model, learning expectations about features constituting product states, showed above-chance accuracy in Inference Probes, but no performance increase over time. In this model, Sequence and Inference Probe accuracy were indistinguishable. A hybrid model captured many aspects of human behavior but predicted no difference between both graph factors' Inference Probe accuracies. Our results suggest that humans factorize state spaces underlying their experience, allowing for efficient reuse of knowledge to reason about potential states of the world.

P1.016 - Short-term training attenuates the repetition probability effect for non-face objects

C. Li[1], **G. Kovács**[1]

Friedrich-Schiller-Universität Jena, Germany

The magnitude of repetition suppression (RS), measured by fMRI, is modulated by the probability of stimulus (P(rep)). The P(rep) effect refers a stronger RS in blocks, where the probability of repetitions was higher when compared to blocks with less frequent repetitions. Previous studies have suggested that the P(rep) effect depends on the extensive, long-term experience of participants with the stimuli. However, the modulation of the P(rep) effect by short-term perceptual learning (PL) remains largely unknown. To address this issue, we used fMRI and measured the P(rep) modulation of RS before and after a 10-day PL period, performed for non-face objects (cars). The results showed a significant P(rep) effect for faces within the Fusiform Face Area (FFA) and for cars within the Lateral Occipital Complex (LO) in the pre-training fMRI session. Following the PL training, behaviourally, participants exhibited strong improvements in the categorization of the trained stimuli. Interestingly, the P(rep) effect disappeared in the post-training fMRI session, both for faces and cars. Overall, these results suggest that the P(rep) modulation of RS is modulated by the short-term perceptual learning experiences.

P1.017 - Two distinct ways to form long-term object-recognition memory during sleep and wakefulness

M. Harkotte[1,2], **A. Sawangjit**[1], **C. Oyanedel**[1], **N. Niethard**[1], **J. Born**[1,3,4], **M. Inostroza**[1]

[1] Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen, Germany
[2] Graduate Training Centre of Neuroscience, International Max Planck Research School, Tübingen, Germany.
[3] German Center for Diabetes Research (DZD), Institute for Diabetes Research and Metabolic Diseases of the Helmholtz Center Munich at the University of Tübingen (IDM), Tübingen, Germany.
[4] Center for Integrative Neuroscience, University of Tübingen, Germany

Memory consolidation is promoted by sleep. However, there is also evidence for consolidation into long-term memory during wakefulness via processes that preferentially affect non-hippocampal representations. We compared in rats the effects of 2-h post-encoding periods of sleep and wakefulness on the formation of long-term memory for objects and their associated environmental contexts. We employed a novel object recognition (NOR) task, using object exploration and exploratory rearing, respectively, as behavioral indicators of these memories. Remote recall testing (after 1 week) confirmed significant long-term NOR memory under both conditions, with NOR memory after sleep predicted by the occurrence of EEG spindle-slow oscillation coupling. Rats in the sleep group decreased their exploratory rearing at recall testing, revealing successful recall of the environmental context. By contrast, rats that stayed awake after encoding showed equally high levels of rearing upon remote testing as during encoding, indicating that context memory was lost. Disruption of hippocampal function during the post-encoding interval (by muscimol administration) suppressed long-term NOR memory together with context memory formation when animals slept, but enhanced NOR memory when they were awake during this interval. Testing remote recall in a context different from that during encoding impaired NOR memory in the sleep condition, while exploratory rearing was increased. By contrast, NOR memory in the wake rats was preserved and actually superior to that after sleep. Our findings indicate two distinct modes of long-term memory formation: Sleep consolidation is hippocampus-dependent and implicates event-context binding, whereas wake consolidation is impaired by hippocampal activation and strengthens context-independent representations.

P1.018 - Hunger drives the formation of long-term spatial memory during wakefulness

A. Sawangjit[1], **M. Inostroza**[1], **J. Born**[1,2,3]

[1] Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen, Germany
[2] German Center for Diabetes Research (DZD), Institute for Diabetes Research and Metabolic Diseases of the Helmholtz Center Munich at the University of Tübingen (IDM), Tübingen, Germany.
[3] Center for Integrative Neuroscience, University of Tübingen, Germany

Consolidation of spatial memory is promoted by sleep. However, recent evidence suggests that memory under some circumstances such as starvation does not require sleep for consolidation. In this study we aimed at investigating whether long-term spatial memory can also be formed during wakefulness in the hunger state.
We used an object-place recognition (OPR) task in rats to assess recognition memory for spatial location. Rats explored two identical objects in an arena for 10 min (Encoding), and then remained awake for 2 hours. For retrieval testing 24 hours later, one of the two objects used in the encoding phase was displaced to a novel location. Spatial memory was assessed based on the increased exploration time the rat devotes to the displaced object during the retrieval phase. To investigate the effects of hunger on spatial memory consolidation, two groups of rats were food-deprived for 24 hours prior to the encoding of the OPR task. One group received food immediately after the encoding (Wake-Full), while rats of another group had a prolonged period (2 hours) of food deprivation (Wake-Hunger).
Remote retrieval testing showed that only rats of the Wake-Hunger group showed significant long-term OPR memory, and the remote memory performance of this group was superior to that of the Wake-full group. Control parameters such as body weight, total object exploration, and locomotor activity at the encoding and retrieval phases did not differ between the two groups. Our findings indicate that consolidation of spatial memory in the state of hunger is a sleep-independent process.

P1.019 - Acute stress influences decisions informed by social and reward inference

S. Schulreich[1], **L. Schwabe**[1]

Universität Hamburg, Deutschland

Adaptive decision making often requires people to take experienced consequences as well as social information such as advice into account. In everyday life, many decisions take place under stress or elicit stress themselves. Acute stress can modulate social inference and reward-based learning. However, little is known about the neurocomputational mechanisms that mediate stress effects on social inference and on the interplay or arbitration between social and reward-based learning. Learning about other's intentions in advice giving (and, consequently, from advice) and reward-based learning rely on similar learning processes, which are, however, supported by partially different neural networks. To test whether and how stress affects these neural components and their interplay, we randomly assigned participants to a psychosocial stress or control manipulation before they performed a probabilistic learning task while we measured brain activity via functional magnetic resonance imaging (fMRI). In this task, participants had to learn from experienced rewards but also about the intentions of an advice-giver to reach optimal performance. Our behavioral data show that acute stress reduced learning performance. We will complement our initial analysis with behavioral modeling under a hierarchical Bayesian cognitive framework and with a model-based fMRI analysis. Data are currently being analyzed and will be presented at the conference.

P1.020 - Cognitive processing during sleep: designed to be parsimonious and sleep-protective

C. Blume[1,2], M. Niedernhuber[3], M. Spitschan[1,2,4,5], H. C. Slawik[6], M. P. Meyer[6], C. Cajochen[1,2], T. Bekinstein[3]

[1] Centre for Chronobiology, Psychiatric Hospital of the University of Basel, Switzerland
[2] Transfaculty Research Platform Molecular and Cognitive Neurosciences, University of Basel, Switzerland
[3] Consciousness and Cognition Lab, Department of Psychology, University of Cambridge, United Kingdom
[4] Translational Sensory and Circadian Neuroscience, Max Planck Institute for Biological Cybernetics, Tübingen, Germany
[5] TUM Department of Sport and Health Sciences (TUM SG), Technical University of Munich, Germany
[6] Psychiatric Hospital of the University of Basel, Switzerland

The sleeping brain enters a processing mode in which it continues to monitor the environment, balancing sleep protection with the need to respond to stimuli. However, the relationship between top-down attentional mechanisms and bottom-up stimulus input is unclear. Furthermore, whether pre-sleep light exposure may modulate attentional resources and thereby modify stimulus processing acutely and during subsequent sleep is unknown.
To address these questions, 29 healthy participants (18-30 y, 15 women) performed a local-global auditory oddball task (Bekinschtein et al., 2009) during wakefulness and sleep with polysomnography. They came to the laboratory twice with visits differing only in the light exposure (1-h pre-sleep; high- vs. low-melanopic metamers, difference factor 2x in melanopsin activation). We used temporal generalisation analyses based on event-related potentials to evaluate (dis-)similarities in the neural signatures across vigilance stages (i.e., wake, N1-N3, REM) and between the two light exposure conditions. Effects of interest were (i) processing of global deviants, which is modulated by attention, and (ii) processing of omissions (silence where sound was expected) of bottom-up input as a measure of top-down expectations.
Global effects were evident during wakefulness, N2 and N3 sleep. Contrasting earlier findings, this indicates that the ability to generate relatively complex task-relevant expectations and compare them to stimulus input is retained during sleep. However, in the absence of bottom-up input, effects were no longer evident during sleep underlining the parsimony and thus sleep-protective nature of this processing mode. Processing was not modulated by pre-sleep light exposure targeting specifically the melanopsin system using metameric light.

P1.021 - Generalization, memory specificity and their overnight fate are differentially associated with age in childhood

E. S. Buchberger[1], A. Joechner[1], C. T. Ngo[1], U. Lindenberger[1,2], M. Werkle-Bergner[1]

[1] Max Planck Institute for Human Development, Berlin, Germany
[2] Max Planck UCL Centre for Computational Psychiatry and Ageing Research, Berlin, Germany, and London, United Kingdom

Adaptive memories are formed in the face of a fundamental tension: extracting commonalities across experiences to generate novel inferences (i.e., generalization) while simultaneously forming separate representations of similar events (i.e., memory specificity). During childhood, this tension is further amplified through the uneven progression of generalization and memory specificity. In particular, it is not well understood whether these processes are interdependent, and how children manage to consolidate both generalized and specific memories.
In this study, a total of 141 children aged four to eight years underwent an experimental paradigm that assesses generalization and specificity in tandem to investigate whether (i) age differentially relates to generalization and memory specificity abilities; (ii) generalization is contingent on memory specificity and (iii) the effect of a sleep-filled delay on these memory processes differs by age.
We found age-related differences in both generalization and memory specificity, with greater differences for generalization than for memory specificity. Unlike prior evidence in adults, children's generalization success was contingent on memory specificity for conceptual object properties and inter-object semantic proximity, but not on perceptual attributes or surrounding contexts. Further, older children were more likely to retain both general and specific aspects of memory after an overnight delay. However, memory gains differed across processes: Compared to younger children, older children showed greater gains in generalized, but not in specific memories.
In summary, the present results reveal aspects of past experiences upon which children draw when creating inferences and suggest that the overnight fate of generalization and memory specificity changes with age.

P1.022 - Challenges of tracking sequential memory replay during wakeful rest

S. Kern[1], **S. Gais**[3], **G. Feld**[1,2]

[1] Zentralinstitut für seelische Gesundheit Mannheim
[2] Universität Heidelberg
[3] Eberhard Karls Universität Tübingen

Replaying memory traces of recently learned material plays an important role for the consolidation of long-term memories. The role of replay has been mainly investigated in animal research, whereas measuring replay in humans is still methodologically challenging. Many approaches so far have focused on the targeted memory-reactivation-design, where an external stimulus that was presented together with the learned information, is presented again during retention, which is thought to trigger the reactivation of the memory trace. However, a new line of research focuses on uncovering replay using intrinsic physiological features such as functional connectivity, oscillations or similarity analyses. One such approach is Temporally Delayed Linear Modelling (TDLM, Liu et al 2020) in which decoders are used to find evidence for sequential replay of previously learned items.In this study we let 30 participants learn a sequence of visual items. In a second step we use decoders to find traces of activity of the previously seen individual items in a subsequent resting state. Using TDLM, we test for sequentialness of the decoded items in the same order as the learned sequences. In our preliminary analysis, we are able to find, depending on the decoder, evidence for replay at different time lags. Our results outline the importance of decoder choice and the challenges that are posed by using a decoding approach.

P1.023 - Measuring the effect of reward on memory without the confounding influence of response bias

D. P. Morgan[1,2,3], **J. Tkotz**[1,2,3], **G. B. Feld**[1,2,3,4]

[1] Department of Clinical Psychology, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany
[2] Department of Addiction Behavior and Addiction Medicine, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany
[3] Department of Psychiatry and Psychotherapy, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany
[4] Department of Psychology, Heidelberg University, Heidelberg, Germany

A common procedure used in reward research is the Motivated Learning Task. In that task participants memorise pictures associated with a reward (learning phase) that is paid out for later recognising the previously learned pictures among a set of new pictures (test phase). Typically, the task is suggested to demonstrate the influence of reward on memory encoding, with hit rate as its outcome measure. This is problematic since the hit rate cannot distinguish between improved memory (sensitivity) and changes in response bias. Therefore, we re-designed the task to separate the two concepts by adding congruent or incongruent reward information to the test phase. In an online pre-registered experiment (N = 205) we confirmed that sensitivity was higher for high-reward images than for low-reward images in the congruent condition. This indicates that high rewards during learning increase memory encoding in a recognition memory paradigm. When comparing the hit rate within the incongruent condition, there was a reward effect for the rewards shown during the test phase but not for those shown during the learning phase. This indicates that reward information presented during testing can influence response bias. These findings suggest that although rewards during learning can affect memory encoding this effect is likely smaller than the effect of reward information during the test phase. Therefore, source memory of the reward contingencies may drive reward effects on the hit rate via criterion shifts in the Motivated Learning Task.

P1.024 - Differential oscillatory processes associated with successful sequence memory encoding in young and older adults

N. Ehrhardt[1], **G. Lucchese**[1], **A. Flöel**[1,2], **D. Antonenko**[1]

[1] Klinik und Poliklinik für Neurologie, Universitätsmedizin Greifswald
[2] Deutsches Zentrum für Neurodegenerative Erkrankungen (DZNE) Standort Greifswald

Sequence memory is subject to age-related decline, but the underlying processes are not yet fully understood. In young adults, amplitude of theta oscillations and their phase-coupling with gamma waves (phase-amplitude coupling; PAC) is associated with memory performance, possibly providing an oscillatory mechanism underlying successful memory formation. Here, we recorded EEG in 32 older (60-80 years old) and 32 young adults (20-30 years old) during a task where participants had to remember the order of visually presented objects. We compared time-frequency spectra and theta-gamma PAC during encoding of subsequently correctly and incorrectly remembered sequences. An interaction between memory and age in the theta band suggested stronger desynchronization for correct as compared to incorrect trials in young adults (mean difference (SD) = -0.536 (0.797) dB, p(corr) = 0.003) whereas this effect was absent in older adults (mean difference (SD) = 0.245 (0.442) dB, p(corr) > .99). Further, young but not older adults showed higher gamma power for correct than incorrect trials (mean difference (SD) = 0.768 (1.316) dB, p(corr) < .001). Surprisingly, no clear pattern emerged for PAC in association with memory either in young or older adults. Nevertheless, our results are in line with literature showing desynchronization in the theta band and higher gamma power associated with memory performance in young adults. Older adults show deficits in theta desynchronization and gamma oscillations during correct trials, suggesting these processes as neurophysiological correlates of age-related memory decline. Further studies with targeted modulation of these processes could elucidate the causal relevance of these phenomena.

P1.025 - Modeling adaptation to environmental volatility using recurrent neural networks

D. Tuzsus[1], **I. Pappas**[2], **J. Peters**[1]

[1] Department Psychologie, Universität zu Köln, Deutschland
[2] University of Southern California, USA

Introduction: Past research in reinforcement learning showed that human subjects adapt to changes in environmental volatility by increasing their learning rate, such that new information replaces old in a faster fashion with higher volatility. It is still unclear why and how learning rate adaptations emerge. To investigate the computational mechanism we utilized recurrent neural networks (RNNs) as a model of human decision-making. These models allow researchers to analyze the hidden unit dynamics underlying a networks performance to explore how the system adapts to changing volatility in reinforcement learning.
Methods: We trained two different RNN architectures, basic RNNs or LSTM networks (both 48 hidden units), using REINFORCE or the Advantage-Actor-Critic algorithm on restless bandit problems with varying training schedules of either low or medium volatility. A meta-volatility schedule was included, where networks were exposed to a range of volatilities during training. RNN performance was examined on the same task structure across a range of test volatilities with network weights held fixed (meta-learning) to investigate how training affects adaptation to test volatility. Then, we applied computational modeling and principal component analysis to analyze RNN performance.
Results: RNNs trained on at least medium volatility showed improved adaptation. As in human studies, RNNs achieved this by increasing exploration and learning rates. PCA-analysis suggest that RNNs as humans likely track the underlying reward random walks of the restless bandit. Further analyses will examine signatures of random and directed exploration in neural network behavior.
Discussion: We discuss effects of training volatility in RNNs during reinforcement learning.

P1.026 - Quantifying information processing in human and rodent sleep signatures

M. A. Hahn[1], **M. Inostroza**[2], **R. F. Helfrich**[1]

[1] University Medical Center, Tübingen, Germany
[2] Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen, Tübingen, Germany

Sleep spindles (~12-16 Hz) are prominent waxing and waning electrophysiological signatures of NREM sleep that are remarkably well preserved across species. Spindle occurrence is frequently related to neuronal efficiency and memory consolidation in humans and rodents. One key question is, how can a comparable electrophysiological potential in humans and rodents shape their neuronal processing given the vastly different anatomy of both species, which also differ dramatically in their mental capacities. Here, we directly compared the information content high-frequency activity (70 – 150 Hz) in human intracranial recordings and rodent local field potentials as surrogate of multi-unit activity. Critically, in both species, we obtained invasive recordings from the hippocampus and prefrontal cortex as well as scalp EEG from frontal and parietal scalp sensors to directly compare electrophysiological activity. We computed information theoretical metrics, including contrast entropy, to quantify neural efficiency and robustness. Here we report sleep stage-, region- and species-specific signatures of neural information processing during sleep. In addition, we provide a direct comparison of electrophysiological sleep signatures. Collectively, our results indicate that information-theoretical approaches are viable to quantify the processing capacity of synchronized electrophysiological signatures and sleep networks in support of long-term memory consolidation.

P1.027 - Erotic cue exposure modulates physiological arousal, increases temporal discounting and attenuates model-based reinforcement learning

D. Mathar[1], **A. Wiebe**[2], **D. Tuzsus**[1], **J. Peters**[1]

[1] Department Psychologie, Universität zu Köln, Deutschland
[2] Klinik für Psychiatrie und Psychotherapie, Universitätsklinikum Bonn, Deutschland

Introduction
Cue-exposure effects are thought to underlie maintenance of addiction. Here we investigated whether appetitive (erotic) cues can exert similar effects on temporal discounting (TD) and model-based reinforcement learning (RL) in healthy participants.
Methods
In a within-subject design n=38 healthy male participants performed tasks following either erotic or neutral cue exposure. We utilized hierarchical Bayesian drift diffusion modeling (DDM) and physiological monitoring (spontaneous eye blink rate, heart rate and pupil dilation) to assess cue exposure effects.
Results
Erotic vs. neutral cue exposure reduced pupil dilation (mean±SE: -.14+/-.04, t(38)=-3.77, p=$5.5*10^{-4}$) and increased LF/HF heart rate ratio (.1±.05, t(38)=1.98, p=.05). On the behavioral level erotic cue exposure led to a non-significant increase in TD (%LL choices, erotic (neutral): 52.12 (54.4)±.3.74 (3.34); p=.07). Diffusion modeling linked this effect to a shift in the starting point towards impatient (smaller-sooner) choices (s_β=-.03 [-.05,-.01], BF=.004). Erotic cue exposure attenuated model-based control during RL (β(reward*transition*cue) =-.07; z=-3.13, p=.002). Diffusion modeling then revealed increased forgetting rates of choice option values (mean [90% HDI]: s_γ=-.31 [-.51,-.11], Bayes Factor (BF)=.007) and reduced drift-rate asymptotes during 1st stage choices (s_(ν_([max]_1))=-.28 [-.44,-.12], BF=.002).
Discussion
Erotic cue exposure resulted in decision-making effects that resonate with previous findings of cue exposure in behavioral addictions (Dixon et al., 2006; Wagner et al., 2021). This was accompanied by changes in physiological arousal reflected in pupil dilation and heart rate variability.

P1.028 - The role of dopamine, reward learning and prefrontal activity in expectation-induced mood enhancement

N. Augustat[1], **L. Chuangl**[1]

Philipps-Universität Marburg, Deutschland

Emerging evidence from neuroimaging, computational and behavioral studies suggests that clinical and subclinical depression is associated with attenuated reward learning (RL), presumably due to abnormalities in the dopamine (DA) system. Both RL deficits and DAergic activity can be ameliorated in Parkinson's disease by inducing positive treatment expectation, and placebo treatments are reported to attenuate depressive symptoms in the long run. Here, we assess to what extent expectation-induced mood enhancement is mediated by DA D2 receptor blockade and reward processing. First, we present findings from our pilot study (n=56) that show increased reward learning rates and altered cardiac responses in enhanced vs. neutral treatment expectations. Second, we present a randomized 2x2 double-blind study design with n=296 healthy participants that are given a placebo or a high-dose DA D2 receptor antagonist (sulpiride 400mg). In each group, the expectation group allocation (antidepressant vs. placebo) is randomized. RL is assessed with computational markers (learning rates), decisional indices (gain selection vs. loss aversion), reward-sensitive EEG event-related potentials (reward positivity and feedback error-related negativity), prefrontal oscillatory activity (frontal midline theta electroencephalogram power), and source-localized brain activity (LORETA) in a probabilistic reinforcement task. The participants are further subjected to the Effort Expenditure for Rewards Task (EEfRT) and a neutral vs. negative mood induction procedure. Negative affect is measured through the Positive and Negative Affect Schedule (PANAS) before, within and after the mood induction procedure. We hypothesize that expectation enhancement inhibits evoked negative affect via improved RL and that high-dose sulpiride suppresses this mediating effect via DA blockade.

P1.029 - The adaptation process of sleep during non-consecutive nights in unfamiliar versus familiar environments

A. Wick[1], **S. Combertaldi**[1], **B. Rasch**[1]

Universität Fribourg, Schweiz

The first night in an unfamiliar environment is accompanied by reduced sleep quality and changes in sleep architecture. This so-called First Night Effect (FNE) is a well-established phenomenon in sleep research and is best examined for two consecutive nights. However, adaptation processes in non-consecutive nights are less understood. Problematically, in sleep experiments, adaptation nights (included to overcome the FNE) typically take place several days before experimental sessions.
To fill this scientific gap, we examined adaptation processes over four, weekly separated, non-consecutive nights. First, 45 participants spent four nights in the sleep laboratory. Second, 30 participants spent counterbalanced two nights in the sleep laboratory, and two nights at home. Sleep was recorded using polysomnography.
In both studies, sleep onset latency (SOL) was longer in the first and the second night com-pared to subsequent nights. Additionally, an FNE was observed for wake time after sleep on-set. In other sleep parameters (e.g., Slow Wave Sleep (SWS), sleep stage N2), no FNE was detectable. Interestingly, Experiment 2 revealed an adaptation advantage when sleeping first at home: The SOL of the first night in the sleep laboratory was not significantly enhanced, when participants already slept at home with the recording setup.
Our results show that sleep parameters (e.g., SOL) adapt over non-consecutive nights, whereas SWS and N2 do not show a significant adaptation. We conclude that non-consecutive adapta-tion nights can control for some sleep parameters and that adaptation nights in familiar envi-ronments (e.g., at home) might be interesting alternatives for future sleep studies.

P1.030 - Attentive immobility in the face of inevitable distal threat— Startle potentiation and fear bradycardia as an index of emotion and attention

C. Szeska[1], **J. Richter**[2], **J. Wendt**[1], **M. Weymar**[1], **A. Hamm**[2]

[1] Universität Potsdam
[2] Universität Greifswald

During fear conditioning, a cue (CS) signals an inevitable distal threat (US) and evokes a conditioned response that can be described as attentive immobility (freezing). The organism remains motionless and monitors the source of danger while startle responses are potentiated, indicating a state of defensive hypervigilance. Although in animals vagally mediated fear bradycardia is also reliably observed under such circumstances, results are mixed in human fear conditioning. Using a single-cue fear conditioning and extinction protocol, we tested cardiac reactivity and startle potentiation indexing low-level defensive strategies in a fear-conditioned (n = 40; paired presentations of CS and US) compared with a non-conditioned control group (n = 40; unpaired presentations of CS and US). Additionally, we assessed shock expectancy ratings on a trial-by-trial basis indexing declarative knowledge of the previous contingencies. Half of each group underwent extinction under sham or active transcutaneous vagus nerve stimulation (tVNS), serving as additional proof of concept. We found stronger cardiac deceleration during CS presentation in the fear learning relative to the control group. This learned fear bradycardia was positively correlated with conditioned startle potentiation but not with declarative knowledge of CS-US contingencies. TVNS abolished differences in heart rate changes between both groups and removed the significant correlation between late cardiac deceleration and startle potentiation in the fear learning group. Results suggest, fear- conditioned cues evoke attentive immobility in humans, characterized by cardiac deceleration and startle potentiation. Such defensive response pattern is elicited by cues predicting inevitable distal threat and resembles conditioned fear responses observed in rodents.

P1.031 - Memory reprocessing of narrative contents in sleep and wakefulness

J. Palmieri[1], D. Kumral[1], S. Wymer[1], S. Kirchner-Adelhardt[2], M. Schneider[2], S. Gais[3], M. Schönauer[1]

[1] University of Freiburg, Germany
[2] LMU Munich, Germany
[3] University of Tübingen, Germany

Sleep supports memory consolidation. Many studies have shown that learning content is better retained over sleep than over wakefulness. Reactivation of daily-life experiences during sleep has been shown to be crucial for the formation of long-term memories. Dreaming might reflect memory reprocessing on a cognitive level. The role of dreams for our memory, however, is still unclear but might shed light on the processes contributing to memory consolidation in sleep. If dreaming reflects nighttime memory reactivation, it should be associated with enhanced memory performance, and could give insights to what information is preferentially processed.
We investigated how sleep and dreaming impact memory for narratives, i.e. complex naturalistic information. Participants were presented with audiobooks before they went to bed. We then collected dream reports in serial awakening paradigms. Memory performance was assessed before and after sleep. We demonstrate that previous learning content is incorporated into dreams: Blind raters were able to predict the content of the narratives a participant had studied based solely on their dream reports. The more information from the narratives surfaced in their dreams, the better the participants were able to retain the contents. These results suggest that dreaming may in part reflect ongoing nighttime memory processing. Whether dreams hold a functional role in memory consolidation, however, remains unclear.

P1.032 - Functional dissociation of hippocampal and neocortical ripples: From information transfer to consolidation

F. v. Schalkwijk[1], J. Lendner[1,2], I. Skelin[3,4], J. Lin[5], R. Helfrich[1]

[1] Hertie-Institute for Clinical Brain Research, Center for Neurology, University Medical Center Tübingen, Tübingen, Germany
[2] Department of Anesthesiology and Intensive Care Medicine, University Medical Center Tübingen, Tübingen, Germany
[3] Department of Neurology, University of California, Irvine, CA, USA
[4] Department of Neuroscience, University of Lethbridge, Lethbridge, Canada
[5] Department of Neurology, University of California, Davis, CA, USA

Hippocampal sharp-wave ripples play a critical role in the hippocampal-neocortical dialogue that supports sleep-dependent memory consolidation. Whereas ripples were previously considered exclusive to the medial temporal lobe, recent findings have shown ripple occurrence in all cortical regions. To date, it is unclear whether cortical ripples are functionally similar to hippocampal ripples. Moreover, it is unknown if and how cortical ripples support hippocampal-neocortical interactions that facilitate information transfer and consolidation. Here, we establish how cortical ripples are functionally different from their hippocampal counterparts and how they affect the hippocampal-neocortical dialogue. We conducted full-night sleep recordings in pharmacoresistant patients with epilepsy undergoing invasive recordings prior to resective surgery (N=14; mean age=36.79 +/- 13.28y, range 19-58y; 64% female). Although hippocampal and cortical ripples were near-identical in their morphology, we found strong functional differences. Hippocampal ripples induced a low-dimensional network response that promoted directional information transfer from medial temporal lobe to prefrontal cortex. In contrast, cortical ripples showed a high-dimensional network response that prevented directional information transfer from the hippocampus to prefrontal cortex. We conclude that hippocampal and cortical ripples are uniform in their morphology, yet distinct in their functionality. Moreover, we propose that hippocampal ripples prompt network engagements that support information transfer from the medial temporal lobe to cortical areas, whereas cortical ripples prevent hippocampal input in favor of local consolidation processes within neocortical loops. Thus, the functional differentiation and temporal coordination of hippocampal and cortical ripples result in a dynamic hand-off between information transfer and local consolidation processes.

P1.033 - Oscillatory and non-oscillatory brain activity and peripheral indicators in fear and extinction memory

P. Bierwirth[1], **M. I. Antov**[1], **U. Stockhorst**[1]

Universität Osnabrück, Deutschland

Fear extinction is pivotal for inhibiting fear responding to former threat-predictive stimuli. Improving extinction learning constitutes an important means to derive adequate therapeutic strategies for anxiety and trauma-related disorders. In rodents, short intervals between fear acquisition and extinction impaired extinction recall compared to long intervals, known as Immediate Extinction Deficit (IED). Importantly, human studies of the IED are sparse and its neurophysiological correlates have not been examined in humans. To close this gap, we used electroencephalography (EEG) recording and skin conductance responses (SCRs) and assessed fear recall and extinction recall. 40 male participants were randomly assigned to extinction learning either 10min after fear acquisition (immediate extinction) or 24h afterwards (delayed extinction). Fear and extinction recall were assessed 24h after extinction learning. As expected, we observed an IED in SCR responses (ηp2=0.13), but – unexpectedly - not in theta oscillations. Irrespective of extinction time-point, fear conditioning caused a tilt of the non-oscillatory background spectrum with decreased low-frequency power (< 30 Hz) for threat-predictive stimuli. When controlling for this tilt, we observed a suppression of theta and alpha oscillations to threat-predictive stimuli, mainly during fear acquisition. Our data reveal delayed extinction to be advantageous over immediate extinction in reducing peripheral arousal to former threat-predictive stimuli, suggesting the importance of adequate timing of extinction-based therapies for long-term symptom relief in anxiety-related disorders. Furthermore, we demonstrate that oscillatory and non-oscillatory activity is sensitive to fear conditioning and that standard power estimates can be highly distorted due to fear-induced non-oscillatory brain dynamics.

P1.034 - Investigation the role of serotonin in declarative memory using a human serotonin lesion model

R. Coray[1], J. Zimmermann[1,2], K. Henke[3], A. Stock[4], C. Beste[4], B. B. Quednow[1,2]

[1] Experimental and Clinical Pharmacopsychology, Department of Psychiatry, Psychotherapy, and Psychosomatics, Psychiatric University Hospital Zurich, University of Zurich, Switzerland
[2] Neuroscience Center Zurich, ETH Zurich and University of Zurich, Zurich, Switzerland
[3] Cognitive Neuroscience of Memory and Consciousness, Institute of Psychology, University of Bern, Switzerland
[4] Cognitive Neurophysiology, Department of Child and Adolescent Psychiatry, Faculty of Medicine, TU Dresden, Germany

The exact role of serotonin in declarative memory functions remains unclear. Thus, this project aims to examine the impact of long-term serotonergic hypofunction on visuo-spatial episodic and verbal declarative memory in the human serotonin lesion model of 3,4-methylenedioxymethamphetamine (MDMA, "Ecstasy") users.
To assess episodic and verbal declarative memory capacity, we used a self-developed associative learning task and a standardized verbal memory task. The retrieval of learned material from both tests took place at two test days to compare short-term and long-term memory functions between 41 healthy controls and 44 MDMA users supposed to suffer from a chronic serotonin hypofunction. In addition, we collected structural (T1-weighted) and seed-based resting-state functional magnetic resonance imaging data at day 1. Volume changes of grey matter in memory-relevant regions (such as the hippocampus) and differences in connectivity of memory networks between groups were examined.
We found pronounced impairments in memory retrieval at both time-points in MDMA users, while their learning performance was largely intact. Structural analyses revealed a smaller volume in the hippocampal CA1 (bihemispheric) and CA4 (left) regions in MDMA users. They also showed smaller volumes of superior and inferior parietal lobe regions. Moreover, memory-associated connectivity changes were shown within the right medial temporal lobe and between medial temporal lobe areas and other cortical regions.
A low serotonergic tone, as assumed for MDMA users, is associated with impaired retrieval of episodic and verbal information indicating disturbed memory consolidation. These changes are correlated with structural and functional alterations of the medial temporal lobe.

Topic 4: Cognition

P1.035 - High density parietal alpha training for sense of presence in Virtual reality. A pilot study

L. Botrel[1], **R. Zechner**[2], **M. Mueller**[2], **A. Kübler**[1]

[1] Universität Würzburg, Deutschland
[2] VTplus GmbH, Würzburg, Deutschland

Sense of presence in virtual reality (VR) is the subjective feeling of being there (in VR). Studies showed that decreased alpha activity in the parietal cortex was related with higher immersive characteristics of VR, which is closely related to sense of presence. N=10 participants were trained for 10 sessions in parietal alpha EEG real-time EEG neurofeedback on a standard 2d bar paradigm. In a pre-post design, we assessed sense of presence in separate high immersive VR sessions developped by VTPlus (GmbH). After 10 sessions, half of the participants were 70% of the time above the feedback threshold ('efficient'), determined as the session-wise and participant-wise average alpha power at channel Pz during baseline. By reducing the subset to only 9 channels, 4 participants were still efficient. Behavioral measurements showed no change of the sense of presence over time. We plan to transfer this design to enable neurofeedback training within VR and evaluate the effect on sense of presence.

P1.036 - Preference for and proficiency in mathematical cognition differentially affect early and late stages of primed mathematical vs. non-mathematical meaning processing

L. Bechtold[1], **M. Bayer**[1], **F. Bußmann**[1], **C. Bellebaum**[1], **M. Ghio**[1]

Heinrich Heine Universität Düsseldorf, Deutschland

Mathematical concepts like arithmetic strongly rely on internal (mental-numerical) experience and thus challenge the grounded cognition hypothesis that perceptuomotor experience shapes cognition. We investigated experience-dependent mathematical meaning processing by recording event-related potentials in 39 participants with varying mathematical proficiency during an explicit association judgment task on abstract probe words. The ambiguous probes (e.g., function) could have a mathematical or non-mathematical meaning, which we cued via sentence-primed. As proxies to mathematical experience, the participants' mathematical proficiency (i.e., math test-score) as well as preference for processing mathematical information (i.e., behavioral bias in the association task) should affect the N400 (400-500ms) and N700 (550-750ms), which are markers of automatic integration and strategic imagery processes, respectively. Resolving significant interactions from linear mixed effects analyses revealed that specifically for mathematical (i.e., not for non-mathematical) meaning processing, the right-hemispheric N400 was reduced by the participants' rising preference (at anterior sites; β=1.11, SE=0.51, p=.036), whereas it was enhanced by the participants' rising proficiency (only when preference was high; β=-1.43, SE=0.51, p=.007). An enhanced N700 for processing mathematical vs. non-mathematical meaning depended on a high preference (at right-anterior sites; β=2.10, SE=0.79, p=.011) and additionally on a low proficiency (at posterior sites; β=2.62, SE=1.29, p$\leq$.050). Taken together, the results suggest a dissociation of how the preference for and proficiency in mathematical processing affect automatic and strategic semantic processing stages. Even though we cannot make direct inferences regarding experiential grounding, the specificity of our findings suggest that mathematical experience shapes the neural processes underlying mathematical cognition.

P1.037 - Slip or fallacy? The influence of error severity on the error-related negativity in pianists

C. Albrecht[1], **C. Bellebaum**[1]

Heinrich-Heine-Universität Düsseldorf, Deutschland

While previous research on error processing has focused on distinguishing between “right” and “wrong”, action accuracy is in some contexts represented on a scale from completely correct to completely wrong, with multiple steps in between. The error-related negativity (ERN), a negative event-related potential component, has been found to be larger after errors than after correct actions. It remains open, however, if error processing reflected in the ERN is binary or if it distinguishes between severe and less severe errors. In the present study, we aimed to investigate this question in a setting with high ecological validity by means of electroencephalography in 20 pianists. Pitch errors on the piano can be measured by the number of keys between the actual and the correct note; thus, we distinguished between small (one note off) and large errors (two notes off). We performed a mixed linear model analysis on single-trial ERN amplitudes with the factor event type (correct, small error, large error). We found a significant effect of event type ($p < .001$), with significant differences between small errors and both correct events, ($p = .002$, $b = 0.63$; smaller amplitudes for correct events) and large errors, ($p = .001$, $b = -1.18$; larger amplitudes for large errors). This suggests that errors in the brain are coded not as an all-or-nothing-concept, but as a function of how much the actual action differs from the predicted correct action.

P1.038 - Modulation of self-control by acute and chronic stress

J. Stein[1], **F. Korb**[1], **E. Sinning**[1], **C. Kirschbaum**[1], **T. Goschke**[1], **K. Zwosta**[1]

TU Dresden, Deutschland

Decisions requiring self-control involve conflicts between immediate gratification and long-term goals. In everyday life, these decisions are often made in stressful situations. Stress is known to impair prefrontal cortex functioning and was shown to compromise self-control performance. However, the neural underpinnings of the effects of acute and chronic stress on self-control remain largely unexplored. Our project is currently ongoing and addresses this research gap in a high-powered study. Our experimental design combines a standardized stress induction protocol, a state-of-the-art collection of biomarkers of acute and chronic stress, and a modified version of an established fMRI self-control paradigm involving imaginary everyday life decisions. We hypothesize that acute stress will reduce the impact of anticipated long-term action consequences and increase the impact of short-term consequences on value representations in the brain, and will enhance the influence of immediate outcomes on decisions. We expect acute stress to alter functional connectivity between brain areas representing decision values and brain regions implicated in processing salience and in exerting cognitive control. Additionally, we will explore the extent to which the hypothesized effects are moderated by chronic stress. Here, we show behavioral data supporting the validity of our task, physiological data demonstrating a successful stress induction despite reduced social cues due to wearing face masks, and neural data indicating that the vmPFC encodes decision values in imaginary scenarios. Once completed, our work will be among the first to demonstrate how acute and chronic stress modulate neural mechanisms of self-control and to link these effects to self-control performance.

P1.039 - The effects of working memory load on conscious and unconscious neural processing of task-unrelated acoustic stimuli

L. Brockhoff[1], L. Vetter[1], M. Bruchmann[1,2], S. Schindler[1,2], R. Moeck[1], T. Straube[1,2]

[1] Institute of Medical Psychology und Systems Neuroscience, University of Muenster
[2] Otto Creutzfeldt Center for Cognitive and Behavioral Neuroscience, University of Muenster

High task load has been proposed to affect the processing of task-unrelated information. However, the role of stimulus strength and the extent of this impairment is unclear. Here, we investigated effects of working memory load on perception and event-related potentials (ERPS) to auditory distractor sounds at different intensity levels (i.e., below, at, and above perception threshold). We found that high as compared to low working memory load reduced the perception of sounds. Late but not early potentials were significantly affected by task load. Regardless of load, perceived vs. unperceived sounds evoked an awareness-related negativity and an increased P3. Thus, our study suggest that working memory load affects processing of task-unrelated stimuli but that neural correlates of consciousness are not distorted by task load.

P1.040 - Anticipatory and task-specific allocation of cognitive effort modulates EEG low frequency dynamics during task preparation

N. Liegel[1], **D. Schneider**[1], **E. Wascher**[1], **S. Arnau**[1]

Leibniz Research Centre for Working Environment and Human Factors, Germany

Cognitive effort positively affects task performance. Neuroscientific studies have explored the underlying mechanisms by manipulating the expected monetary incentive associated with successful task performance. Some studies implemented this manipulation by presenting task- and stimulus-unspecific incentive cues prior to the task so that anticipatory allocation of cognitive effort is possible. Other studies linked reward to specific aspects of the task itself, so that the deployment of effort cannot be planned. In the present study, we extend both approaches to test how preparatory and task-specific effort affects performance and EEG activity.
28 participants performed a nested task design comprising a cued number classification task during the retention interval of a cued working memory task. Each trial started with a relevance cue indicating which of the two tasks would be more important in the upcoming trial. Subjects were told to engage in both tasks, but to concentrate on the important task. Feedback was given at the end of each trial. Feedback scores were calculated based on the actual task performance, with scores obtained from the relevant task being tripled.
Participants performed significantly better in either task when it was important compared to when not. A cluster-based permutation test performed on time-frequency decomposed EEG data revealed that this behavioral effect was accompanied by modulations of theta, alpha and beta oscillatory power, predominantly during time intervals associated with preparatory processes. The results indicate that the human information processing system is capable to selectively prioritize relevant aspects of a task by deploying proactive cognitive control.

P1.041 - Opposing effects of intentionally reduced effort and adverse examiner intervention on cognitive control in a simulated neuropsychological assessment scenario

J. Schott[1], **H. Niehaus**[1], **M. Wilbert**[1], **M. Peper**[1]

Phillips Universität Marburg

The intentional manipulation of test taking behavior to achieve a favorable outcome is a pertinent problem of formal (neuro-)psychological assessments. A necessary countermeasure in identified situations of malingering is an intervention by the examiner to point out potential disadvantageous effects of performance manipulations. However, poor effort of the examinee as well as intervention by the examiner may both affect subsequent cognitive processing differently. In particular, this conflict may impose cognitive load additionally limiting working memory (WM) resources of the examinee. According to the model of dual cognitive control (CC; Braver, 2012), WM includes a proactive and reactive component. The first is expected to be more resource-dependent than the latter. Therefore, intentionally controlled effort manipulation is expected to affect reaction time (RT) indicators of proactive WM to a greater degree. On the other hand, negative affect due to the preceding examiner's intervention may induce upregulation of CC and alleviate behavioral responding. Here, we inspected relative effects of effort and social interaction on CC in the context of a mock-assessment. The results confirmed that participants voluntarily manipulated RT predominantly affecting proactive WM performance. Although augmented conflict-related inhibitory control could be expected as a consequence of the examiner's interventions, accelerated RTs were observed indicating increased effort and upregulated CC to resolve the conflict. The current results emphasize the necessity to consider the counteracting effects of intentional effort and interactive social communication on WM function subserving cognitive control. This further clarifies the motivational mechanisms governing effort and executive functioning in formal (neuro-)psychological assessments.

P1.042 - Conjunctive coding of the past and present impairs human behavior

J. Weber[1,2], G. Iwama[1,2], A. Solbakk[3], P. G. Larsson[4], R. T. Knight[5], T. Endestad[3], R. Helfrich[1]

[1] Hertie Institute for Clinical Brain Research, Center for Neurology, University Medical Center Tübingen, Tübingen, Germany.
[2] International Max Planck Research School for the Mechanisms of Mental Function and Dysfunction, University of Tübingen, Tübingen, Germany.
[3] Department of Psychology, University of Oslo, Oslo, Norway
[4] Department of Neurosurgery, Oslo University Hospital, Oslo, Norway
[5] Helen Wills Neuroscience Institute, UC Berkeley, Berkeley, CA, USA

The process of decision making is inherently biased towards previously taken actions, a phenomenon called serial dependence. It has been suggested that the brain uses serial dependences to infer moment-to-moment correlations (e.g. predictive coding). Yet, the brain frequently needs to dynamically switch between different task sets that require different actions. Within a dynamic environment, serial dependences could become maladaptive and adversely affect future behavior (e.g. cost of task-switching). Yet, the neural mechanisms underlying behavioral costs of switching remain elusive. Here, we combined a context-specific stop-signal task with human intracranial EEG recordings (iEEG) in prefrontal and motor areas to address this gap. Successfully replicating previous behavioral work on task-switching, we found that switching action requirements between two successive trials comes at a behavioral cost. By combining uni- and multivariate analysis of the iEEG data, we found that the magnitude of information present about task history in PFC, but not motor cortex, was proportional to the inter-individual cost of switch. Furthermore, the level of information present about the irrelevant task history was inversely correlated with the information present about the current relevant task-context. Thus, individuals with a high cost of switching showed high history-, but less context-coding and vice versa. Finally, we found that the overlap of coding subspaces for task history and context could be directly mapped onto the inter-individual cost of switching. Collectively, this demonstrates that the cost of task-switching underlies a form of resource competition due to conjunctive coding of the past and present in the human prefrontal cortex.

P1.043 - A trial-wise gripforce model reveals effects of model-based values on response vigour during intertemporal choice

E. Smith[1], **J. Peters**[1]

Department Psychologie, Universität zu Köln, Deutschland

Metrics of value-based decision making are typically based on choice and response time data. Building on evidence that valuation is reflected in response vigour (Pessiglione et al., 2007; Reppert et al., 2015), we probed gripforce and fixations as implicit measures of subjective utility. In an intertemporal choice task, participants selected an option by pressing a gripforce transducer, while we tracked fixation shifts between options. Payouts were unrelated to the generated forces. Following our preregistered analyses (https://osf.io/k6jct), we modelled choices and response times using hierarchical Bayesian parameter estimation. For the trial-wise gripforce trajectories, we applied a novel approach using a Gaussian model. Assuming hyperbolic discounting, we analysed associations between gripforce parameters and subjective values derived from softmax and drift diffusion models. Replicating previous findings (Green et al., 1997; Wagner et al., 2020), we found a magnitude effect for temporal discounting, such that higher rewards were discounted less. This effect also manifested in response vigour: Stronger forces were produced in the high vs. the low magnitude condition. Further, higher gripforces, faster response times and fewer fixation shifts were found for trials with higher subjective value differences. Exploratory analyses revealed that subjective value sums across options were stronger related to trial-wise gripforce amplitudes, and combined model-based gripforce measures were better associated with subjective values than model-free metrics. Our data show that subjective utility is reflected in gripforce and visual fixations during intertemporal choice. Considering response vigour might provide deeper insight into reward valuation and maladaptive changes in decision making, e.g. in neuropsychiatric disorders.

P1.044 - Effects of methylphenidate on the motivation of flexible and focused cognitive control

M. I. Froböse[1], J. C. Swart[2], J. L. Cook[3], D. E.M. Geurts[4], S. J. Fallon[5], H. E.M. d. Ouden[2], R. Cools[2,4]

[1] Heinrich Heine University, Düsseldorf, Germany
[2] Donders Institute for Brain, Cognition and Behavior, Nijmegen, The Netherlands
[3] University of Birmingham, UK
[4] Radboud University Medical Centre, Nijmegen, The Netherlands
[5] University of Bristol, UK

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 have suggested that such cognitive control effects might also 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 20mg 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 probing distractor inhibition (i.e. focus) and flexible updating of working memory representations 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 at the cost of flexible updating and hypothesized that methylphenidate would alter the effect of motivation on distractor inhibition versus flexible updating. Results indicate that both methylphenidate and incentive motivation improved task performance (i.e. accuracy) on both flexible and stable conditions. Furthermore, methylphenidate speeded performance on distractor-inhibition relative to flexible updating trials, depending individual differences in working memory capacity. The results from these preliminary analyses strengthen previous observations, but leave open for further analyses the question whether methylphenidate also has more subtle effects on the motivation of cognitive control.

P1.045 - Parameterization of Slow Cortical Potentials During States of Tension and Relaxation and the Moderating Role of Trait and State Variables Linked to Action Control

M. Hense[2,4], L. Hecker[1,2,3,4], E. Pfeifer[5,6], M. Wittmann[2], S. Schmidt[1,2]

[1] Department of Psychosomatic Medicine and Psychotherapy, Medical Faculty, Medical Center - University of Freiburg, Freiburg, Germany
[2] Institute for Frontier Areas of Psychology and Mental Health, Freiburg, Germany
[3] University Medical-Center, University of Freiburg, Freiburg, Germany
[4] Faculty of Biology, University of Freiburg, Freiburg, Germany
[5] Catholic University of Applied Sciences, Freiburg, Germany
[6] Sigmund Freud University Vienna, Faculty of Psychotherapy Science, Austria

Slow cortical potentials (SCPs) have functions in threshold regulation for local excitation and inhibition of cortical networks and have been shown to play an important role in voluntary action regulation, attention and motivation. Several studies have examined SCPs in event-related studies, and could show that the amplitudes of the readiness potential (RP) and the contingent negative variation (CNV) - components of SCPs - are altered in people with depressive disorders or ADHD. SCPs are also accessible through neurofeedback and can be self-regulated, leading to a reduction in symptoms of mental disorders. So far, researchers have only shed light on event-related SCPs preceding or surrounding certain events. The purpose of this study is to parameterize ongoing SCPs during two different states of readiness and to provide a basic parameterization of this so far neglected EEG-signal.
The challenge was to find standardized conditions which reliably induce states of relaxation and tension. SCPs were measured via EEG during seven minutes in which participants were either relaxed (relaxation condition) or in a state of high preparedness (expectancy condition). Level of relaxation as well as levels of motivation were assessed by questionnaires. The aim of this study was to find reliable and meaningful parameters to describe ongoing SCPs during the abovementioned states, wherefore a broad set of parameters suitable for the characterization of fluctuations are tested. First results show that both peak-to-peak amplitude and latency likely play a role in different states of action control.

P1.046 - Investigating Error Monitoring From an Affective Perspective: Association Between Valence Evaluation, Neural Indices, and Autonomic Arousal in Healthy Individuals and Patients With OCD

L. Balzus[1,2], **F. Jüres**[1], **N. Kathmann**[1], **J. Klawohn**[1]

[1] Department of Psychology, Humboldt-Universität zu Berlin, Germany
[2] Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Germany

Research on error monitoring has begun to address the role of affect and motivation. So far, little is known about the nature of affective processes accompanying error monitoring and how they relate to autonomic arousal and neural indices. In two experiments we investigated associations between the valence appraisal of actions, skin conductance response (SCR), and the error-related negativity (ERN) in healthy individuals and patients with obsessive-compulsive disorder (OCD).
To capture the valence appraisal of actions, we used an affective priming paradigm in which responses in a go/no-go task served as primes for a subsequent categorization of affective words as positive or negative. During this paradigm, SCR was recorded in healthy individuals (experiment 1, N = 30) and EEG was recorded in patients with OCD and healthy controls (experiment 2, N = 56).
Both experiments indicated that errors were followed by faster categorization of negative words, hits by faster categorization of positive words. This priming effect after errors was diminished in patients with OCD. A trial-level association of the valence appraisal was found neither with SCR nor with the ERN.
Our findings support the notion that valence is automatically assigned to own actions, with errors being evaluated as negative and correct actions as positive. In OCD, the valence appraisal of errors seems hampered, presumably due to interfering processes (e.g., worry). Our results further suggest that the valence appraisal operates independently of autonomic arousal and neural correlates of error monitoring, indicating that underlying processes may serve different roles in promoting adaptive behavior.

P1.047 - EEG correlates of cognitive effort during cued task-switching

S. Arnau[1], **N. Liegel**[1], **E. Wascher**[1]

Leibniz Research Centre for Working Environment and Human Factors, Dortmund

When engaging cognitive work, individuals do rarely perform as good as they could. The theoretically attainable level of performance is determined by the task characteristics, the skill of the individual, and the available cognitive resources. The realized level of performance, however, is also determined by a set of intervening cognitive processes. These processes are referred to as cognitive effort. The expenditure of effort scales with the expected outcome of successful engagement. In the present EEG study, we investigate the influence of effort in a cued switching task using a monetary incentive delay paradigm to manipulate the subjective value of goal-directed action. The participants performed in a visual search task, in which they had to either identify the stimulus with diverging color or the one with diverging orientation. The analysis of time-frequency decomposed EEG data suggest that cognitive effort affects proactive control processes during the cue-target interval as well as reactive control processes during the visual search task itself. During the cue-target interval, frontal theta power was increased in high reward versus low reward trials, and parietal alpha power was decreased. Both observations have previously been linked to proactive cognitive engagement. Oscillatory dynamics of parietal alpha in response to the probe display showed significant main effects for the factors reward and task-switching, as well as a significant interaction. The decrease of parietal alpha in switch compared to repeat trials was even stronger in high reward trials.

P1.048 - Distilling neural correlates of consciousness during the attentional blink

T. Dellert[1,2], **S. Krebs**[1], **M. Bruchmann**[1,2], **S. Schindler**[1,2], **A. Peters**[1,2], **T. Straube**[1,2]

[1] Institute of Medical Psychology and Systems Neuroscience, University of Münster
[2] Otto Creutzfeldt Center for Cognitive and Behavioral Neuroscience, University of Münster

In search of the neural correlates of consciousness (NCC), several event-related potential (ERP) candidates have been proposed, most prominently the early visual awareness negativity (VAN) and the late P3b component. Particularly influential support for the P3b comes from studies exploiting the attentional blink (AB), where conscious perception of a first visual target (T1) impairs reporting a second target (T2) presented in rapid succession. Recent studies using other paradigms, which circumvented trial-by-trial awareness reports, suggest that the P3b component may reflect task-related post-perceptual processes associated with decision-making rather than awareness. However, such no-report studies are limited in their awareness assessment, and their conclusions have not been tested in an AB paradigm. The present study (N = 45) employed a novel AB paradigm that reduced decision-making processes by omitting a discrimination task on T2 stimuli and rendering their relevance uncertain. Nevertheless, awareness was assessed trial by trial. Contrasting ERPs in response to seen versus unseen T2 stimuli revealed a VAN but no enhanced P3b regardless of whether they were marked as distinct from distractor stimuli or not. Our results support the VAN and challenge the P3b as NCC despite rigorous trial-wise assessment of conscious perception.

Topic 5: Attention and Perception

P1.049 - Differential effects of prediction error and adaptation along the auditory cortical hierarchy during deviance processing

I. Schloßmacher[1,2], **M. Bruchmann**[1,2], **T. Straube**[1,2]

[1] Institute of Medical Psychology and Systems Neuroscience, University of Münster
[2] Otto Creutzfeldt Center for Cognitive and Behavioral Neuroscience, University of Münster

Hearing unexpected changes in regular auditory input is important for perception and action. On a neural level, rare auditory events, i.e., deviants, are accompanied by a stronger response than frequent standards. These deviance responses have been proposed to rely on different mechanisms, including prediction error-related activity and adaptation to frequent stimuli. How these mechanisms vary along the auditory cortical hierarchy is yet unknown. One way to delineate the contribution of these two mechanisms to deviance effects is to compare the responses of deviant and standard stimuli to a control stimulus. In the current study, we recorded blood oxygenation level-dependent (BOLD) responses while participants (N = 54) listened to an auditory oddball sequence as well as a suited control condition. In addition to effects in sensory processing areas, we found several distinct clusters in frontal and parietal areas as well as the insula that indexed deviance processing. In line with predictive processing accounts, prediction-error related processes increased with the hierarchical position of the brain area while adaptation declined. This suggests that the relative contribution of these mechanisms in deviance processing varies systematically across the cortical hierarchy.

P1.050 - Music tempo influences performance and emotional state in a visual oddball task

A. Dienst[1], **J. Keil**[2]

[1] Technische Universität Berlin
[2] Universität Kiel

Introduction: Vigilance is crucial in performing surveillance tasks, which are increasingly found in modern work environments. Maintaining vigilance is "hard and stressful" (Warm et al., 2006), so workers rely on several methods to manage their well-being, one of which is music. Previous research indicates that music tempo might modulate emotional states. Yet little is known regarding the influences of musical parameters on vigilance performance. Therefore, this study investigated possible influences of music tempo on vigilance in a visual oddball paradigm.
Methods: In a randomized controlled online study, 52 participants performed a visual oddball task while hearing instrumental music in three different tempi (slow, medium, and fast, range 60-96 bpm) or white noise as control. Response times and hit rates were measured. Additionally, participants intermittingly rated positive and negative activation and valence as measures of emotional state.
Results: There was a significant time-on-task effect indicating the occurrence of vigilance decrement. Comparing music conditions, response times on oddballs were faster while listening to slow music, but only on a level of $p < .10$. There were no differences in hit rates. Positive activation was lowered by slow music but restored by fast music in comparison to baseline. Negative activation was increased by white noise but lowered by slow music. Valence was lowered by noise but restored by all music versions.
Discussion: Listening to instrumental music seems promising for restoring well-being in performing vigilance tasks. Especially slow ambient piano music lowers activation levels while restoring valence and possibly improving response times.

P1.051 - Longitudinal development of distributed responses in ventral temporal cortex in children is linked to face recognition and reading performance

M. Nordt[1,2], **J. Gomez**[3], **V. Natu**[1], **A. Rezai**[1], **D. Finzi**[1], **H. Kular**[1], **K. Grill-Spector**[1,4,5]

[1] Department of Psychology, Stanford University, Stanford, CA, US
[2] Klinik für Kinder- und Jugendpsychiatrie, Uniklinik Aachen
[3] Princeton Neuroscience Institute, Princeton University, Princeton, NJ, US
[4] Neurosciences Program, Stanford University, Stanford, CA, US
[5] Wu Tsai Neurosciences Institute, Stanford University, Stanford, CA, US

Ventral temporal cortex (VTC), which is involved in the perception of visual categories, undergoes prolonged development during childhood. Studies using univariate measures have revealed that while face- and word-selective regions grow during childhood, limb-selective regions shrink. However, little is known about the development of distributed category information in VTC and whether it is linked to behavior. We acquired longitudinal fMRI data in 29 children (128 functional sessions overall) to assess distributed category representations in VTC. Children, who were initially 5-12 years old, participated for 1 to 5 years. During scanning children viewed images of 10 categories including faces, bodies, characters, objects, and places. To assess distributed representations, we generated a representational similarity matrix (RSM) per session and tested if category distinctiveness develops with age. Distinctiveness is defined as the within-category minus between-category similarity of distributed responses. Results revealed that distinctiveness for faces and houses increased in lateral VTC. Distinctiveness for words increased in the left hemisphere and distinctiveness for numbers in the right hemisphere, while distinctiveness for limbs decreased. These effects were significant across selective voxels in lateral VTC (union of category-selective voxels, defined for each category vs. all other categories), but not in non-selective voxels. Finally, we tested whether these changes were related to behavior. Reading performance was related to distinctiveness for words in left lateral VTC selective voxels and face recognition memory performance was related to distinctiveness for faces in right lateral VTC selective voxels. These results advance our understanding of the development of category representations in VTC.

P1.052 - The THINGS initiative: a global large-scale effort for the representative study of objects in brains, behavior, and computational models

O. Contier[1,3], **L. Teichmann**[2], **C. I. Baker**[2], **M. N. Hebart**[1,2]

[1] Max Planck Institut für Kognitions- und Neurowissenschaften, Deutschland
[2] National Institute of Mental Health, USA
[3] Max Planck School of Cognition, Deutschland

How are we able to make sense of the visual world around us and act on it in a meaningful way? Progress in addressing these challenging questions has been hindered by three aspects: (1) the scale of previous studies, (2) the representativeness of the sampled stimuli, and (3) the comparability of datasets that are based on different stimuli. To overcome these challenges, here we present the THINGS initiative (https://things-initiative.org/), a global concerted effort across many laboratories and disciplines to collect and share behavioral and neuroscience data using the same large-scale database of 1,854 object concepts and 26,107 object images. The THINGS initiative comprises many modalities, including human and macaque electroencephalography and intracortical electrophysiology data, rich metadata about the object concepts and images, and memorability scores for each image. As an outset to these multimodal data, here we focus on our own contribution to the THINGS initiative, including densely-sampled fMRI (N=3; 8,740 unique images), densely-sampled MEG (N=4; 22,448 unique images), and a large-scale behavioral dataset ($\tilde{5}$ million odd-one-out similarity judgements). We then showcase their broad potential for hypothesis testing, exploratory analysis, and multimodal approaches. Together with a growing number of contributors, we hope to provide publicly-available datasets of visual recognition and semantic knowledge that bridge the gap between brain and behavior, recording techniques, species, and artificial intelligence.

P1.053 - A neurodevelopmental case of severe impairments in mid-level vision but intact higher-level vision

S. Weigelt[1], **M. Nordt**[2], **K. Limbach**[1], **S. Rüsing**[1], **R. Walthes**[1]

[1] Vision, Visual Impairment & Blindness, Department of Rehabilitation Sciences, TU Dortmund, Deutschland
[2] Developmental Cognitive Neuroscience, Uniklinik RWTH Aachen, Deutschland

The general notion of visual development is that basic visual functions develop before more complex ones. Here, we report a neurodevelopmental case that seems to contradict this notion: A young women, LS, whom we repeatedly assessed since 2006, shows severe impairments in mid-level, but intact higher-level vision and no previous illnesses/incidents that might have caused these problems. LS is mildly hyperopic with normal oculomotor functions. Visual acuity is in the normal range as is color vision and her visual field. LS shows severe impairments in tests on contour, shape, and texture recognition as well as coherent motion (VOSP, BORB, L-POST) and peculiar eye movements when performing these tests, consummately tracing lines and outer contours with her gaze. Higher-level vision such as biological motion, object recognition based on real photographs as well as the recognition of letters and numbers is normal, although in part effortful and slow. For face recognition, LS even demonstrates above average performance (Benton, CFMT, GFMT, Jenkins/Telling faces apart/together), e.g. 96,4% on the GFMT long version. Furthermore, she is able to identify celebrities even based on line drawings or Mooney faces faster and more accurate than controls. LS is well aware of her visual "peculiarities", her "tracking strategy" as well as her superior face recognition skills. MRI revealed no obvious brain damage. fMRI shows clear face-selective brain regions in ventral visual cortex, while neither cars nor houses elicited the typical patterns. In summary, this neurodevelopmental case provides an astonishing dissociation between mid-level and higher-level vision.

P1.054 - Causal evidence for the role of the frontoparietal network in rhythmic attentional sampling

I. Raposo[1], **S. Szczepanski**[2], **K. Haaland**[3], **T. Endestad**[4], **A. Solbakk**[4], **R. T. Knight**[2], **R. Helfrich**[1]

[1] Hertie Institute For Clinical Brain Research, Germany
[2] Helen Wills Neuroscience Institute, UC Berkeley
[3] Dept. of Psychiatry and Behavioral Sciences, University of New Mexico Health Sciences
[4] Department of Psychology, University of Oslo

Contemporary models of attention suggest that the environment is sampled in a rhythmic manner at around 4 Hz, with alternating periods of heightened and diminished perceptual sensitivity. Neuroimaging studies have implicated frontal and posterior parietal cortical areas, commonly referred to as frontoparietal network (FPN), in attentional control. Yet, it remains unclear if the FPN is causally involved in rhythmic attentional sampling. To test this, we recorded scalp EEG and eye-tracking from patients with focal lesions in either PFC or PPC, while they performed a spatial attention task. Participants were cued to allocate their attention to either the left or right visual hemifield and after a variable cue-target interval (1000 – 2000 ms), which was used to assess behavior as a function of time, a target was shown. Our results reveal increased rhythmic behavioral sampling in the theta (2-7 Hz) and alpha (12-16 Hz) bands in patients. At optimal sampling phases, patients performed on par with healthy controls, while performance was decreased during phases of already diminished sensitivity. A highly comparable pattern with increased power in theta and alpha frequency bands was observed in the EEG data. Correlation analyses revealed that enhanced low frequency activity predicted increased behavioral fluctuations. Furthermore, voxel-based spectral lesion mapping revealed that PFC is causally involved in theta-band sampling, while PPC mediates alpha-band sampling. Our findings demonstrate that lesions in the attention network impair attentional sampling in a phase-dependent manner and that lesion-induced EEG slowing has immediate effects on the temporal dynamics of cognition.

P1.055 - Sound processing in everyday life: A mobile ear-EEG study

D. Hölle[1], **M. G. Bleichner**[1]

Universität Oldenburg, Deutschland

Environmental sounds, even when they are soft, can disturb and annoy people. Yet, not everyone exposed to environmental sounds is annoyed or stressed by them: there are large inter-individual differences.
To study these differences, we are conducting recordings with smartphone-based mobile electroencephalography (EEG) around the ears (cEEGrids) in the lab and in everyday life. We present sounds (paired-click paradigm) and also record the environmental sounds as privacy-aware acoustic features (loudness, power spectral density, sounds onsets). Twenty participants are recorded for 4 hours (1 hour lab, 3 hours everyday life).
In the everyday life recording, participants follow daily activities (studying, reading, Netflix etc.) in an office while they are sporadically presented with clicks. They receive no further instructions. To answer how they perceive the sounds in everyday life, we generate reference conditions of sound processing in the lab that can then be related to the default sound processing of an individual in everyday life. We create three different modes of processing clicks where participants actively or passively listen to sounds or should ignore them.
With this paradigm we can, first, study event-related potentials (ERPs) in relation to experimentally controlled sounds (i.e., the presented clicks) and compare the controlled lab conditions to everyday life. Second, we can study ERPs in relation environmental sounds that are not under experimental control. This provides us with a unique possibility to study sound perception for extended periods of time in an individual. We will discuss practical aspects of data recording and the results.

P1.056 - Listen to me! Auditory attention in online meetings

M. Stollmann[1], **B. Holtze**[1], **M. Jäger**[1], **B. Mirkovic**[1], **S. Debener**[1]

University of Oldenburg

The COVID-19 pandemic gave online meetings unprecedented relevance. Almost all areas of life had to be converted to digital formats at short notice. While there is no reliable evidence for changes in performance, previous research suggests lower subjectively perceived engagement and attention as well as less satisfaction with online meetings in general. To date, however, there is a lack of studies objectively measuring attention in different meeting formats. The present study aims to evaluate the change of the listener's attention in online as compared to meetings in presence. To this end, eight participants underwent two different experimental conditions in which they either attended a lecture in presence or participated in an online lecture. After each block, behavioral data such as content-related questions, listening effort and fatigue were collected. Mobile EEG as well as audio data from the lecture were recorded and serve to track the neural representation of the continuously presented speech – a phenomenon called neural speech tracking. It can be used to quantify the listener's attention and is expected to increase during the latter. The results show a non-significant difference in neural speech tracking between the two conditions. However, the behavioral data indicate higher levels of listening effort and fatigue in the online condition, the difference in fatigue proving to be significant. Moreover, the proportion of correct answers tends to be higher in presence as opposed to online meetings. This pilot study yields promising results while providing important implications for the following main study.

P1.057 - Sensory attenuation of auditory-visual action effects

S. Ayatollahi[1], **C. Bermeitinger**[1], **P. Baess**[1]

University of Hildesheim, Germany

Previous research showed that the sensory consequences of self-initiated sounds are attenuated as indicated by the auditory N1 suppression effect compared to externally-initiated sounds. This effect has also been shown in the visual domain, however, here, self-intiated pictures triggered either an attenuated N1 response or an enlarged N1 response. The primary aim of the present study was to address the question whether or not the electrophysiological suppression of self-initiated stimuli also occurs when auditory and visual stimuli are presented simultaneously.
The present study investigated this by employing three conditions, an auditory condition with self-initiated sounds, a visual condition with self-initiated pattern reversals of a checkerboard, and an auditory-visual condition with simultaneously occurring self-iniated sounds and pattern reversals. For each condition, externally-generated sounds or pattern reversals were collected in a separate block in order to compare them with the self-initiated ones.
The physical stimulus features were identical for the self-initiated and externally-initiated sounds and pattern reversals. EEG was recorded from 27 subjects. Preliminary results showed sensory attenuation in those conditions including auditory and auditory-visual stimuli. However, no sensory attenuation was found for the visual condition. Furthermore, our analysis has important implications for understanding how perception could be influenced by self-initiated sensations across different sensory modalities.

P1.058 - Reward-based multi-session attentional bias modification: A longitudinal EEG study

S. Kang[1], **R. Osinsky**[1]

Universität Osnabrück, Deutschland

Attentional biases towards threat (i.e. the preferential processing of socially threatening stimuli) are postulated to play a causal role in the etiology and maintenance of anxiety disorders (MacLeod et al., 1986). The attentional bias modification (ABM) approach is based on the deliberate manipulation of these biases in order to alleviate symptoms. Typical procedures have involved spatial contingencies between stimuli, designed to direct attention away from specific stimuli towards others, with the outcome measured by reaction time differences (MacLeod et al., 2002). However, recent research using these methods has produced inadequate results in terms of effectiveness and reliability.
In this study, we aimed to improve upon existing procedures in multiple ways. We used an ABM paradigm based on reward contingencies (Sigurjónsdóttir et al., 2015) in a bid to utilize value-driven attentional processes as well as increase intrinsic motivation. Also, instead of measuring attentional bias and its changes via reaction times, we use the N2pc component of the EEG for this purpose, which has been demonstrated to be more suitable (Reutter et al., 2017). Furthermore, we created a smartphone app as a deployment tool for the ABM training (as opposed to laboratory- based training sessions). Healthy subjects (N = 100) completed at least 10 training sessions at home on their own devices over the course of 4 weeks. Prior and following this training period, they underwent a series of tests at our laboratory, including EEG measurement. We will present and discuss preliminary data from this study.

P1.059 - Spontaneous alpha-band oscillations modulate stimulus-specific features representation

E. Balestrieri[1,2], R. Schweitzer[3,5], L. Kroell[3,4], M. Rolfs[3,4,5], N. A. Busch[1,2]

[1] University of Muenster, Germany
[2] Otto Creutzfeldt Center for Cognitive and Behavioral Neuroscience, Germany
[3] Department of Psychology, Humboldt-Universität zu Berlin, Germany
[4] Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Germany
[5] Cluster of Excellence 'Science of Intelligence', Technische Universität Berlin, Germany

Perception varies between observers, as it does within the same observer at different moments in time, even if the stimulus is held constant. Numerous studies have demonstrated that moment-to-moment fluctuations in neuronal excitability, indicated by spontaneous neuronal oscillations in the alpha-band range, are related to this variability in perceptual decision making.
Specifically, strong alpha power has been shown to induce a more conservative criterion in signal detection tasks, thereby reducing the number of correctly detected stimuli. However, the exact mechanism of this effect is largely unknown: do alpha oscillations modulate observers' stimulus-independent decision strategy or the subjective evidence for the specific to-be-detected stimulus? To tackle this question, we recorded EEG from human observers (N=30) who performed a detection task with target gratings of a specific orientation and spatial frequency embedded in gaussian noise. We then used a reverse-correlation analysis to test how random, noise-induced variations in target-specific and unspecific features affected observers' decisions. Specifically, we convolved all presented stimuli with a set of gabor filters of different orientations and spatial frequencies and tested for which stimulus features prestimulus alpha power had the strongest effect on perceptual decisions.
Results confirmed that strong prestimulus alpha power reduced the number of correctly reported stimuli. Importantly, this effect was restricted to the features of the to-be-detected stimulus. This finding suggests that the state of neuronal excitability at the moment of stimulus presentation shapes the subjective perception of task-relevant stimulus features.

P1.061 - Investigating EEG correlates of bottom-up and top-down processing during perceptual uncertainty

M. Maschke[1,3], E. Joos[5], J. Kornmeier[1,2,4], S. P. Heinrich[6]

[1] Institut für Grenzgebiete der Psychologie und Psychohygiene e.V., Germany
[2] Department of Psychiatry and Psychotherapy, Medical Center—University of Freiburg, Germany
[3] Faculty of Biology, University of Freiburg, Germany
[4] Faculty of Medicine, University of Freiburg, Germany
[5] INSERM U1114, Cognitive Neuropsychology and Pathophysiology of Schizophrenia, University of Strasbourg, France
[6] Section for Functional Vision Research, Eye Center, Medical Center—University of Freiburg, Faculty of Medicine, University of Freiburg, Freiburg, Germany

Our visual system must continuously analyse stimuli of varying visibility to build stable, dependable percepts. So far, theories about perceptual processing, postulating recurrent feedforward and feedback activity challenge theories about strict feedforward spatio-temporally hierarchical perceptual processing. To test for these different approaches, we executed an EEG study where participants had to identify the orientation of Landolt C stimuli which varied in size to represent three levels of recognisability (clearly above the threshold, slightly above the threshold, and below the threshold). We compared the temporal and spatial profiles of perceptual processing steps for the different stimuli, using the high temporal resolution of event-related potentials (ERPs).
We report evidence for intertwined bottom-up and top-down processing. The latency of the P1 component decreases with increasing stimulus size. The amplitudes of the P1 and the N1 components differ binarily between below-threshold and (both, clearly and slightly) above-threshold stimuli. Two later ERP components 200 ms (P200) and 400 ms post-stimulus showed larger amplitudes in response to clearly above-threshold stimuli compared to the other two stimulus sizes. The latter two effects were labelled as 'Uncertainty Effects' in previous studies.
The P1 latency effect indicates low-level sensory processing. The P1 and N1 amplitude effects may indicate an intermediate yet subconscious visibility-processing step. A mere 30-70 ms after this low- and intermediate-level processing, meta-perceptual analyses of stimulus uncertainty characteristically modulate cortical processing (P200 and P400). This rapid succession suggests an inherently interwoven flow of information.
Acknowledgements: We thank the Deutsche Forschungsgemeinschaft (HE 3504/9-1; 435838478) for financial support.

Topic 6: Brain and Periphery, Neuroendocrinology, and Stress

P1.063 - Short-term high-fat feeding induces a reversible net decrease in synaptic AMPA receptors in the hypothalamus

J. Liu[1], S. Dimitrov[1,2,3], A. Sawangjit[1], J. Born[1,2,3], I. Ehrlich[4,5], M. Hallschmid[1,2,3]

[1] Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen, Tübingen, Germany
[2] German Center for Diabetes Research (DZD), Tübingen, Germany
[3] Institute for Diabetes Research and Metabolic Diseases of the Helmholtz Center Munich at the University Tübingen (IDM), Tübingen, Germany
[4] Hertie Institute for Clinical Brain Research and Center for Integrative Neuroscience, University of Tübingen, Tübingen, Germany
[5] Department of Neurobiology, Institute for Biomaterials and Biomolecular Systems, University of Stuttgart, Stuttgart, Germany

Dietary obesity compromises brain function, but the effects of high-fat food on synaptic transmission in hypothalamic networks, as well as their potential reversibility, are yet to be fully characterized. We investigated the impact of high-fat feeding on a hallmark of synaptic plasticity, i.e., the expression of glutamatergic α-amino-3-hydroxy-5-methyl-4-isoxazole propionic acid receptors (AMPARs) that contain the subunits GluA1 and GluA2, in hypothalamic and cortical synaptoneurosomes of male rats. In the main experiment (experiment 1), three days, but not one day of high-fat diet (HFD) decreased the levels of AMPAR GluA1 and GluA2 subunits, as well as GluA1 phosphorylation at Ser845, in hypothalamus but not cortex. In experiment 2, we compared the effects of the three-day HFD with those a three-day HFD followed by four recovery days of normal chow. This experiment corroborated the suppressive effect of high-fat feeding on hypothalamic but not cortical AMPAR GluA1, GluA2, and GluA1 phosphorylation at Ser845, and indicated that the effects are reversed by normal-chow feeding. High-fat feeding generally increased energy intake, body weight, and serum concentrations of insulin, leptin, free fatty acids, and corticosterone; only the three-day HFD increased wakefulness assessed via video analysis. Results indicate a reversible down-regulation of hypothalamic glutamatergic synaptic strength in response to short-term high-fat feeding. Preceding the manifestation of obesity, this rapid change in glutamatergic neurotransmission may underlie counter-regulatory efforts to prevent excess body weight gain, and therefore, represent a new target of interventions to improve metabolic control.

P1.064 - Baseline and inflammation-induced state fatigue impact motivated behavior in the context of a SARS-CoV-2 vaccination model

D. S. Stolz[1], F. Luebber[1,2], T. Lange[2], J. Lasselin[3], M. Ziemann[4], G. Riemekasten[2], J. Rupp[5], S. Krach[1], F. M. Paulus[1]

[1] Social Neuroscience Lab, Department of Psychiatry and Psychotherapy, University of Lübeck, Lübeck, Germany
[2] Department of Rheumatology and Clinical Immunology, University of Lübeck, Lübeck, Germany
[3] Division of Psychoneuroimmunology, Department of Psychology, Stockholm University, Sweden
[4] Institute of Transfusion Medicine, University Hospital of Schleswig-Holstein, Lübeck, Germany
[5] Department of Infectious Diseases and Microbiology, University of Lübeck, Lübeck, Germany

Background. Fatigue is understood as multidimensional with at least physical (e.g., effort expenditure) and mental (e.g., reward learning) components that affect motivated behavior, but their interaction is not fully understood. Here, we jointly objectify both components in a validated experimental setup to better understand how they contribute to changes in behavioral motivation under physiological fatigue.
Methods. In a repeated-measures design (N = 55), we use ongoing vaccinations against SARS-CoV-2 as a model for immune-related fatigue, and employ an experimental task where reward magnitude depends on both choice and physical effort exertion. Using mixed-effects models, we analyze the effects of baseline fatigue, vaccination-induced state changes of fatigue and their interaction on five outcome measures of task performance.
Results. SARS-CoV-2 vaccination increased state fatigue. Together with baseline fatigue levels, these state fatigue increases predicted altered behavioral outcomes. Greater increases in state fatigue predicted reduced confidence while learning when to express effort, whereas baseline fatigue was associated with greater coregulation of effort and confidence. In line with vulnerability-stress models of disease, task performance was decreased in participants with high baseline level of fatigue who additionally showed greater vaccination-induced state changes of fatigue.
Conclusion. Our approach could help explain the wave-like dynamics in many fatigue-associated clinical conditions, where short-lived stressful events result in exceptional severe impairments. Moreover, the interplay of baseline and state changes suggests that an exclusive focus on either the short-lived peaks or long-lasting, habitual levels of fatigue could constrain our understanding of individual trajectories and effects on everyday life activities.

P1.065 - Burnout, Chronic Work Stress and Allostatic Load: First Results from the Regensburg Burnout Project

C. Bärtl[1], G. Henze[1], M. Giglberger[1], H. L. Peter[1], J. Konzok[2], S. Wallner[3], S. Wüst[1], B. M. Kudielka[1]

[1] Institute of Psychology, University of Regensburg, Germany
[2] Department of Epidemiology and Preventive Medicine, University of Regensburg, Germany
[3] Department of Clinical Chemistry and Laboratory Medicine, University Hospital Regensburg, Germany

Background: Burnout and chronic work stress have been linked to various negative health outcomes. While the mechanisms underlying this interplay are still unclear, the allostatic load (AL) model was suggested to demonstrate a possible biological pathway. However, previous studies provided divergent results regarding the association between burnout and AL, probably also due to the heterogeneity of selected samples. Therefore, the aim of the present study was to examine differences in AL between a conceptually strictly specified group of individuals suffering from burnout (BO group) and a healthy comparison group (HC group).
Methods: After a multi-stage recruitment procedure with strict inclusion criteria based on burnout symptomatology and pathogenesis, the BO group (n = 56) was compared to the HC group (n = 65) regarding an index of AL. The AL-index comprised 14 parameters representing immune, blood coagulation, metabolic, neuroendocrine, and cardiovascular system functioning.
Results: The BO group showed significantly higher AL-scores in comparison to the HC group. This effect remained significant after adjusting for sex, age, and smoking status. Additionally, burnout symptoms (Maslach Burnout Inventory), MBI-subscales emotional exhaustion and depersonalization as well as chronic work stress (assessed with the effort-reward imbalance questionnaire) were significantly associated with higher AL-scores.
Conclusions: Consistent with our hypothesis, we detected higher AL-scores in the BO compared to the HC group, indicating a greater cumulative physiological burden in individuals suffering from burnout. Given the high heterogeneity in individuals experiencing burnout symptoms, future studies may focus on well-specified subgroups, when examining the association between burnout and psychophysiological dysregulations.

P1.066 - Keep calm and relax: increase in parasympathetic activity by watching 360° and 2D nature videos

R. J. Gaertner[1], **A. B. E. Benz**[1], **J. C. Pruessner**[1]

Universität Konstanz, Deutschland

Virtual environments allow standardized simulation of various real-life environments and can be used for therapeutic or research purposes. So far, the psychological and physiological response to relaxing virtual environments has not been studied extensively, partly because of missing standardized relaxation protocols.
In this study, we defined physiological relaxation as a significant increase in parasympathetic activity measured by high-frequency heart rate variability (HF-HRV) and compared the relaxing effects of a 10 minute 360° nature video with the same video in 2D. The sample consisted of 42 participants (32 female, agemean=25.1+/-8.96 years), evenly distributed to both experimental conditions. For statistical analysis, we employed multilevel modeling. The best-fitting model included a random, quadratic main effect for time ($F(2,374)=3.65$, $p<.05$), interaction of time and condition ($F(2,374)=3.09$, $p<.05$), and age as covariate ($F(1,39)=5.23$, $p<.05$). Both videos lead to an increase in HF-HRV, but only in the 360° condition, participants continued to elicit increased HF-HRV in the first interval after the video. These results point towards a delay in relaxation responses and emphasize the importance of continued measurement after an intervention.
On a subjective level, participants in both conditions indicated increased subjective relaxation measured on a VAS after the video, suggesting that physical and subjective relaxation do not always correspond.
These results indicate that virtual nature videos are successful in increasing parasympathetic activity and subjective relaxation and that 360° interventions using virtual reality glasses have a greater effect on the HF-HRV than 2D videos.

P1.067 - Digitalisierungs-assoziierte Veränderungen in stress-relevanten Arbeitsbedingungen von Ärzt:innen

M. K. Wekenborg[1,2], **K. Förster**[1], **F. Schweden**[3], **C. Kirschbaum**[1], **B. Ditzen**[4]

[1] TU Dresden
[2] Else Kröner Fresenius Zentrum für digitale Gesundheit, TU Dresden
[3] IInstitut für Arbeitsgestaltung & Organisationsentwicklung [INAGO]
[4] Institut für Medizinische Psychologie, Universitätsklinikum Heidelberg

Theorie: Vereinzelte Forschungsergebnisse weisen darauf hin, dass digitale Transformationen im Gesundheitswesen (z.B. digitale Patientenakten, digitale diagnostische Tools) das Stress-Level von Ärzt:innen beeinflussen können. Daher testeten wir, ob (1) digitale Transformationen mit einer veränderten Wahrnehmung von Stress-relevanten Arbeitsbedingungen durch Ärzt:innen assoziiert sind, und ob (2) individuelle Merkmale (Alter, Geschlecht) diese Veränderungen in der Wahrnehmung beeinflussen.
Methode: Wir analysierten querschnittlichen Online-Fragebogendaten von 268 Ärzt:innen (mittleres Alter [SD] = 40,9 [12,3] Jahre; 44% Frauen) in Deutschland. Die Teilnehmenden schätzten ihr chronisches Stress-Level sowie 11 Stress-relevante Arbeitsbedingungen vor und nach der Einführung einer relevanten Digitalisierungsmaßnahme an ihrem Arbeitsplatz ein. Zusätzlich sendeten N = 60 (55% Frauen) Teilnehmende selbst-erhobene Haarproben für die Analyse der Haar-Cortisol-Konzentration (Hair-F) ein.
Ergebnisse: Signifikante Korrelationen zwischen selbst-eingeschätzten chronischem Stress-Level und Hair-F mit den untersuchten Arbeitsbedingungen bestätigten deren generelle Stress-Relevanz für Ärzt:innen. Multi-Level-Modellierungen zeigten, dass digitale Transformationen mit potentiell Stress-erhöhenden Effekten in sechs Arbeitsbedingungen (z.B. Handlungsspielraum) und stress-reduzierenden in zwei weiteren Arbeitsbedingungen (z.B. Quantitative Arbeitsbelastung) assoziiert waren. Männliches Geschlecht und ein höheres Alter waren mit einer eher Stress-erhöhenden Wahrnehmung von digitalisierungs-assoziierten Veränderungen assoziiert.
Fazit: Digitale Transformationen beeinflussen die Wahrnehmung von Stress-relevanten Arbeitsbedingungen durch Ärzt:innen auf spezifische Art und Weise, mit Stress-erhöhenden, aber auch Stress-reduzierenden Effekten. Diese Wahrnehmung wird durch Alter und Geschlecht beeinflusst. Die vorliegende Studie hat daher wichtige Implikationen für die erfolgreiche Gestaltung digitaler Transformationen im Gesundheitswesen.

P1.068 - Die automatische Erkennung von nicht-metabolischen HRV-Reduktionen im Alltag: Ist die Bewegung oder deren Inverse sinnvoller für einen Algorithmus zur Erkennung psychologischer Phänomene?

A. Schwerdtfeger[1], **C. Rominger**[1]

Karl-Franzens-Universität Graz, Österreich

Die Entwicklung eines interaktiven psychophysiologischen Assessments, das darauf abzielt, psychologisch relevante Episoden mittels physiologischer Signale zu erkennen, steckt noch in den Kinderschuhen. Insbesondere das Konzept der zusätzlichen Herzratenvariabilitätsreduktion (AddHRVr), also einer von Stoffwechselanforderungen unabhängigen Verminderung der HRV, scheint ein vielversprechender Ansatz zu sein. Hierbei werden HRV-Reduktionen als psychologisch bedeutsam klassifiziert, wenn sie über die bewegungsassoziierte Reduktion hinausgehen. Kürzlich haben wir einen 2-Stufen-Ansatz vorgestellt, um verschiedene Parametereinstellungen eines solchen AddHRVr-Algorithmus zu simulieren und schließlich die bestmöglichen Parameter für eine Online-Anwendung zu erhalten. Zunächst werden einzelne Algorithmusparameter basierend auf linearen Regressionen geschätzt, die die HRV der Teilnehmer/innen anhand der Bewegungsaktivität vorhersagen. Dieser Schritt ist zentral für die spätere Funktionsweise des Algorithmus. Bis heute hat jedoch keine Studie systematisch untersucht, ob Bewegung oder ihre Inverse die HRV im Alltag besser vorhersagen kann. Daher haben wir mehrere Algorithmuseinstellungen basierend auf der einfachen Bewegung und ihrer Inverse in zwei unabhängigen Stichproben simuliert. Ausgehend von der simulierten Power und den Schätzungen der Effektgröße könnte der auf inverser Bewegung basierende Algorithmus sensitiver sein, wenn es darum geht, objektive Belastungen zu erkennen (in einer Stichprobe von 38 Feuerwehrleuten). Der einfache Bewegungsansatz schien jedoch einem inversen Algorithmus bei der Vorhersage der subjektiv bewerteten Qualität sozialer Interaktionen (in einer Stichprobe von 21 Personen) überlegen zu sein. Diese beiden Simulationsstudien liefern erste Hinweise darauf, dass sowohl einfache als auch inverse Bewegungsansätze, je nach untersuchtem psychologischem Phänomen, adäquate Vorhersagen erzielen können. Dennoch benötigen wir weitere (Simulations-)Studien, um robuste Algorithmen für ein interaktives psychophysiologisches Assessment momentaner psychischer Phänomene abzuleiten.

P1.069 - The effect of early-life adversity and cognitive reappraisal on cortisol stress responses in healthy young women

U. U. Bentele[1], M. Meier[1], A. B. Benz[1], R. Gaertner[1], B. Denk[1,2], S. J. Dimitroff[1], E. Unternaehrer[1,3], J. C. Pruessner[1,2]

[1] Department of Psychology, University of Constance, Constance, Germany
[2] Centre for the Advanced Study of Collective Behaviour, University of Constance, Constance, Germany
[3] Child and Adolescent Research Department, Psychiatric University Hospitals Basel (UPK), University of Basel, Switzerland

Background. Early-life adversity (ELA) is related to long-lasting dysregulations of the hypothalamic-pituitary-adrenal (HPA) axis, reflected in either blunted or exaggerated cortisol responses to acute stress. One factor that might contribute to these inconsistent findings is emotion regulation capacity, specifically the use of cognitive reappraisal. The aim of this study was to investigate a possible interaction of the extent of early-life maternal care (MC), one form of ELA, and instructed emotion regulation, on cortisol stress responses.
Methods. Ninety-three healthy women (mean(age)=21.16, sd(age)=2.78) participated in the study. Prior to the experiment, participants were assigned to either a low (n=33) or high (n=60) MC group, based on the self-reported early-life MC. Upon arrival, participants either received written instructions to use cognitive reappraisal (reappraisal group, n=45) or to focus on their senses (control group, n=48) during the Trier Social Stress Test, which they underwent subsequently. Salivary cortisol levels were measured repeatedly throughout the experiment.
Results. Multilevel model analyses revealed a significant MC by regulation interaction effect on cortisol trajectories (b=1.02, SE=0.50, t(350)=2.06, p=.040), while controlling for menstrual cycle status. Specifically, low MC individuals in the control compared to the reappraisal group showed increased cortisol responses; high MC individuals did not differ regarding regulation condition.
Conclusion. These results suggest that regulation strategies significantly impact the association between ELA and HPA axis regulation. Future studies should thus (1) include both factors in study design, and (2) investigate emotion regulation strategies as promising aspect of interventions to normalize HPA axis dysregulation, fostered by a history of ELA.

P1.070 - Validation of an online version of the Trier Social Stress Test in adults

M. Meier[1], K. Haub[1], M. Hamma[1], M. Schramm[1], A. Benz[1], U. U. Bentele[1], S. J. Dimitroff[1], B. F. Denk[1], R. Gärtner[1], E. Unternaehrer[1,2], J. C. Pruessner[1]

[1] Department of Psychology, Neuropsychology, University of Konstanz, Constance, Germany
[2] Child and Adolescent Research Department, Psychiatric University Hospitals Basel (UPK), University of Basel, Switzerland

Background. The Trier Social Stress Test (TSST) is a reliable and efficient protocol to induce acute psychosocial stress in the laboratory. However, not all circumstances allow in-person assessments. An online version of the TSST (TSST-OL) could create more flexible research opportunities. To date, studies have confirmed subjective stress and heart rate increases in response to TSST-OL protocols. In this preregistered study (https://osf.io/u57aj), we focused on the effect of the TSST-OL on cortisol and alpha amylase responses. As cortisol stress reactivity is mediated by sex, we further compared men and women. We hypothesized significant increases in cortisol, alpha amylase and arousal, and a decrease in pleasure in response to the TSST-OL. Also, we expected stronger cortisol responses in males as compared to females.
Methods. N=48 adults (57.45% females, meanage=23.00, SD=3.22) participated in the study. Saliva sampling devices were sent to their home prior to testing sessions, for which the experimenter, mixed-sex panel, and participant joined a video call. Participants underwent the TSST-OL and provided five saliva samples for cortisol and alpha amylase detection. Mood ratings and psychometric questionnaires were completed online.
Results. As hypothesized, the TSST-OL significantly increased cortisol, alpha amylase, and arousal levels, while it decreased pleasure. Cortisol responses of males were significantly stronger as compared to females. 64% of subjects were classified as responders (cortisol rise>1.5nmol/l), with no significant difference between sexes.
Conclusion. The TSST-OL successfully induced psychophysiological stress in males and females. Our protocol offers new possibilities to study stress in a standardized manner outside of the laboratory.

P1.071 - The influence of induced positive emotions on psychobiological stress reactions

K. Henkel[1], **A. Luxem**[1], **L. Geißert**[1], **N. M. Schmidt**[1], **A. J. L. Munk**[1], **J. Hennig**[1]

Justus-Liebig-Universität Gießen, Deutschland

The role of Positive Psychological Interventions (PPI) in activating positive emotions has been widely shown. Their effects under acute stress, however, have rarely been investigated and results are ambiguous. Although a higher cortisol response is often interpreted negatively, there are findings that discuss short-term increases in cortisol as being adaptive when facing acute stressors. To further investigate the effects of PPI in situations of acute stress, we randomly assigned N=40 healthy men to a PPI inducing joy (vs. control) and then to the Trier Social Stress Test (TSST; vs. control). Subjective experience as well as salivary cortisol were measured across 6 time points. Firstly, the results show that the PPI successfully induced joy and that subjective and endocrine stress responses were significantly higher in the TSST vs. control group.
Most importantly, the PPI affected the subjective experience as well as cortisol levels, although in different directions – stressed PPI participants experienced less negative affect than stressed controls, but showed the highest cortisol stress reactions.
These results indicate that PPI can influence the stress reaction and support the assumption of a more adaptive stress response consisting of lowered negative subjective experience and an amplified physiological stress response.
These findings will be consolidated with an increased sample size and should be replicated independently in order to increase our understanding of stress and coping mechanisms.

P1.073 - Evaluation and update of the expert consensus guidelines for the assessment of the cortisol awakening response

T. Stalder[1]

Universität Siegen, Deutschland

The cortisol awakening response (CAR), i.e., the marked increase in cortisol secretion over the first 30-45 min following morning awakening, is frequently assessed in psychobiological stress research. Obtaining reliable CAR data, however, is not trivial and requires careful attention to methodological detail. This is particularly critical due to the fact that the CAR is typically assessed by self-collection of saliva samples in participants' home-settings, which does not allow for the direct supervision/control of the time-sensitive CAR sampling schedule. To obtain valid CAR data in this context, it is thus critical that objective measures to verify the accuracy of sampling are employed and that additional methodological factors are considered.
To promote best methodological practice, the International Society of Psychoneuroendocrinology charged a panel of experts with the task to develop clear consensus guidelines for the assessment of the CAR (published in Stalder et al., 2016, PNEC). While it appears that these guidelines have subsequently been well-received by the research community, it is currently still unknown to which extent this has resulted in actual improvements in methodological quality. In a first part of this presentation, data from a quantitative literature evaluation will be presented, comparing the methodological quality of CAR research published during a three-year-period before the guidelines (2013 – 2015) vs. a three-year-period after the guidelines (2018 – 2020). In a second part, preliminary results from a critical evaluation and an update of the consensus guidelines will be presented.

P1.074 - Prediction of antibody levels after COVD-19 vaccination: a study on immune interoception

S. J. Dimitroff[1], L. Würfel[1], M. Meier[1], K. E. Faig[2], A. E. Benz[1], B. Denk[1,3], U. U. Bentele[1], U. Eva[1,4], J. C. Pruessner[1,3]

[1] Department of Psychology, Division of Neuropsychology, University of Konstanz, Germany
[2] Department of Psychology, Hamilton College, USA
[3] Centre for Advanced Study of Collective Behavior, University of Konstanz, Germany
[4] Child and Adolescent Research Department, Psychiatric Hospital Basel, University of Basel, Switzerland

Background: How protected is one against COVID-19 after vaccination? IgG antibodies are an important part of the artillery for the immune system's defense against the SARS-CoV-2 virus, and its levels are predictive of protection against infection. The number of antibodies produced by some individuals is exponentially higher than others. This difference represents important variance in the future susceptibility to COVID-19 infection. The current study was conducted to determine whether individuals were able to estimate how many antibodies they produced after their COVID-19 vaccinations.
Methods: 166 participants (18-60 years old, 103 female) were recruited to the lab 14-60 days post-vaccination, where a blood sample was taken for analysis. Participants were asked to estimate on a scale from 0-10 how many antibodies they produced, and were also asked how protected they felt from COVID-19 due to vaccination.
Results: Both self-predicted antibody levels ($r(162) = 0.17$, $p = 0.028$), and feelings of protection against COVID-19 ($r(162) = 0.20$, $p = 0.009$) were significantly related to their actual IgG spike antibody titers. Results from this study suggest that individuals are able to predict their IgG titers after COVID-19 vaccination.
Conclusion: These results hold relevance in two domains. Firstly, they suggest individuals who sense they have low protection, probably do. Such information can help individuals make informed choices about self-protective behaviors. Secondly, results provide empirical evidence for the transmission of immune information through humoral pathways of interoception. These findings open the door for future work in the intriguing domain of immune interoception.

P1.075 - The Association of Hair Cortisol, Stressful Life Events, and Psychosocial Stress Habituation

J. Planert[1], **J. B. Finke**[1], **T. Stalder**[1]

Universität Siegen, Deutschland

The analysis of hair glucocorticoid levels became an instrument of particular interest in stress-related psychoneuroendocrine research. In comparison to conventional methods of measuring long-term glucocorticoid levels in humans, the quantification of hair cortisol is feasible, reliable, and time-efficient. Yet, previous research was hardly able to detect a consistent relationship between hair cortisol and perceived (chronic) stress. Specifically, whether and how past life events shape this relationship is still an unresolved question. More so, almost nothing is known about the potential modulatory role of differences in psychosocial stress reactivity and its habituation across multiple exposures. Thus, the present study, aimed to clarify these questions, consisted of one kick-off meeting and three further appointments scheduled for approximately 1.5 hours at the same time in weekly intervals. At the first appointment, participants were asked to complete questionnaires covering sociodemographic data, recently perceived stress, and stressful life events. Additionally, a sample of hair was extracted for glucocorticoid analysis. At the other appointments, participants underwent the Trier Social Stress Test (TSST), a well-established method for psychosocial stress inducement. Before, during, and after the TSST of each session, various physiological measures such as salivary cortisol and heart rate as well as self-report data on perceived stress were assessed. Preliminary results on associations between hair cortisol, stressful life events, and psychosocial stress habituation are to be presented, discussing new insights regarding the potential use and validity of hair cortisol in psychoneuroendocrine research.

P1.076 - How hair keeps track: Associations between hair concentrations of psychoactive substances and steroid hormones in a large cohort sample of young adults in Switzerland

L. Johnson-Ferguson[1,2], L. Shanahan[1], J. Zimmermann[2,3,4], L. Bechtiger[1], A. Steinhoff[1], M. Baumgartner[5], T. Binz[3], D. Ribeaud[1], M. Eisner[1,6], B. B. Quednow[1,2,4]

[1] Jacobs Center for Productive Youth Development, University of Zurich, Switzerland
[2] Experimental and Clinical Pharmacopsychology, Department of Psychiatry, Psychotherapy, and Psychosomatics, Psychiatric University Hospital Zurich, University of Zurich, Switzerland
[3] Department of Health Sciences and Technology, ETH Zurich, Zurich, Switzerland
[4] Neuroscience Center Zurich, ETH Zurich and University of Zurich, Zurich, Switzerland
[5] Center for Forensic Hair analytics of the University of Zurich, Switzerland
[6] Institute of Criminology, University of Cambridge, United Kingdom

Cortisol and cortisone are frequently used as physiological stress markers in neuropsychiatric research, with growing interest also in the role of testosterone. These steroid hormones are increasingly measured via hair sampling to provide a window into cumulative exposure. However, studies investigating steroid hormones in hair largely ignore the potential effects of psychoactive substances, although animal models suggest a knock-on effect of psychoactive substances on the hypothalamic–pituitary–adrenal axis stress response.

This project aims to assess the association between steroid hormones and a number of substances such as cannabinoids, stimulants, 3,4-methylenedioxymethamphetamine (MDMA), and opioids in hair. We expected higher concentrations of cocaine, cannabis, and MDMA to be associated with higher levels of cortisol in hair.

Data was drawn from a large representative sample of 20-year olds (n=1002). Multiple regression models were used to assess associations between steroid hormones, potential covariates, and psychoactive substances in hair. Median splits were used to divide participants into: no, low, and high concentrations of each substance.

Preliminary results show an association between both low (β=.29, 95% CI=0.02-0.34, p=0.026) and high concentrations of cannabinoids (β=.40, 95% CI=0.10-0.40, p=0.001) with higher levels of hair cortisol. High cocaine concentrations were associated with higher levels of cortisol (β=.0.31, 95% CI=0.01–0.60, p=0.040). Testosterone levels were not associated with substance concentrations in hair.

Topic 7: Social and Environmental Neuroscience

P1.077 - On using fNIRS in the cockpit: Frontal cortical oxygenation changes as a means of measuring mental workload in simulated flights

A. Hamann[1], **N. Carstengerdes**[1]

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Deutschland

Flying an aircraft puts high cognitive demands on the pilot. If the demands exceed the pilot's cognitive resources, this may lead to errors and severe, if not fatal, consequences. A continuous and objective assessment of mental workload could indicate when to provide assistance to the pilots, even before performance declines. A viable candidate for such an assessment is functional near-infrared spectroscopy (fNIRS).
In the present study, we used fNIRS to assess mental workload changes in a flight task. 35 participants completed a 40-minute simulated flight with an incorporated adapted n-back task: The participants had to perform course corrections in accordance with the n-back task in four difficulty levels (0- to 3-back). We assessed n-back performance and oxygenation changes in the dorsolateral prefrontal cortex. Our results show that performance in the n-back task was stable between the 0- and 1-back conditions, then decreased linearly with each higher n-back level. fNIRS data showed a decrease in deoxygenated hemoglobin (Hbr) with increasing n-back level. More precisely, using Hbr, we could discriminate all n-back levels apart from the two highest.
We conclude that while fNIRS was not sensitive to higher levels of demand where performance already showed a steady decline, it was indeed sensitive even to slight elevations of cognitive demand that did not yet impair performance. In consequence, fNIRS is a promising method for mental workload assessment and its application in the aviation domain.

P1.078 - The reward-like nature of smiling and sad faces: Social influence on costly punishment

M. Weiß[1], P. Mussel[2], J. Rodrigues[3], H. Heekeren[2], J. Hewig[3]

[1] University Hospital Würzburg; Würzburg; Germany
[2] Freie Universität Berlin; Berlin; Germany
[3] Julius-Maximilians-University Würzburg; Würzburg; Germany

Costly punishment describes an interaction partner's decision to punish a counterpart for violating fairness rules at a personal cost. To investigate this mechanism in more detail, we extended the interaction process in a modified Ulitmatum Game. Here, we tested the effect of a proposer's socio-emotional reaction in response to the punishment, indicating whether the punishment was successful or not. We used emotional facial expressions of the proposer in response to the responder's decision as feedback stimuli and analyzed their influence on behavior and neural correlates at the single-trial level. It turns out that both an honored reward after accepting an offer (smiling compared to neutral facial expression) and a successful punishment (sad compared to neutral facial expression) evoked a reward positivity, thereby signaling that punishment was the intended outcome. To demonstrate the specificity of our results for the social context of costly punishment, we compared the pattern of results with that of a probabilistic learning task. Brain-behavior relations additionally showed that acceptance rates change as a function of P3 amplitudes in response to the proposer's emotional facial response. In conclusion, the findings are consistent with the concept of costly punishment as an intentional action following norm-violating behavior. In economic decisions, socio-emotional cues have an important influence on the perception of the counterpart and the behavior in negotiation scenarios.

P1.079 - Behavioral and neural dissociation of social anxiety and loneliness

J. Lieberz[1], S. G. Shamay-Tsoory[2], N. Saporta[2], A. Kanterman[2], J. Gorni[1], T. Esser[1], E. Kuskova[1], J. Schultz[3,4], R. Hurlemann[5,6], D. Scheele[1,5]

[1] Department of Psychiatry and Psychotherapy, University Hospital Bonn, Germany
[2] Department of Psychology, University of Haifa, Israel
[3] Center for Economics and Neuroscience, University of Bonn, Germany
[4] Institute of Experimental Epileptology and Cognition Research, University of Bonn, Germany
[5] Department of Psychiatry, School of Medicine & Health Sciences, University of Oldenburg, Germany
[6] Research Center Neurosensory Science, University of Oldenburg, Germany

Loneliness is a public health concern with detrimental effects on physical and mental well-being. Given phenotypical overlaps between loneliness and social anxiety (SA), cognitive-behavioral interventions targeting SA might be adopted to reduce loneliness. However, whether SA and loneliness share the same underlying neurocognitive mechanisms is still an elusive question. The current study aimed at investigating to what extent known behavioral and neural correlates of social avoidance in SA are evident in loneliness. We used a pre-stratified approach involving 42 (21 females) participants with high loneliness (HL) and 40 (20 females) participants with low loneliness (LL) scores. During functional magnetic resonance imaging,participants completed a social gambling task to measure the subjective value of engaging in social situations and responses to social feedback. Uni- and multivariate analyses of behavioral and neural data replicated known task effects. However, although HL participants showed increased SA, loneliness was associated with a response pattern clearly distinct from SA. Specifically, contrary to expectations based on SA differences, Bayesian analyses revealed moderate evidence for equal subjective values of engaging in social situations and comparable amygdala responses to social decision-making and striatal responses to positive social feedback in both groups. Moreover, while explorative analyses revealed reduced pleasantness ratings, increased striatal activity, and decreased striatal-hippocampal connectivity in response to negative computer feedback in HL participants, these effects were diminished for negative social feedback. Our findings suggest that unlike SA, loneliness is not associated with withdrawal from social interactions. Thus, established interventions for SA should be adjusted when targeting loneliness.

P1.080 - EmBody, EmFace – Ein neues, offenes Tool zur Erfassung von Emotionserkennung aus Körper- und Gesichtsausdrücken

L. L. Lott[1], **F. B. Spengler**[1], **B. Schiller**[1], **T. Stächele**[1], **M. Heinrichs**[1]

Universität Freiburg, Germany

Die Gefühle und Absichten Anderer erkennen zu können ist grundlegend für eine erfolgreiche soziale Interaktion. Obwohl hierbei nicht nur das Gesicht, sondern auch der Körper als zentrale Informationsquelle dient, erhielt Körpersprache in vorangegangenen Untersuchungen bisher wenig Aufmerksamkeit. Eine mögliche Ursache hierfür ist, dass geeignete experimentelle Tools fehlten, um die Wahrnehmung von Körper- und Gesichtsausdrücken gezielt untersuchen und vergleichen zu können. Um diese Forschungslücke zu schließen, entwickelten wir das Tool EmBody/EmFace, das die Untersuchung emotionaler Ausdrücke aus 3D-animierten Körperausdrücken (Task 1: EmBody) und aus parallelisierten Gesichtsausdrücken (Task 2: EmFace) erlaubt. Beide Tasks nutzen Stimuli, die drei emotionale Zustände (Ärger, Freude, neutral) zeigen und eine hohe visuelle Standardisierung aufweisen, um den Einsatz sowohl in Verhaltensstudien als auch in funktionellen Bildgebungsstudien zu ermöglichen. Daten der Validierungsstichprobe von 217 gesunden Männern und Frauen belegen ein erfolgreiches Matching des EmBody und des EmFace nach Schwierigkeit sowie anderen psychometrischen Eigenschaften, wodurch die beiden Tasks entweder getrennt oder in Kombination angewendet werden können. Erste klinische Validierungsdaten aus einer Gruppe autistischer Männer sowie nach Alter und IQ gemachten Kontrollprobanden deuten außerdem daraufhin, dass der EmBody/EmFace spannende Erkenntnisse zur Emotionserkennung bei Personen mit Störungen der sozialen Kognition liefern kann. Insgesamt ergeben sich hierdurch viele Anwendungsmöglichkeiten für den EmBody/EmFace, beispielsweise in den affektiven und sozialen Neurowissenschaften sowie im Kontext klinisch relevanter Störungen der sozialen Kognition, wie etwa bei Autismus-Spektrum-Störungen.

P1.081 - Cross-modal decoding of emotional expressions in fMRI – mirror neurons in social cognition

L. A. Wallenwein[1], **S. N. L. Schmidt**[1], **J. Hass**[2], **D. Mier**[1]

[1] Department of Psychology, University of Konstanz, Konstanz, Germany
[2] Faculty of Applied Psychology, SRH University Heidelberg, Heidelberg, Germany

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

P1.082 - Imitation - a basic mechanism culturally influenced? A fMRI investigation of Chinese and German participants

C. A. Sojer[1], **S. N. L. Schmidt**[1], **Z. Yan**[1], **P. Kirsch**[2], **D. Mier**[1]

[1] Universität Konstanz, Deutschland
[2] Zentralinstitut für Seelische Gesundheit, Mannheim, Deutschland

Introduction Imitation is said to be a basic mechanism of social cognition and social interactions. Recent cultural neuroscience studies showed differences between people from collectivistic and individualistic cultures in complex social-cognitive processes, such as empathy and Theory of Mind. However, studies investigating differences in the neural basis of the imitation of people from the own and a foreign culture are missing.
Methods In our study, 35 Germans and 35 Chinese living in Germany, completed an fMRI task, in which they observed and imitated happy and fearful facial expressions of persons from their own and the foreign culture group.
Results Across participants imitation in comparison to observation activated a broad network of brain regions, involved in motor and emotional processing. Group comparison showed enhanced activation in the temporoparietal junction and precuneus, as well as parahippocampal gyrus when imitating faces from their in- compared to the outgroup in Chinese participants.
Discussion Our results replicate previous fMRI studies on imitation and show group differences between Chinese and Germans depending on the imitation of in- versus outgroup facial expressions. In agreement with previous cultural neuroscience studies on people with a collectivistic background, the pattern of enhanced activation may suggest more self-referential processing in Chinese than German participants when imitating people of their own culture.

P1.083 - Does an empty stomach influence the brain's response to social recognition?

U. Sailer[1], F. Riva[1], D. M. Pfabigan[1,2]

[1] University of Oslo, Norway
[2] Vestfold Hospital Trust, Norway

Animal research has shown that social interaction is increased by administrating ghrelin, an appetite-stimulating hormone. These findings have inspired the idea of ghrelin's involvement in the valuation of many 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 influences neural processing of recognition by others as a social reward in humans.
In a within-group design consisting of two sessions inducing high (no-meal) vs. low (liquid-meal) levels of ghrelin, 48 healthy volunteers performed a reward task. Participants could receive social reward when their music choice was confirmed 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 conditions. Ghrelin levels served as predictor and mean activity of three ROIs previously found to be 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 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.

P1.084 - Always look on the bright side of life: The effect of social exclusion on emotional reactivity and emotion regulation

A. Reinhard[1], **S. N.L. Schmidt**[1], **C. Wienbruch**[1], **M. Erkic**[2], **S. Fenske**[2], **P. Kirsch**[2], **D. Mier**[1]

[1] Department of Psychology, University of Konstanz
[2] Department of Clinical Psychology, Central Institute of Mental Health, University of Heidelberg / Medical Faculty Mannheim

Social exclusion (SE) can be related to negative long-term consequences for mental health, such as depression and anxiety. Research on the effect of SE on psychological processes suggest an emotional numbness and relate it to a so called deconstructed state, including reduced self-regulation. Studies on autonomous nervous system (ANS) response during SE revealed heterogeneous results. Our aim was to examine the impact of SE on emotional reactivity to positive and negative stimuli, the associated electrodermal response and heart rate variability, as well as the ability to apply different emotion regulation (ER) strategies.
98 participants underwent an SE paradigm at two appointments. We implemented the cover story of interacting with two other players in a monetary interaction game, where SE was induced by the points received by the other players. The interaction game was alternating with blocks of an ER task. To capture emotional reactivity and ER we assessed participants' valence and arousal ratings before and after watching emotional pictures and executing different ER strategies.
Emotional reactivity to positive stimuli was significantly higher in excluded than in included individuals. No significant differences could be found in emotional reactivity to negative stimuli or the application of any ER strategy. Analysis of ANS data is currently in progress.
Our behavioral results speak against the hypothesis of a deconstructed state in individuals experiencing SE, and suggest even enhanced reactivity to positive stimuli after SE. Analyses of the physiological data will reveal whether the ANS responses are in congruence or dissociate from behavioral data.

P1.085 - Investigating Mu rhythm and its source localization during the observation of human social interaction and biological movement

S. Dastgheib[1,2], **J. M. Kaufmann**[1,2], **S. Moratti**[3], **S. R. Schweinberger**[1,2]

[1] Department for General Psychology and Cognitive Neuroscience, Institute of Psychology, Friedrich Schiller University of Jena, Am Steiger 3/1, 07743 Jena, Germany
[2] Social Potential in Autism Research Unit, Friedrich Schiller University of Jena, Am Steiger 3/1, 07743 Jena, Germany
[3] Department of Experimental Psychology, Complutense University of Madrid, Spain.

Suppression of the mu rhythm (~8-12 Hz, recorded from central electrodes) has been suggested as a potential EEG marker for human mirror neuron system (MNS) activation. In our study, 24 neurotypical participants underwent EEG recording in rest and observation of two-minute videos showing:

1. Non-biological movements (moving balls)
2. Non-goal-directed biological actions (simple hand movements)
3. Goal-directed biological actions toward an object (complex hand movements)
4. Social interactions

We assessed mu power (8-12 Hz) in a 100-second segment of artifact-free data per condition. Mu suppression index (MSI) was calculated relative to two different baselines: 1. Eyes open resting condition; 2. Moving balls. Results showed that relative to the resting baseline, there was significant mu suppression during the observation of simple hand movements and social interactions, with no significant differences between all scenarios. However, there was no mu suppression with non-biological movements as the baseline; even enhancement was observed in simple and complex actions.
Interestingly, cluster-based permutation tests demonstrated significant suppression in intraparietal lobule during social interaction observation. We speculate that the counterintuitive mu enhancement is mediated by top-down inhibition and the interaction of the MNS with other cognitive systems. On the other hand, source localization shows a similar pattern of suppression in areas assumed for the MNS's activation. Finally, more research is required on the mu rhythm paradigms as it is complex to interpret in humans. Nevertheless, this frequency band seems a promising marker for investigating the human MNS.

Topic 8: Development and Ageing

P1.086 - The role of multivariate representations of task sets for age differences in task-switching performance

S. A. Schwarze[1], **S. Bonati**[1], **Y. Fandakova**[1]

Max Planck Institute for Human Development, Deutschland

Flexible switching between tasks requires the updating of the relevant task set and the inhibition of the no-longer relevant set. These processes are thought to contribute to the well-established phenomenon of switch costs, or the decreased performance on trials requiring a task switch vs. repetition. Compared to adults, children show greater switch costs, potentially due to the ongoing development of task updating and inhibition. Neuroimaging studies utilizing multivariate pattern analysis (MVPA) in adults have shown that task-set representations are encoded by frontoparietal regions and are less stable on switch than repeat trials. While more distinct representations have been associated with better task-switching performance in adults, it is unclear to what extent differences in neural task-set representations contribute to individual differences in switch costs in children. In the present study, we examined age differences in neural task-set representations during task switching and their relevance for performance in a sample of 89 children (8-11 years) and 53 adults (20-30 years). Both children and adults showed switch costs, however, these costs were higher in children. Searchlight whole-brain MVPA revealed that information about the relevant task set could be decoded from frontoparietal regions including the inferior frontal junction and superior parietal lobe, as well as stimuli-specific regions including the fusiform and parahippocampal gyri. Within these regions, we expect higher decoding accuracies on repeat than switch trials, as well as in adults compared to children. Ongoing analyses investigate if decoding accuracy is associated with better performance, and how these associations differ between children and adults.

P1.087 - On the long term consequences of preterm birth on the self-control brain network: A DTI study on adolescents measured in the ABCD study

M. Marek[1], **J. F. Q. Sánchez**[1,3], **A. Heep**[2,4], **A. Hildebrandt**[1,2,3]

[1] Psychological Methods and Statistics, Department of Psychology, School of Medicine and Health Sciences, Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany
[2] Research Center Neurosensory Science, Carl von Ossietzky Universität Oldenburg, Germany
[3] Cluster of Excellence Hearing4all, Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany
[4] Paediatrics, Department of Human Medicine, School of Medicine and Health Sciences, Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany

Preterm birth occurs in 1 out of 10 worldwide deliveries and is associated with long-term developmental consequences. It has been suggested that impairments in self-regulation in infancy and childhood, as well as alterations of white matter microstructural properties of associated brain areas are present at young age and conceivably persist into adolescence. Since self-regulation is a relatively malleable skill that can be effectively targeted by interventions, it is essential to robustly identify possible disadvantages of vulnerable groups such as preterm-born adolescents. In the present study, we investigate differences between preterm- and term-born individuals at the beginning of adolescence (9-10 years), as well as brain-behavior associations in the domain of self-regulation. We hypothesize lower latent self-regulation abilities in preterm adolescents, as well as less favorable microstructural properties of the white matter fiber bundles connecting self-regulation brain hubs when compared to term-born peers. We further assume that behavioral self-regulation and microstructural properties of the self-regulation brain network correlate across and within the groups. These associations are predicted to be more pronounced in preterm adolescents, given that the biological determination of behavior is stronger in individuals with less favorable behavioral outcomes. In this well-powered study, we will compare N1=1400 preterm born adolescents at 9-10 years of age and N2=1400 matched term born peers sampled from the ABCD (Adolescent Brain Cognitive Development) study cohort – the largest U.S. longitudinal study of adolescent brain development and child health to date. The poster will cover the first stage of a registered report (Theoretical Background and Methodology).

P1.088 - Preterm birth and microstructural properties in fiber tracts among audio-visual integration brain regions in neonates

J. F. Quinones[1,3], **C. M. Thiel**[2,3,5], **A. Heep**[2,4], **A. Hildebrandt**[1,2,3]

[1] Psychological Methods and Statistics, Department of Psychology, School of Medicine and Health Sciences, Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany;
[2] Research Center Neurosensory Science, Carl von Ossietzky Universität Oldenburg, Germany;
[3] Cluster of Excellence Hearing4all, Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany
[4] Paediatrics, Department of Human Medicine, School of Medicine and Health Sciences, Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany.
[5] Biological Psychology, Department of Psychology, School of Medicine and Health Sciences, Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany

Despite the well documented sequelae following preterm birth, little is known about the effects of prematurity on audiovisual integration (AVI) ability, which entails several developmental advantages supporting social cognition. AVI ability thus proves essential to the understanding of short- and long-term sequelae of preterm birth. The present study aimed to establish the effect of prematurity on structural connections among AVI brain areas in neonates. We employed probabilistic tractography to reconstruct fiber tracts in 63 full term and 63 preterm neonates (median gestational age at birth = 32.71) scanned at around term age and matched via propensity score matching out of a total sample of 505 neonates (dHCP; http://www.developingconnectome.org). By means of regression analysis we tested the effect of prematurity on tract-averaged diffusion tensor imaging and neurite orientation dispersion and density imaging metrics. We found an overall significant effect on fractional anisotropy, mean diffusivity and neurite density index. Furthermore, by means of the Levene test we investigated whether individual differences in AVI fiber properties are larger in preterm neonates, but this was not the case. At the group level, large intraclass correlation coefficients suggest homologous developmental order of the reconstructed AVI fiber tracts in preterm and full term neonates. We conclude that prematurity is associated with microstructural properties typically observed in less developed white matter., but there is no evidence of atypical developmental order induced by premature exposure to the environment. Overall less developed microstructural properties of the white matter may contribute to the deficits in AVI observed in preterm-born infants.

P1.090 - Less efficient cognitive pain modulation in healthy older adults – the impact of executive functions, chronic stress, and physical activity

A. Heller[1], M. V. d. Meulen[2], W. Miltner[4], A. Schulz[3], C. Vögele[3], R. Kumsta[2], A. Dierolf[2]

[1] Universität Luxembourg, FHSE
[2] Universität Luxemburg, Department of Behavioural and Cognitive Sciences; Institute for Health and Behaviour; Stress, Pain, and Gene-Environment Interplay
[3] Universität Luxemburg, Department of Behavioural and Cognitive Sciences; Institute for Health and Behaviour; Self-Regulation and Health
[4] Friedrich-Schiller-Universität Jena - Klinische Psychologie

Demographic change and the associated increasing prevalence of chronic pain have contributed to increased research interest in the field of aging. Aging has been associated with less efficient pain inhibition through cognitive distraction. As pain modulation and executive functioning mainly involve the prefrontal cortical network, which shows age-related atrophy, we hypothesized an association between deteriorating cognitive modulation of pain in healthy older adults and reduced executive functions. As chronic stress can decrease executive functioning through prefrontal cortical impairment, we expected a negative impact on distraction from pain. In contrast, physical activity can have a stress-buffering effect and positively influences executive functions in older age. Therefore, increased physical activity should lead to better distraction from pain. Healthy young (18 -30 years) and older adults (65+ years) took part in a pain distraction paradigm (N-back) while receiving non-painful and moderately painful electric stimuli. Before, we examined executive functions, including response inhibition (Go/No-Go-task), inhibitory control (Stroop task), and working memory (Sternberg task). Additionally, chronic stress and physical activity were assessed using self-report questionnaires, supported by physiological measurements (heart rate variability). Preliminary results indicate a negative impact of chronic stress on distraction from pain particular in young participants, while physical fitness was related to more successful pain modulation in older adults. Our final results will contribute to a more differentiated view on executive functioning and pain modulation in aging, thereby leading to a better understanding of the impact of aging on non-pharmacological pain treatment and to better adapted pain therapies in this population.

P1.091 - Neural Correlates of Short and Long Delay Memory Consolidation Differ Between Children and Young Adults

I. Schommartz[1,2], P. F. Lembcke[3], F. Pupillo[1], H. Schuetz[3], N. W. d. Chamorro[4,5], A. M. Kaindl[4,5,6,7], C. Buss[3,8], Y. L. Shing[1,2]

[1] Goethe University Frankfurt, Deutschland
[2] Center for Individual Development and Adaptive Education of Children at Risk (IDeA), Frankfurt, Germany
[3] Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Humboldt-Universität zu Berlin, Department of Medical Psychology, Berlin, Germany
[4] Charité – Universitätsmedizin Berlin, Department of Pediatric Neurology, Berlin, Germany
[5] Charité – Universitätsmedizin Berlin, Center for Chronically Sick Children, Berlin, Germany
[6] Charité – Universitätsmedizin Berlin, Institute of Cell- and Neurobiology, Berlin, Germany
[7] Charité – Universitätsmedizin Berlin, Department of Pediatric Surgery, Berlin, Germany
[8] Development, Health and Disease Research Program, Department of Pediatrics, University of California Irvine, USA

Memory consolidation evolves over time and involves interaction between medial temporal lobe (MTL) and neocortical structures. Thus far, little is known about how extended developmental trajectories of brain maturation may affect the memory consolidation processes. In the present study, applying functional magnetic resonance imaging, we examined system-level memory consolidation of object-location associations after one night of sleep (short delay) and two weeks of sleep (long delay), in 6-year-old children (n = 37, 15 females), and young adults (n = 36, 16 females). Our behavioural results showed that: (i) short delay memory retention rates declined only in children but not in adults; (ii) long delay memory retention rates declined in both age groups, but the decrease was steeper in children. Our fMRI results for correctly retrieved remote in comparison to recent memories showed that: (i) posterior hippocampal activation remained stable over time in both groups, while anterior hippocampal activation increased over time only in children, remaining stable in adults; (ii) activation in posterior parahippocampal gyrus, lateral prefrontal cortex, precuneus, and lateral occipital cortex increased over time only in adults but not in children. Taken together, compared to adults, children showed lower retention rates of learned information after one night of sleep and over two weeks. Observed age-related differences in differential involvement of neural regions for retrieving consolidated memory demonstrate persistent involvement of hippocampus early on in childhood, with increasing involvement of neocortical regions across development.

P1.092 - Multimodal Brain-Phenotype Relations of the Angular Gyrus: Group Trends versus Individual Profiles

C. Jockwitz[1,2], C. Krämer[1,2], J. Stumme[1,2], P. Dellani[1], S. Moebus[3], N. Bittner[1,2], S. Caspers[1,2]

[1] Institute of Neuroscience and Medicine (INM-1), Research Centre Jülich, Jülich, Germany
[2] Institute for Anatomy I, Medical Faculty & University Hospital Düsseldorf, Heinrich Heine University, Düsseldorf, Germany
[3] Institute of Urban Public Health, University of Duisburg-Essen, Essen, Germany

The angular gyrus (AG) has been associated with multiple cognitive functions, i.e., language, and memory. Although the AG is thought to be a cross-modal hub region suffering from significant age-related structural atrophy, the exact relation with cognitive decline in older adults is not fully understood, which may be related to two aspects: First, the AG is cytoarchitectonically divided into two areas, PGa and PGp, potentially subserving different cognitive functions. Second, the older adult population is characterized by high between-subject variability which requires targeting individual phenomena during the aging process. We therefore performed a multimodal (grey matter volume [GMV], functional and structural connectivity) characterization of AG subdivisions PGa and PGp in older adults (n=499), together with relations to age, cognition and lifestyle. We then switched the perspective to the individual, which is particularly important when considering individual patients.
Results present the AG as a heterogeneous structure: Different AG parts were associated with distinct patterns of whole-brain GMV associations as well as their associations with structural and functional connectivity. Similarly, differential effects of age, cognition and lifestyle on the GMV of AG subdivisions were observed. This suggests each region to be structurally and functionally differentially involved in the older adult's brain network architecture which was supported by differential molecular and genetic patterns (derived from EBRAINS multilevel atlas framework; https://ebrains.eu). Importantly, individual profiles deviated considerably from the global conclusion drawn from the group. Hence, general observations within the older adult population should be carefully considered when addressing individual conditions in clinical practice.

P1.093 - Appetitive Operant Conditioning in Children Aged 4-6 Using a Mechanistic Game

J. Jagusch-Poirier[1], K. Hagelweide[1], K. Lehnen[1], K. Conrad[2], L. Neuhoff[2], S. Schneider[2], S. Weigelt[1]

[1] Vision, Visual Impairments & Blindness, Department of Rehabilitation Sciences, TU Dortmund University
[2] Mental Health Research and Treatment Center, Faculty of Psychology, Ruhr-University Bochum

Learning and storing new information leads to a continuous acquisition of knowledge, behavior and various abilities over the life span. Since learning capacities increase with age in humans and may differ between developmental stages, it is important to analyze such developmental differences and highlight contextual effects in learning.
To assess differences in extinction learning from early childhood onwards, we developed an appetitive conditioning paradigm, the "Candy Mountain Treasure Hunt". It allows the examination of extinction learning and context-dependent renewal in children using an operant conditioning box, which is comparable to a small gaming machine and was designed to fit children's interests. We manufactured the box mechanistically to enable an immersive, real-life experience. Here, we investigated 92 children (44 female) in three groups aged four, five and six years, thus covering a developmental phase, which - besides infancy and (pre-) adolescence - is assumed particularly relevant for extinction learning development. During acquisition, participants received candy reinforcers for pressing a button.
The response behavior in three different phases (acquisition, extinction, renewal) with switching background lighting as configural context manipulation was recorded. Based on an acquisition performance criterion, 97% of participants were classified as learners. Extinction learning was successfully elicited in general with extinction behavior being similar in the observed age groups, as extinction responses did not differ significantly between groups. Future studies using this paradigm with adolescents and young adults will provide further important insights into different extinction learning mechanisms and associated effects throughout human development in the appetitive domain.

Topic 9: Disorders and Interventions

P1.094 - Personalized neurofeedback: a systematic comparison of self- and externally-paced training in healthy adults

S. Uslu[1], **C. Vögele**[1]

University of Luxembourg

Neurofeedback training has been shown to modulate a wide range of cognitive abilities in standardized protocols. However, inter-individual differences in responsiveness to neurofeedback directly impact the outcome of neurofeedback trainings. More recently, studies have, therefore, focused on more personalized approaches. Nevertheless, these studies are rare, so there is a lack of systematic comparisons between standardized and personalized training protocols.
In this study we investigated the efficacy of self-paced neurofeedback in modulating EEG activity compared to sham and externally-paced neurofeedback. Sixty participants were randomly allocated to one of the three training protocols. While the training duration was the same across all participants, those in the self-paced condition determined the pace of their training (and rest periods) themselves, as opposed to an externally-paced condition. The control condition involved the feedback of the recorded signal from another person as sham feedback to participants. Before and after the neurofeedback session, we administered a mental rotation task and the trail making task to assess effects on neurocognitive functions. In preliminary analyses using linear mixed models we estimated the effect of condition and time-point (pre vs post) on performance in the mental rotation task. Self-paced neurofeedback reduced the overall response time less than externally-paced neurofeedback. There were no significant interactions on response accuracy or response times restricted to correct trials.
These preliminary findings suggest that control over training is related to an increased effort in cognitive tasks. Future studies are required to further investigate how different neurofeedback parameters relate to changes in behavioural outcomes.

P1.095 - Interoceptive accuracy and salience network functional connectivity in depression

M. Blickle[1], M. Gamer[2], J. Deckert[1], A. Menke[3]

[1] Zentrum für Psychische Gesundheit, Universitätsklinikum Würzburg, Deutschland
[2] Julius-Maximilians-Universität Würzburg, Deutschland
[3] Medical Park Chiemseeblick, Bernau am Chiemsee, Deutschland

Major depressive disorder (MDD) is one of the most prevalent mental disorders and accompanied by cognitive, affective and somatic symptoms. The deficient perception of internal body signals is associated with the pathogenesis of depression. Interoceptive accuracy (IAc) refers to the ability to accurately perceive bodily sensations (e.g., own heartbeat). Previous studies showed that depressed patients exhibit reduced IAc but results yielded inconsistent findings. Especially, it has remained unclear to what extent middle-aged and older depressed patients show altered IAc. In neuroimaging studies using resting-state functional magnetic resonance imaging (rs-fMRI) lower IAc was associated with altered insula and salience network (SN) activity.
30 depressed inpatients ($\geq$ 50 years) and 30 age- and gender-matched non-psychiatric controls were investigated. IAc was assessed via a heartbeat perception task. Additionally, all subjects underwent a 3T rs-fMRI. Seed-to-voxel analysis with seeds in the SN was conducted.
Depressed patients showed functional hypoconnectivity between several seeds in the SN und parts of the superior frontal gyrus, supplementary motor cortex, lateral occipital cortex and occipital pole. However, depressed patients did not differ with regard to IAc.
Our findings underscore differences in intrinsic functional connectivity in middle-aged and older depressed patients but not in terms of interoception.

P1.096 - Bipolar disorder moderates the relationship between self-referential thinking and impulse control

R. Suchting[1], T. D. Meyer[1], I. Bauer[1], B. Irungu[1], M. Wu[1], J. Soares[1]

McGovern Medical School, Psychiatry & Behav. Sciences, University of Texas HSC at Houston, USA

Introduction: Patients with bipolar disorder (BD) show impairments in a number of cognitive domains which are discussed to be associated with modo symptoms. There is also sparse but clinically-relevant evidence showing that abnormalities in self-referential thinking in BD. The present study explored the correlation between cognitive performance and self-referent thinking in euthymic BD patients.
Methods: The study included 45 euthymic patients with BD and 24 healthy controls. The Cambridge-Gambling-Task was used to examine delay aversion, deliberation time, and risk taking. For the current analysis we focused on self-reported 'self-regulation' as self-referent thinking measure. Bayesian generalized linear models explored the univariate and moderating effects of diagnosis and self-regulation on impulse control (measured by delay aversion, deliberation time, and risk taking), controlling for age and education.
Results: Univariate models found lower delay aversion and higher risk taking among patients with BD. 'Self-regulation' was associated with higher delay aversion, higher deliberation time, and more risk taking. An interaction between diagnosis and 'self-regulation' was only observed for deliberation time but not delay aversion or risk taking. The increase in deliberation time with increased self-reported self-regulation skills was much more pronounced in HC than in patients with BD.
Conclusions: While there might be main effects related to a diagnosis of BD in neurocognitive tests, self-referential thought related to self-regulation, self-concept, or even intrinsic motivation might help understand performance in such tests. Our analyses show that there might even be moderating effects of a diagnosis when it comes to the association between hot and cold cognition.

P1.097 - The neural underpinnings of approach-avoidance training changing food choices while bypassing preferences

A. Zahedi[1,2,6], S. O. Artigas[3], N. Swaboda[6], C. E. Wiers[5], K. Görgen[6,7,8], S. Q. Park[1,2,3,4,7]

[1] Deutsches Institut für Ernährungsforschung (DIfE), Germany
[2] Neuroscience Research Center, Charité-Universitätsmedizin Berlin, Corporate Member of Freie Universität Berlin, Humboldt-Universität zu Berlin, and Berlin Institute of Health, Neuroscience Research Center, Berlin, Germany
[3] Department of Psychology, University of Lübeck, Lübeck, Germany
[4] German Center for Diabetes Research (DZD), Neuherberg, Germany
[5] Department of Psychiatry and Radiology, University of Pennsylvania, Philadelphia, PA, USA
[6] Berlin Center for Advanced Neuroimaging, Charité – Universitätsmedizin Berlin, Germany
[7] Charité – Universitätsmedizin Berlin (corporate member of Freie Universität Berlin, Humboldt-Universität zu Berlin, and Berlin Institute of Health), Department of Psychiatry and Psychotherapy, Bernstein Center for Computational Neuroscience, Berlin, Germany
[8] Science of Intelligence, Research Cluster of Excellence, Marchstr. 23, 10587 Berlin

Across species, a reward signaling stimulus automatically initiates the approach behavior of an animal. In the obesogenic environments governing modern society, the cues signaling food reward are pervasive, making a proper behavioral response extremely difficult. Although studies suggest that a cued-approach and avoidance training (AAT) could effectively modify behavior, its underlying neural, anatomic, and cognitive underpinnings are mainly unknown. In the current study, we investigated healthy, normal-weight participants on three consecutive days. On Day 1 and 3, participants' food choices were tested while the neural activity was measured using functional magnetic resonance imaging, and they rated the food items. On day 2, participants underwent AAT by consistently approaching low-calorie food images while avoiding high-calorie food cues. AAT significantly facilitated low-calorie food choices, leaving the food-value ratings unchanged. Instead, we observed a significant shift in indifference points indicating that newly formed stimulus-response contingencies were the driver of changes in food choices. Corroborating this, training-induced behavioral changes were associated with the increase in the posterior cingulate cortex (PCC) activity, whereas its connectivity to the dorsolateral prefrontal cortices (dlPFC) was attenuated. In contrast, we did not observe changes in the medial PFC coding subjective ratings. Finally, the grey matter density in PCC predicted training-induced functional changes, shedding light into individual anatomic differences predefining the training effect. Together, our results show how simple behavioral modification training can change the choice and its underlying cognitive mechanisms. These findings provide novel perspectives for different disciplines, offering an alternative strategy to optimize behavior orthogonal to subjective value.

P1.098 - Riemannian vs. Linear P300 classification for a tactile Brain-Computer Interface in an end-user scenario

M. Pfeiffer[1], **M. Eidel**[1], **W. Tröger**[2], **T. Giesler**[2], **A. Kübler**[1]

[1] Universität Würzburg, Deutschland
[2] Technische Hochschule Nürnberg, Deutschland

Introduction: By creating an output directly derived from brain activity, Brain-Computer Interfaces (BCIs) allow people in a Locked-In-State (LIS) to interact with their environment. Regarding their usability, classification optimization remains one of the main challenges. Therefore, algorithms have been investigated regarding their suitability for application in the domain. However, since most studies were performed on healthy participants, results may not be fully translatable to impaired potential end-users.
Methods: One LIS patient underwent a total of 17 sessions of tactile BCI-training. The obtained data were used to compare different state-of-the-art classification approaches in an online-like process. Shrinkage Linear Discriminant Analysis and Riemannian Geometry Classifiers were compared to a Stepwise Linear Discriminant Analysis (SWLDA) used during online classification in different calibration modes, including inter-session classifier transfer and varying amounts of training data.
Results: In all sessions, the patient was able to elicit a P300 with mean amplitudes of 1.9 μV at Cz (SD=1.7). High variances in amplitudes and classification accuracies were observed. The SWLDA was outperformed in certain conditions, but no algorithm was able to perform continuously above the usability criterion level ($\geq$ 70% accuracy) across all sessions in any of the calibration modes.
Discussion: These results underline the importance of classification-algorithm selection for the usability of BCIs. But they also indicate potential for improvement in said domain, with an emphasis on the need for more research directed towards the classification of data obtained in actual use-cases.

P1.099 - Der Zusammenhang von Intrusionssymptomen und kontextbezogenen Furchtkonditionierungsprozessen bei der sozialen Angststörung

S. Fricke[1,2], R. J. Seinsche[1,2], M. K. Neudert[1,2], R. I. Zehtner[1,2], A. Hermann[1,2,3], R. Stark[1,2,3]

[1] Professur für Psychotherapie und Systemneurowissenschaften, Justus-Liebig-Universität Gießen
[2] Bender Institute of Neuroimaging, Justus-Liebig-Universität Gießen
[3] Center for Mind, Brain and Behavior (CMBB), Universität Marburg und Justus-Liebig-Universität Gießen

Aversive soziale Ereignisse sind ein wichtiger Faktor bei der Entwicklung der sozialen Angststörung (SAD). Neben störungsspezifischen Symptomen, wie starker Angst von anderen negativ bewertet zu werden und Vermeidungsverhalten, können auch Wiedererlebenssymptome vorkommen. Diese treten zum Beispiel in Form von verzerrten negativen Vorstellungsbildern auf. Demnach spielen bei der SAD, wie auch bei der posttraumatischen Belastungsstörung (PTBS), klassische Konditionierungsprozesse eine wichtige Rolle für die Entwicklung der Störung und zusätzlich bestehen Ähnlichkeiten in der Symptomatik dieser beiden Erkrankungen. In der vorgestellten Studie werden neuronale Korrelate kontextabhängiger Furchtkonditionierungsprozesse bei SAD Patienten mit Symptomen intrusiven Wiedererlebens in Reaktion auf ein autobiografisches, aversives soziales Ereignis, im Vergleich zu SAD Patienten ohne diese Symptome, untersucht. Es wurde ein zweitägiges kontextabhängiges Furchtkonditionierungsparadigma mit Furchtakquisition und Extinktion am ersten Tag, sowie Extinktionsabruf im Extinktionskontext und Furchtrenewal in einem neuen, sowie im Akquisitionskontext an einem zweiten Tag durchgeführt. Währenddessen fand eine funktionelle Magnetresonanztomografie-Untersuchung statt. Erste Ergebnisse zeigen, dass sich zwischen Patienten mit klinisch relevanten Intrusionssymptomen (n=19) und Patienten ohne Intrusionssymptome (n=29) Unterschiede in furcht- und extinktionsrelevanten Gehirnregionen, spezifisch der Amygdala, sowie dem ventromedialen Präfrontalkortex, ergeben. Insbesondere eine reduzierte Aktivierung des vmPFC während der Extinktion, dem Extinktionsabruf, sowie dem Furchtrenewal im neuen Kontext bei den Patienten mit Intrusionssymptomen deutet darauf hin, dass SAD Patienten mit Intrusionen, ähnlich wie PTSD Patienten, Kontextinformationen schlechter nutzen, um ihre Furcht zu regulieren. Diese Ergebnisse geben einen Hinweis auf die transdiagnostische Relevanz von Intrusionssymptomen in Reaktion auf aversive (soziale) Ereignisse bei SAD im Zusammenhang mit kontextabhängigen Furchtkonditionierungsprozessen.

P1.101 - The influence of visual exploration on fear generalization in social anxiety

J. Teigeler[1], **J. Jochim**[1], **M. Gamer**[1], **M. Reutter**[1]

Department of Psychology, University of Würzburg, Deutschland

Increased fear generalization has been suggested to contribute to the etiology and maintenance of anxiety disorders. However, the underlying role of attentional mechanisms is still debated. Here, we used a differential fear conditioning and generalization paradigm to examine whether alterations in gaze behavior are related to individual differences in fear generalization profiles in socially anxious individuals.
The preliminary sample consisted of 57 individuals (43 female; 25.4 $\pm$ 4.2 years) who were selected to show a high variance of social anxiety (Social Phobia and Anxiety Inventory = 2.49 $\pm$ 1.03, range 0 - 6). We used a set of facial stimuli with almost identical pairs that could only be distinguished by looking into the region around the eyes or mouth/nose, respectively. These pairs were used as conditioned stimuli (CS+ and CS-). After fear acquisition, a generalization phase followed and morphs were presented, creating a continuum between CS+ and CS-. Fear ratings, eye-tracking data, heart rate, and electrodermal activity were measured.
The finding from a previous study that individual patterns of visual exploration predicted the extent of fear generalization could not be replicated. Nonetheless, participants quickly oriented their attention towards diagnostic facial features during the first 1500 ms of stimulus presentation. Furthermore, higher levels of social anxiety were associated with faster fixation of these distinguishing regions, as well as a tendency towards subsequent avoidance. In conclusion, socially anxious individuals indeed show specific alterations in attentional deployment, which might be a future target point for the development of personalized therapeutic strategies.

P1.102 - Effort-based decision making and motivational deficits in stroke patients

M. E. Abdoust[1,2], **G. Jocham**[1], **S. Knecht**[3], **M. Husain**[4,5,6], **C. L. Heron**[7,8], **B. Studer**[3]

[1] Biological Psychology of Decision Making, Institute of Experimental Psychology, Heinrich Heine University Düsseldorf, Düsseldorf, Germany
[2] Department of Neurology, Mauritius Hospital Meerbusch, Meerbusch, Germany
[3] Institute of Clinical Neuroscience and Medical Psychology, Medical Faculty, Heinrich-Heine-University Düsseldorf, Düsseldorf, Germany
[4] Department of Experimental Psychology, University of Oxford, Oxford, UK
[5] Nuffield Department of Clinical Neuroscience, University of Oxford, Oxford, UK
[6] Division of Clinical Neurology, John Radcliffe Hospital, Oxford University Hospitals Trust, Oxford, UK
[7] Department of Neurology, Christchurch Hospital, Christchurch, New Zealand
[8] New Zealand Brain Research Institute, Christchurch, New Zealand

Motivational deficits in patients recovering from stroke are common and can hinder successful rehabilitation and thereby functional recovery. In a first study, we investigated effort-based decision-making parameters and clinical characteristics of inpatients that displayed reduced drive during post stroke rehabilitation. Thirty drive-impaired and thirty matched non-impaired control stroke patients completed an effort-based decision-making paradigm and different apathy and depression questionnaires. While self-reported ratings revealed higher depression (but not apathy) in drive-impaired patients, we found alterations in terms of performance, rather than decision making. Drive-impaired individuals did not differ from controls in terms of their willingness to accept or reject offers of monetary reward in return for performing different levels of physical effort. However, compared to controls, after accepting an offer, drive-impaired patients were more likely to fail to perform the required effort demand. These results suggest a more complex relationship between readiness to invest effort and the capability to actually exert it.
In a second study, we explored a possible role of serotonin in effort-based decision making in post-stroke patients. We tested the effects of serotonergic antidepressants in patients either after they were newly introduced to their pharmacological treatment ("ON group") or after it was discontinued ("OFF group"). We used the same decision-making paradigm as above and tested both groups before and after the change in medication and compared them to controls that did not receive serotonergic drugs. None of the treatments affected effort-based decision making, indicating that serotonin-modulating drugs do not induce any short-term motivational effects in post-stroke patients.

P1.103 - Divergence of Brain Connectivity in Anxiety Disorders: A Transdiagnostic multicenter Resting-state fMRI Study

T. Langhammer[1], I. Periard[1], I. C. Ridderbusch[2], A. Wroblewski[2], Y. Yang[2], J. Richter[3], M. Hollandt[3], A. O. Hamm[3], H. Wittchen[4,5], A. Ströhle[6], J. Plag[6], U. Dannlowski[7], V. Arolt[7], K. Koelkebeck[8], J. Margraf[9], M. J. Herrmann[10], K. Domschke[11], A. Pittig[12], J. Deckert[12], M. Lotze[13], S. Schneider[14], T. Kircher[2], B. Straube[2], T. Fydrich[1], K. Hilbert[1], U. Lüken[1]

[1] Department of Psychology, Humboldt-Universität zu Berlin, Germany
[2] Department of Psychiatry and Psychotherapy and Center for Mind, Brain and Behavior - CMBB, Philipps-Universität Marburg, Germany
[3] Institute for Psychology, University of Greifswald, Germany
[4] Institute for Clinical Psychology and Psychotherapie, Technichal University of Dresden, Germany
[5] Department of Psychiatry and Psychotherapy, Ludwig-Maximilians-University (LMU) Muenchen, Germany
[6] Department of Psychiatry and Psychotherapy, Campus Mitte, Charité-Universitätsmedizin Berlin, Corporate Member of Freie Universität Berlin, Humboldt-Universität zu Berlin, Berlin Institute of Health, Berlin, Germany
[7] Department of Psychiatry and Psychotherapy, University Hospital Muenster, Germany
[8] Department of Psychiatry and Psychotherapy, Hospital and Institute of the University of Duisburg-Essen, Germany
[9] Chair in Psychiatry and Psychotherapy, Ruhr University Bochum (RUB), Germany
[10] Center for Mental Health, Department of Psychiatry, Psychosomatics, and Psychotherapy, University Hospital Wuerzburg, Germany
[11] Department of Psychiatry and Psychotherapy, Medical Center – Faculty of Medicine, University of Freiburg, Germany
[12] Department of Psychology, Center of Mental Health, University of Würzburg, Würzburg, Germany
[13] Functional Imaging Unit, Diagnostic Radiology, University Medicine Greifswald, Germany
[14] Department of Clinical Child and Adolescent Psychology, Ruhr-University Bochum, Bochum, Germany

Objective: Anxiety disorders (ADs) are associated with altered connectivity in large-scale intrinsic brain systems including executive and salience networks. The extent to which these signatures are shared across different phenotypes remains however elusive and direct transdiagnostic comparisons are yet missing. We evaluated differences in functional connectivity in a transdiagnostic sample of AD patients and healthy controls.
Method: Prior to treatment, 439 patients from two multicenter clinical trials at nine different sites fulfilling a diagnosis of panic disorder and/or agoraphobia (PD/AG, N=154), social anxiety disorder (SAD, N=95), or specific phobia (SP, N=190) and healthy controls (HC, N=105) underwent an 8 minute resting-state fMRI assessment. ROI-to-ROI analyses on a priori defined regions were performed using one-way analysis of covariances with age, sex and site as covariates of no interest.
Results: Relative to healthy controls, AD patients showed significantly reduced connectivity between the insula and the thalamus. In particular, PD/AG patients showed increased (insula, amygdala, hippocampus, thalamus) and decreased (periaqueductal grey, and frontal areas) positive

connectivity between subcortical and cortical areas. In contrast, SAD patients showed decreased negative connectivity in cortical areas (orbitofrontal cortex, insula), whereas no differences were found in SP patients. Connectivity was not related to state anxiety during scanning.
Conclusions: We were able to directly compare functional connectivity along a range of ADs. Findings indicate that PD/AG patients show altered connectivity along a widespread subcortical-cortical network, including the midbrain. The relative specificity of findings speaks against a strong overarching factor and thus challenges the predominance of transdiagnostic concepts.

P1.104 - Validation of an fMRI-based Olfactory Cue Reactivity Task

Ç. N. Gürsoy[1,2,3], **G. B. Feld**[1,2,3]

[1] Department of Clinical Psychology, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany
[2] Department of Addiction Behaviour and Addiction Medicine, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany
[3] Department of Psychiatry and Psychotherapy, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany

Alcohol Use Disorder (AUD) is one of the most prevalent substance use disorders and globally millions of persons are affected by it. During the development of AUD, sensitization of the dopaminergic reward networks in the brain is thought to enhance "wanting" of alcohol, whereas "liking" of alcohol may stay the same or even decrease. Persons with substance use disorders experience an enhanced craving response towards drug related cues, i.e., cue reactivity that is related to the probability of relapse. In the cue reactivity task, enhanced activation of dopaminergic reward areas in the brain in response to alcohol stimuli, has been shown using fMRI measurements. By combining an image and odour based cue reactivity task, we aim to show the effectivity of olfactory cues compared with the tried and tested image-only cue reactivity task. Our goal is to ultimately enhance the measurement precision of the task. In this validation experiment, we recruit participants who have hazardous or harmful alcohol consumption behaviour, confirmed by Alcohol Use Disorders Identification Test. In the combined cue reactivity task, olfactory and synchronous visual alcohol and non-alcohol cues are delivered to participants lying in the MRI using an olfactometer and an MRI compatible screen. We contrast this with a version of the task only showing the visual stimuli. We predict that the combined stimulation will elicit stronger cue reactivity than the visual stimulation alone. Preliminary data analysis will be presented.

P1.105 - Taking depression at face value: Study protocol and pilot data on utilizing facial expressions as biomarker and biofeedback intervention within a smartphone-based reappraisal training

K. Capito[1], L. Schindler-Gmelch[1], S. Böhme[1], L. H. Rupp[1], R. Richer[2], M. Sadeghi[2], B. Eskofier[2], M. Berking[1]

[1] Lehrstuhl für Klinische Psychologie und Psychotherapie, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)
[2] Lehrstuhl für Maschinelles Lernen und Datenanalytik, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)

Objective biological markers offer the chance of important and more holistic insights into the etiology, diagnostics, and treatment of mental disorders. However, the transfer to everyday (psychotherapeutic) life has been hampered by the necessary complex and expensive technical requirements. However, recent technological advantages both in data collection as well as data analysis methods provide promising new avenues.
By taking such recent technological developments into account, our study focuses on the assessment of facial (micro)expressions as a non-invasive, easy-to-implement biomarker in depression, utilizing highly innovative sensor technology and methods of machine learning.
To evaluate their relevance for depressive mood detection and reduction, a randomized controlled trial with n = 128 individuals diagnosed with unipolar depression and n = 128 healthy controls is planned. After depressive mood induction, three active groups receive a smartphone-based intervention. Conditions are either 1) verbal cognitive reappraisal, 2) cognitive reappraisal enhanced by facial expressions, or 3) a biofeedback training focusing on antidepressant facial expressions. An additional control group receives a placebo intervention. Affect-relevant bodily processes and facial expressions will be assessed throughout the study.
It is expected that machine-learning based automated facial expression recognition can precisely differentiate between individuals with and without the diagnosis of depression. Furthermore, it is expected that all three intervention conditions lead to more pronounced reductions of depressed mood compared to the placebo condition, with cognitive reappraisal enhanced by antidepressant facial expressions being particularly effective. Preliminary pilot data are presented and discussed with particular regard to current clinical practice.

P1.106 - Vagally-mediated heart rate variability is attenuated during breathing meditation in patients with borderline disorder

A. B. E. Benz[1], B. Skorzinski[1], J. Oerther[1], M. Meier[1], R. J. Gaertner[1], S. J. Dimitroff[1], B. F. Denk[1], U. U. Bentele[1], E. Unternaehrer[1,2], J. C. Pruessner[1]

[1] Universität Konstanz, Deutschland
[2] Universitäre Psychiatrische Kliniken Basel (UPK), Switzerland

Borderline Personality Disorder (BPD) is a severe mental disorder including impaired emotion regulation, interpersonal relationships, and self-concept. Alongside affective and behavioral problems, psychobiological dysregulations are observed in individuals with BPD (e.g. vagally-mediated heart rate variability (vmHRV) appears to be reduced). In healthy samples, mindfulness practices, e.g. breathing meditations, are effective in increasing vmHRV. It remains unclear whether vmHRV also changes in individuals with BPD, in response to an acute breathing meditation.
To investigate this question, we measured vmHRV in n=12 individuals with BPD (83% female, agemean=25.67 ±4.56) and n=27 healthy controls (81% female, agemean=26.63 ±8.04) during two mindfulness breathing exercises. As an indicator of vmHRV, we calculated high frequency heart rate variability (HF-HRV) and performed repeated measure ANOVAs in JASP. We pre-registered the study protocol prior to data acquisition (https://osf.io/4rwyn) and uploaded the dataset and scripts used for analyses (https://osf.io/cfrxk/).
HF-HRV increased in both groups during both exercises compared to a questionnaire baseline before and after each exercise ($F(10,370)=27.16$, $p<.001$, partial eta squared=.42). Furthermore, we observed a main effect of group ($F(1,37)=4.64$, $p=.038$, partial eta squared=.11), in that individuals with BPD had overall lower HF-HRV. Interaction effects did not reach significance, indicating comparable response patterns in both groups, but statistical power to test this was limited.
Thus, while a BPD diagnosis is associated with overall attenuated vmHRV, the ability to respond to a mindfulness breathing exercise seemed unaffected, at least in this sample. Future studies should aim to include more subjects with BPD.

P1.107 - Altered EEG Variability on Different Time Scales in Participants with Autism Spectrum Disorder - An Exploratory Study

L. Hecker[1,2,3,4,5], **M. Wilson**[1,2,3,4], **L. T. v. Elst**[1,2], **J. Kornmeier**[1,2,3,4]

[1] Department of Psychiatry and Psychotherapy, University of Freiburg Medical Center, Freiburg, Germany.
[2] Faculty of Medicine, University of Freiburg, Freiburg, Germany.
[3] Faculty of Biology, University of Freiburg, Freiburg, Germany
[4] Perception and Cognition Lab, Institute for Frontier Areas of Psychology and Mental Health (IGPP), Freiburg, Germany.
[5] Department of Psychosomatic Medicine and Psychotherapy, University of Freiburg Medical Center, Freiburg, Germany.

One of the great challenges in psychiatry is finding reliable biomarkers that may allow for more accurate diagnosis and treatment of patients. Neural variability received increasing attention in recent years as a potential biomarker.
In the present explorative study, we investigated temporal variability in visually evoked EEG activity in a cohort of 16 adult participants with Asperger Syndrome (AS) and 19 neurotypical (NT) controls. Participants performed a visual oddball task using fine and coarse checkerboard stimuli. We investigated various measures of neural variability and found effects on multiple time scales. (1) As opposed to the previous studies, we found reduced inter-trial variability in the AS group compared to NT. (2) This effect builds up over the entire course of a 5-minute experiment and (3) seems to be based on smaller variability of neural background activity in AS compared to NTs. The here reported variability effects come with considerably large effect sizes, making them promising candidates for potentially reliable biomarkers in psychiatric diagnostics. The observed pattern of universality across different time scales and stimulation conditions indicates trait-like effects. Further research with a new and larger set of participants are thus needed to verify or falsify our findings.

P1.108 - Treatment response prediction based on resting-state neurofunctional data in spider phobia

J. Böhnlein[1], N. R. Winter[1], E. J. Leehr[1], L. Stumpe[1], K. Roesmann[2,3], B. Gathmann[4], M. J. Herrmann[5], M. Junghöfer[3,6], F. R. Seeger[5], N. Siminski[5], T. Straube[4], K. Hilbert[7], U. Lueken[5,7], U. Dannlowski[1]

[1] Institute for Translational Psychiatry, University of Münster, Germany
[2] Institute for Clinical Psychology, University of Siegen, Germany
[3] Institute for Biomagnetism and Biosignalanalysis, University of Münster, Germany
[4] Institute of Medical Psychology and Systems Neuroscience, University of Münster, Germany
[5] Department of Psychiatry, Psychosomatics, and Psychotherapy, Center for Mental Health, University Hospital of Würzburg, Germany
[6] Otto-Creutzfeld Center for Cognitive and Behavioral Neuroscience, University of Münster, Germany
[7] Department of Psychology, Humboldt-Universität zu Berlin, Berlin, Germany

Introduction: Exposure therapy is the gold standard for the treatment of anxiety disorders. However, about half of the patients do not respond sufficiently. Using prediction of therapy response with machine learning approaches, we could stratify patients to the right treatment and thus improve these rates. In previous research, we showed that prediction based on clinical and demographic data can be accurate above chance; however, accuracy rates must be improved to be of clinical use. One way to achieve this might be by using different data bases, like neurofunctional data.
Methods: In a bicentral study, in N=190 patients with spider phobia, symptom severity was assessed with a behavioral avoidance test and the Spider Phobia Questionnaire at three times: Before a one-session virtual reality exposure treatment, after the treatment and at a six-months follow-up. Additionally, a resting-state fMRI paradigm was conducted before the treatment. We used the PHOTON toolbox (https://photon-ai.com) to predict treatment response based on region-to-region correlation matrices of the resting-state activity at pre-treatment.
Results: In contrast to previous results based on clinical and demographic data, prediction based on RS did not achieve accuracy rates significantly above chance, irrespective of the predicted outcome variable (behavioral avoidance test or questionnaire) and time point (post and follow-up).
Discussion: The results suggest that easily obtainable data like questionnaires might surpass neurofunctional data as a basis for ML prediction in some cases. Further research should combine different data bases as well as incorporate changes over time in neurofunctional data to obtain more informative data bases.

P1.109 - Differentiability of extinction and reconsolidation by prefrontal brain activation in social drinkers

I. Int-Veen[1]

Universitätsklinikum Tübingen, Deutschland

Cue Exposure Therapy (CET) is a psychotherapeutic intervention whereby patients are gradually exposed to relevant cues of the drug of abuse in order to extinguish conditioned responses (Drummond et al., 1990). It is one the most empirically supported treatment for alcohol abuse and dependence (Chambless & Ollendick, 2001), however outcomes are so far not satisfactory (Mellentin et al., 2017). Investigating the neurobiological underpinnings in order to understand the interplay of psychological and physiological mechanisms and in the end improve therapeutic interventions seems promising. In the study at hand, we assessed the physiological (heart rate, electrodermal activity), subjective (craving), behavioral (drinking) as well as neural correlates (functional near-infrared spectroscopy, fNIRS) of 40 social drinkers performing a cue exposure. Following recent research, we propose increased activity of the orbitofrontal cortex (OFC) due to the processing of reinforcement value and increased sympathetic activity due to activation of the addiction memory, which lead to increased craving. In case of extinction processes, we expect increased functional connectivity between the OFC and dorsolateral prefrontal cortex (dlPFC) as an index of (deficient) behavioral inhibition as well as increased connectivity reflecting reductions in craving and sympathetic activity. Using the craving ratings and fNIRS data as a basis for different algorithms (Support Vector Machine, Hidden Markov Models), we hypothesize to be able to differentiate extinction and reconsolidation processes: While it is not possible to differentiate whether no cue reactivity was provoked or whether it was successfully suppressed in the case of subjective craving, using fNIRS potentially offers this opportunity.

P1.110 - The N400 response as a marker of cognitive processing in patients with disorders of consciousness – evidence from semantic violations in sentences and proverbs

S. Geukes[1], **I. Steppacher**[1], **J. Kißler**[1]

Universität Bielefeld, Deutschland

In unresponsive patients, it is a significant clinical challenge to assess the current level of consciousness and predict subsequent recovery. In previous work from our group, we auditorily presented sentences with semantically congruent and incongruent endings to patients with disorders of consciousness (unresponsive wakefulness state or minimally conscious state). We showed that the presence of an N400 response was a strong predictor of later recovery in both groups. Here, we extended this approach by comparing the N400 response in sentences (possible/nonsense endings) to the N400 response in common proverbs (correct/possible/nonsense endings), aiming for conceptual replication as well as testing for paradigm-specific differences. Therefore, we recorded data for both paradigms from 17 patients with disorders of consciousness and from 31 healthy controls and assessed the presence of N400 responses on the individual and the group level. On the group level, controls, but not patients, showed significant N400 responses in both paradigms. In controls, N400 amplitudes in the proverb paradigm did not differ between incorrect but possible endings and nonsense endings. On the individual level, 12 controls and 2 patients showed a significant N400 in the proverbs paradigm. In the sentence paradigm, 17 controls and 3 patients showed an N400 response. So far, data suggest superiority of the standard N400 paradigm over the proverb paradigm. The fact that on the individual level only a subset of controls showed an N400 effect underlines its significance when found in patients. The true predictive value for this sample will be assessed in upcoming analyses.

P1.111 - The interplay of acute trauma, stress and brain morphology

M. Ehlers[1], **K. Schüren**[1], **S. Biedermann**[1], **T. Lonsdorf**[1]

University Medical Center Hamburg Eppendorf, Deutschland

Previous studies reported mixed results regarding morphological changes in survivors of acute trauma and resultant posttraumatic symptoms. While some studies show a reduction in e.g. hippocampal volume following trauma others were not able to detect group differences. The results of cross-sectional studies are however hampered in their interpretability because it remains unclear whether altered morphology is a trait factor favouring the development of posttraumatic symptoms or whether it develops as a consequence of the traumatic experience.
In this longitudinal study, 31 survivors of acute trauma and 39 controls underwent magnetic resonance imaging, completed a battery of questionnaires and provided cortisol samples at two time points. The first measurement time point took place within one week of the traumatic experience, the longitudinal follow-up appointment took place three months later. Cortical thickness and subcortical volume of four regions of interest (i.e. hippocampus, amygdala, anterior cingulate cortex, medial orbitofrontal cortex) were extracted using the software Freesurfer.
Cerebral morphology of trauma victims and matched controls are compared at baseline and at three months follow up in interaction with symptom severity in order to answer the question whether morphological alterations constitute a predisposition or a consequence of exposure to acute trauma. Cortisol levels immediately after trauma exposure are assessed as a potential predictor for morphological changes and posttraumatic symptoms at follow-up.
The current study aims to shed light on the interplay of exposure to acute trauma and the observed changes in stress response and brain morphology and may help to better understand their causal relationship.

P1.112 - Now or later? A comparison of the effectivity of continuous and intermittent feedback for neurofeedback learning

M. Jindrova[1], M. Paro[1], L. Wölfl[1], N. Lubianiker[2,3], C. Schmahl[1], C. Paret[1,2]

[1] Department of Psychosomatic Medicine and Psychotherapy, Central Institute of Mental Health, Mannheim, Germany
[2] Sagol Brain Institute, Wohl Institute for Advanced Imaging, Tel-Aviv Sourasky Medical Center and School of Psychological Sciences, Tel-Aviv University, Israel
[3] School of Psychological Sciences, Gershon H. Gordon Faculty of Social Sciences, Tel-Aviv University, Israel

Amygdala neurofeedback (NF) is a promising tool for emotion regulation therapy. Participants get real-time feedback about their brain activation and they learn to modulate this signal. In standard protocols, subjects view affective pictures to evoke an amygdala response, which they then try to downregulate with aid of real-time feedback. However, little is known about how the timing of feedback affects the effectivity of learning. Presenting feedback continuously alongside affective stimuli imposes additional cognitive processing demands as compared to feedback alone. Presenting aggregated feedback right after the regulation block, which is called intermittent feedback, reduces the complexity of the interface and may favor more efficient training of regulation strategies. The main goal of this study is to investigate the difference in the effectiveness of NF-learning between the two groups. 68 healthy participants are randomized to two groups, receiving either continuous or intermittent feedback. Amygdala electrical fingerprint (EFP) technology is used to provide feedback. EFP is an fMRI-inspired EEG signature that offers a scalable and more widely available alternative for the feedback of deep brain activity as compared to fMRI. The difference in the ability to downregulate the EFP signal will be compared between the two groups using mixed-level ANOVA with a session as within-factor and group as a between-factor. Preliminary results will be presented. The results of this study may help to improve amygdala-NF training protocols. The study was preregistered at OSF (https://osf.io/pzbct).

P1.113 - Interactions of Prenatal and Postpartum Depression and Infants' Temperament Trajectories: From Age 6 Weeks to 18 Months

F. Sörensen[1], B. Mahjani[2], V. Brenner[3], I. Krägeloh-Mann[1], A. Skalkidou[4], E. Fransson[4,5]

[1] Pediatric Neurology & Developmental Medicine, University Children's Hospital Tübingen, Germany
[2] Seaver Autism Center for Research and Treatment, Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, USA
[3] Child and Adolescent Psychiatry Tübingen, Germany
[4] Department of Women's and Children's Health, Uppsala University, Uppsala, Sweden
[5] Department of Microbiology, Tumor and Cell Biology, Karolinska Institutet, Stockholm, Sweden

Background: Perinatal depression is a widespread condition that affects not only mothers but also their infants. The interaction between maternal prenatal depressive mood and the developmental course of difficult infant temperament over time is not well explored.
Method: Data for 1642 mothers and their infants from the Swedish BASIC cohort ("Biology, Affect, Stress, Imaging and Cognition in pregnancy and puerperium") and the follow-up study (U-BIRTH). Depression was assessed via the Edinburgh Postnatal Depression Scale (EPDS) during pregnancy at gestational weeks 17 and 32 and postpartum at week 6. Infant temperament was assessed at age 6 weeks, 12 and 18 months. Difficult infant temperament trajectories were calculated via Group-Based Trajectory Modeling and could be classified as (1) stable low, (2) stable medium and (3) high rising.
Results: Higher mean EPDS pregnancy scores during pregnancy were associated with the more difficult temperament trajectories (2) and (3) compared to temperament trajectory (1). Introducing postpartum depression in the model attenuated the association between the high rising difficult temperament trajectory and mean pregnancy EPDS scores, while the association for medium difficult temperament was still significant. No sex differences were found.
Conclusion: Maternal depression during pregnancy and postpartum also affects child development and is associated with difficult temperament trajectories of the child, which may indicate future adverse effects. The sample in this study displays a high socioeconomic background; stronger associations might be found in samples that are more representative of the general population.

Topic 10: (Brain) Stimulation

P1.115 - Distinct Neuromodulation-Induced Eeg-Behavior Prediction Patterns: Low-Intensity Transcranial Focused Ultrasound Targeting the Right Prefrontal Cortex Increases Approach and Decreases Withdrawal Behavior Via Specific Inhibition of Midfrontal Theta

P. Ziebell[1], J. Rodrigues[1], A. Forster[1], I. Landwehr[1], T. Seibert[1], J. Sanguinetti[2], J. Allen[2], J. Hewig[1]

[1] University of Würzburg, Würzburg, Germany
[2] University of Arizona, Tucson (AZ), USA

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.

P1.116 - When time matters: differential effects of electrical stimulation on learning performance

S. Paßmann[1], **S. Baselgia**[1], **B. Rasch**[1]

Universität Fribourg, Schweiz

Successful learning or recall of information correlates positively with increased activity in the theta frequency band. It is assumed that theta serves as a key element in the bi-directional interaction between prefrontal cortex (PFC) and hippocampus (HPC). However, a functional relevance of theta for memory formation has not yet been shown. Therefore, we investigated in two different groups (study 1: N = 30; study 2: N = 22) whether bi-hemispheric alternating current stimulation in the theta band (theta-tACS; stim-electrodes: FP1 & P7 as well as FP2 & P8) improved learning performance in a word-pair learning paradigm as opposed to a control condition (beta-based tACS). Two word pair lists were learned in each study, with tACS administered only during learning of the first list in study 1 (online list; list 2: offline list), and during the delayed mixed recall of both lists in study 2. A direct comparison of the two studies showed no effect of stimulation frequency on overall learning performance (both lists), but a general greater loss for study 2 in contrast to study 1. A more detailed, list-based analysis showed that the learning performance of the offline list (study 1) has a clear advantage under theta-tACS, in contrast to beta-tACS. Especially, this advantage is shown in comparison to study 2, where theta-tACS even has a disadvantageous effect in contrast to beta-based tACS. Results could not be supported by preliminary analyses of neurophysiological data, but are discussed with regard to the possibility of a tACS-based influence on interhemispheric synchrony.

P1.117 - Optimizing transcranial electrical stimulation for improved sleep physiology and memory

J. Ladenbauer[1], L. Khakimova[1], R. Malinowski[1], D. Obst[1], E. Tönnies[1], D. Antonenko[1], K. Obermayer[2], J. Hanna[1], A. Flöel[1,3]

[1] Universitätsmedizin Greifswald, Deutschland
[2] Technische Universität Berlin
[3] German Centre for Neurodegenerative Diseases (DZNE) Greifswald

Sleep slow oscillations (SO), spindles and their precise temporal interplay are crucial for successful memory consolidation. Alterations of these memory-relevant sleep parameters occur in aging and are most pronounced in neurodegenerative diseases such as Alzheimer's dementia. A feasible approach to enhance these sleep parameters is anodal transcranial slow oscillatory stimulation (so-tDCS) during sleep, which was shown to positively impact retrieval performance after sleep. However, response to so-tDCS varied quite markedly between individuals and studies, highlighting the need for optimization and individualization of the stimulation.
We tested differences between so-tDCS with eigenfrequency and standardized frequency of 0.75 Hz on SO-spindle coupling during napping in 28 healthy older adults. Moreover, we systematically explored differences between diverging durations of stimulation trains (30 sec, 2 min and 5 min). Contrary to our expectations, standardized frequency rather than individualized frequency indicated stronger aftereffects in coupling between SOs and spindles. In addition, aftereffects of 30-sec so-tDCS were comparable in magnitude with significantly longer stimulation durations.
Our results indicate no benefit of individualized stimulation frequency relative to standardized so-tDCS for the improvement of memory-relevant sleep oscillations in healthy older adults. As short stimulation trains were sufficient to induce significant changes in sleep physiology, this is a first important step towards the possibility of applying several trains of stimulation within one sleep session, possibly inducing larger aftereffects in terms of neurophysiology and memory consolidation. Ongoing experiments now determine whether these effects on memory consolidation emerge, and explore additional variations in stimulation parameters such as polarity and tonic current.

Topic 11: Affective Neuroscience

P1.118 - The Balance of Approach and Avoidance Behavior – The Role of Noradrenaline and Cortisol

K. Fricke[1], **S. Vogel**[1]

MSH Medical School Hamburg, Deutschland

Humans tend to approach positive stimuli and to avoid negative, potentially dangerous stimuli. Many situations, however, contain both positive and negative aspects, resulting in conflicts between approach and avoidance. A disturbance of the balance between approach and avoidance is key to several psychiatric disorders like anxiety or substance use disorders. In many of these disorders, stress is assumed to play a critical role in both development and maintenance. A better understanding of how stress and major stress mediators affect approach and avoidance behavior in healthy individuals could therefore have important implications for our understanding of how stress-related mental disorders develop.
In this project, the impact of noradrenaline and cortisol on approach-avoidance behavior was investigated. Our hypothesis was that the combined pharmacological administration of hydrocortisone and the adrenoceptor antagonist yohimbine would mimic stress effects on approach-avoidance behavior (i.e., increased importance of threat distance under stress), while administration of either alone, would potentially not be sufficient. Ninety-six healthy participants (48 female) were divided into four groups (20mg yohimbine, 20mg hydrocortisone, both or placebo). Forty-five minutes after intake, participants completed a computerized approach-avoidance conflict task, where they had to forage for coins under threat. Here, we present findings related to the effects of yohimbine and cortisol administration as well as interindividual differences in personality (trait anxiety, aggression, sensation-seeking) on the balance of approach and avoidance. Gender is highly predictive of approach-avoidance behavior, while yohimbine, cortisol and interindividual differences have little or no effect. Potential reasons for our findings are discussed.

P1.119 - Ewww - Investigating the neural basis of disgust in response to naturalistic and virtual nauseating stimuli

G. Berretz[1], C. Dutschke[1], E. Leonard[1], J. Packheiser[2]

[1] Department of Biopsychology, Institute of Cognitive Neuroscience, Faculty of Psychology, Ruhr University Bochum, Bochum, Germany
[2] Netherlands Institute for Neuroscience, Social Brain Lab, Amsterdam, The Netherlands

Enhancing the ecological validity in psychological research improves the reliability and validity of its findings. When it comes to the induction of emotions, most studies are using pictures or videos. This leaves the question of whether elicited reactions reflect real emotions. To investigate this issue, the present study goes one step further: we used the presentation of pictures and naturalistic disgusting stimuli as well as neutral controls in 56 participants during which we recorded EEG alpha asymmetries at frontal and occipital electrodes. On the behavioral level, participants showed significantly higher disgust ratings for naturalistic stimuli compared to pictures. Across all participants, there were no significant differences between presentation conditions on frontal electrodes. On the O1-O2 electrode pair, there was a significant effect of emotions indicating stronger right-hemispheric activity during disgusting stimuli. When investigating participants that showed a pronounced disgust response, there was a significant difference between naturalistic and picture stimuli at the F3-F4 indicating more right-hemispheric activity during naturalistic stimuli. At the O1-O2 electrode pair, there was also a significant interaction between presentation condition and emotional valence with more right-sided activity during the presentation of naturalistic disgusting stimuli. As the right hemisphere has been suggested to process negative and avoidance-related emotions, this indicates that the presentation of real stimuli elicits not only a stronger subjective feeling of disgust but also a stronger neural response compared to the presentation of pictures. As ecological validity and reliability gain increasing importance in psychology and neuroscience, using real-life stimuli might increase both.

P1.120 - ERP effects of emotion and selective attention on face processing

J. Schmuck[1], **H. Kirsten**[1], **V. Shivani**[1], **H. Gibbons**[1]

Universität Bonn, Deutschland

We encounter a variety of facial expressions every day. The way we process these faces depends on multiple factors, including the emotionality of the expression and how much attention we pay to the respective face. An interesting question concerns the extent to which selective attention to particular emotional facial expressions affects the processing of the face. Until now, besides independent emotion and attention effects, event-related potentials (ERPs) mostly revealed interaction effects for late components. However, it has been argued that selective attention also implies neuronal activity in preparation for the features to be attended. Consequently, this could potentially implicate particular effective top-down processing at earlier stages, especially for emotional compared to neutral facial expressions.
In this preregistered study, we investigated ERP effects of valence and selective attention in a valence detection task (N = 60). Fearful, happy, and neutral faces were presented in randomized order. Depending on a block-wise varying target level of valence, participants were instructed to respond via button press only to faces congruent with the current target level of valence.
Main effects of valence in emotion-sensitive ERP components should indicate processing advantages for emotional faces. We also expected components to be larger in the attended condition. These main effects are expected to be qualified by interactions of valence and attention at early components (P1, N170, Early Posterior Negativity), reflecting that early attentional mechanisms specifically enhance the processing of emotional faces. Data analysis including frequentist and Bayesian statistics is in progress; results will be presented at the conference.

P1.121 - Unterscheiden sich die appetitiven Konditionierungs- und Extinktionsprozesse mit pornographischen, gaming-bezogenen und monetären Belohnungsstimuli?

K. Krikova[1,3], S. Klein[2,3], I. T. León[1,3], T. Klucken[1], R. Stark[2,3]

[1] Universität Siegen, Deutschland
[2] Justus-Liebig-Universität Gießen, Deutschland
[3] Bender Institute of Neuroimaging, Deutschland

Appetitive Konditionierung ist ein bedeutender Mechanismus für die Entstehung und Aufrechterhaltung von Verhaltenssüchten wie beispielsweise Pornografie-Nutzungsstörung sowie Computerspielstörung (Brand et al. 2019). Es wird angenommen, dass pornografischen Stimuli primäre Verstärker sind, während monetäre oder gaming-bezogene Stimuli eher sekundäre Verstärker darstellen. Frühere Forschungsarbeiten zeigten, dass bei der Verarbeitung von primären und sekundären Belohnungsstimuli zum Teil unterschiedliche Hirnareale beteiligt sind (Sescousse et al. 2013). Ob und inwieweit sich die Konditionierungs- und Extinktionsprozesse mit pornografischen, gaming-bezogenen und monetären Belohnungsstimuli bei gesunden Menschen unterscheiden, ist noch wenig untersucht.
In dieser Studie werden appetitive konditionierte Reaktionen (neuronale Korrelate sowie subjektive Bewertungen) mit pornografischen, gaming-bezogenen und monetären Belohnungen als unkonditionierte Stimuli untersucht und miteinander verglichen. Während der fMRT-Messungen werden männliche heterosexuelle Probanden, die zwischen 18 und 50 Jahre alt sind und keine Pornografie-Nutzungsstörung oder Computerspielstörung aufweisen, ein differentielles klassisches Konditionierungsparadigma mit einer Lern- und einer Extinktionsphase durchlaufen. Dabei werden in der Lernphase vier neutrale Stimuli (geometrische Figuren) als konditionierte Stimuli verwendet (CS+ porn, CS+ gaming, CS+ money und CS-), die mit pornografischen Bildern (UCS porn), Bildern aus unterschiedlichen Computerspielen (UCS gaming) und Bildern von Geld, welche 50 Cent Gewinn ankündigen (UCS money), in 62,5% der Fälle verknüpft werden. Nach der Präsentation eines CS- folgen keine Bilder. In der Extinktionsphase werden konditionierte Stimuli ohne unkonditionierte Stimuli präsentiert.
Die Erhebung der Daten ist bislang nicht abgeschlossen. Ergebnisse und Schlussfolgerungen werden zum Zeitpunkt der Konferenz präsentiert und diskutiert.

P1.122 - Early and mid-latency amygdala gamma responses to faces are dependent on the attended to expression. Insights from intracranial recordings

E. M. Weidner[1], S. Moratti[2,3], S. Schindler[4], P. Grewe[5], C. G. Bien[5], J. Kissler[1]

[1] Bielefeld University, Department of Psychology, Bielefeld, Germany
[2] Laboratory for Clinical Neuroscience, Centre for Biomedical Technology, Technical University of Madrid, Madrid, Spain
[3] Department of Experimental Psychology, Complutense University of Madrid, Madrid, Spain
[4] Institute of Medical Psychology and Systems Neuroscience, University of Münster, Münster, Germany
[5] Department of Epileptology, Medical School OWL, Bielefeld, Germany

The amygdala is assumed to contribute to a bottom-up attentional bias for emotional faces. However, its interaction with top-down attentional processes awaits further clarification. Here, we studied the interaction of emotion and attention during face processing via intracranial EEG depth recordings of the amygdala in 7 patients with epilepsy (4 right, 3 left). Three randomized blocks consisting of angry, neutral, and happy facial expressions were presented, and one expression was denoted as the target category in each block. Emotional faces were detected faster compared to neutral faces. They were also detected more accurately with an advantage for happy faces on a descriptive level. On the group level, an early onset (about 60 ms) increase in amygdala gamma-activity (60-80 Hz) was selective to attended threat which was consistent across patients. A mid-latency (about 220 ms) gamma-power increase (40-70 Hz) during the neutral target condition was found specifically for angry faces and less pronounced for happy faces. This effect was less consistent across patients. Attention to happy faces did not result in an electrophysiological differentiation of facial expressions in the gamma frequency range. The present data shed light on the context-dependence of amygdala threat-sensitivity. These results uncover possible mechanisms of how different task-induced attentional biases can modulate oscillatory neural responses to emotion. Assuming that individuals differ in implicit attentional biases that the present explicit instructions might mimic, these data might help explaining individual differences in emotion processing.

P1.123 - Individual freezing-like behavior in relation to threat proximity

A. Koppold[1], **T. B. Lonsdorf**[1]

Universitätsklinikum Hamburg-Eppendorf, Deutschland

When facing threat, defensive circuits are activated to ensure survival. In the context of survival, blunted physiological responding is associated with action preparation, but less is known about individual differences in threat imminence. Here we present a paradigm which is intended to capture defensive psychophysiological responding and reactions in varying situations of threat imminence, (uncertainty) and safety. Within a multimethodological approach, we combine the human body sway, a proxy for freezing-like behaviour in humans as assessed by a stabilometric force platform, heart rate variability, fear potentiated startle and skin conductance response as outcome measures. The overarching aim is to identify data-driven latent subgroups based on the freezing-like behaviour and the individual task performance in relation to the perception of threat proximity with a sample of 500 participants. First results validated the paradigm by revealing a generally reduced freezing-like behaviour on the stabilometric-force platform in the experimental conditions of threat imminence. Here, I present the first study results (n = 60) from the paradigm and will showcase first results on defensive behaviour in a threat imminence context and on individual difference characteristics.

P1.124 - The amygdala in emotional word reading: Event-related potentials following unilateral medial temporal lobe resections

J. Kißler, M. Mielke[1], L. M. Reisch[1,3], S. Schindler[2], C. Bien[3]

[1] Abteilung für Psychologie, Universität Bielefeld, Deutschland
[2] Institut für medizinische Psychologie, Universität Münster
[3] Universitätsklinik für Epileptologie, Universität Bielefeld

We investigated the impact of left and right unilateral anteromedial temporal lobe resections including the amygdala on event-related potentials (ERPs) during attentive reading of negative and neutral words as well as their emotional appraisal and recognition memory. Word ratings did not differ between left (lTLR) and right (rTLR) resection groups or healthy controls. All groups also had better recognition memory for negative than neutral words. ERP emotion enhancements were found across groups in the P1 (75-115 ms), EPN (200-300 ms and 300 – 400 ms), and LPP (400 – 600 ms and 600 – 800 ms). However, targeted analysis revealed that the rTLR group lacked the P1 emotion effect. By contrast, the LPP emotion effect was not significant in lTLR, but present in rTLR and the healthy control group. In the N1, only lTLR, but not the other two groups showed emotional modulation over occipital and left frontal cortex. All groups had intact EPN emotion modulation. This pattern of ERP effects seems most compatible with the view that the right medial temporal lobe, including the amygdala, critically contributes to rapid emotion processing, also in verbal stimuli, whereas the left medial temporal lobe plays an important role in their sustained processing. Data disconfirm the view that either side alone is decisive for emotional word processing and also indicate that multiple sources contribute to emotion processing, resulting in largely adequate behavioral performance after unilateral loss. Overall, these data help specify the neural mechanisms underlying the commonly seen emotion enhancements in word processing.

P1.125 - Processing emotion words in the absence of subjective awareness: an fMRI study

M. Ghio[1], **B. Cassone**[2], **M. Tettamanti**[3]

[1] Heinrich Heine University Düsseldorf, Germany
[2] CIMeC - University of Trento, Italy
[3] University of Milano-Bicocca, Italy

Neuroimaging research showed that not only the perception and recognition of emotions, but also their conceptualization, including the lexical-semantic word processing, involves areas within the limbic system (i.e., amygdala, anterior cingulate, orbitofrontal and insular cortices, Lindquist et al., 2011). Whether the involvement of the limbic system is independent of conscious emotion concept processing, however, is still an open question. Our fMRI study (involving 21 healthy participants) addressed this question by applying Continuous Flash Suppression, a technique to instantiate subliminal stimulus processing conditions over a time interval sufficient to induce lexical-semantic encoding (Tsuchiya & Koch, 2005). As stimuli, we used emotion words parametrically distributed along the negative-to-positive valence dimension (e.g., sadness, joy), with neutral words (e.g., calm) serving as a semantically-related control condition. Manipulable object words (e.g., hammer) served as a semantically-unrelated control condition, for which activations within the premotor-parietal action system were expected also under subliminal conditions (Tettamanti et al., 2017). By considering the absence of subjective awareness based on behavioural participants' responses, we found that unconscious semantic processing triggered brain activity in areas within the limbic and action systems. Post-hoc comparisons revealed that subliminal processing of emotion and manipulable object words elicited stronger activations in, respectively, the left amygdala and the left premotor-parietal action system. These results extend previous evidence by showing that a specific emotion and action encoding occurs, not only for perception and recognition but also for lexical-semantic processing, even in the absence of awareness.

P1.126 - Sexual cue processing across the oral contraceptive regimen: Neural correlates and self-reported sexual desire

N. M. Schmidt[1], **K. Henkel**[1], **L. Geißert**[1], **A. Luxem**[1], **J. Hennig**[1], **A. J. L. Munk**[1]

Differentielle und Biologische Psychologie, Justus-Liebig-Universität Gießen

Background: In recent years, influences of oral contraceptives (OCs) on female mental and sexual health have been widely discussed. However, studies assessing neural correlates of sexual stimulus processing under OC treatment are rare and often assess OC users only once – that is, at any time point during the active OC treatment. Still, most adverse effects of OC treatment are reported during the OC break, and differences between active and inactive treatment periods have previously been reported regarding emotion regulation and emotional processing.
Method: Emotional processing was assessed using an Emotional Picture Stroop Paradigm consisting of erotic, positive and neutral visual stimuli during which an electroencephalogram was recorded and late positive potential (LPP)-amplitudes were extracted. 33 OC users underwent EEG-recording at three time points across the OC regimen: after the first and the second week of OC intake and during the OC free week. At each lab session, saliva samples were collected for analysis of estradiol and progesterone, and subjects completed the sexual desire inventory (SDI-2).
Results: LPP-amplitudes towards erotic vs. neutral stimuli were highest during the second week of active OC treatment compared to the first and the inactive week. However, neither solitary nor dyadic self-reported sexual desire differed between measurement times and no significant correlations emerged between endogenous gonadal steroid levels and LPP-amplitudes or sexual desire.
Discussion: Neural but not self-reported sexual cue processing differed across the OC regimen. Higher erotic vs. neutral LPP-amplitudes were noted at time points associated with most stable endocrine status.

P1.127 - Absolute reduction in eliciting stimulus intensity as a new index of startle PPI

A. Behrje[1], **J. B. Finke**[2], **T. Blumenthal**[3], **H. Schächinger**[2]

[1] Uni Trier, Deutschland, GERMANY
[2] University of Siegen, GERMANY
[3] Wake Forest University, NC, USA

Introduction: The human startle reflex and prepulse inhibition (PPI) are well established tools in psychophysiological research. Effects of PPI on the motor response and on perceived stimulus properties might be based on overlapping circuits. 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 attenuation in dB.
Method: 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.
Results: 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.

P1.128 - Kann der Bachelorstudiengang Psychologie als psychologischer Stressor angesehen werden? Ergebnisse einer Pilotuntersuchung

A. Geiss

Universität zu Köln, Deutschland

Fragestellung. Im Zuge der Bologna Reform wurde der Bachelor-und der Masterstudiengang auch für das Psychologiestudium eingeführt. Die psychische Belastung wird von den Studierenden mit einem mittleren Notendurchschnitt im Bachelorstudiengang als am höchsten eingeschätzt, weil dessen Abschlussnote eine Voraussetzung für die Zulassung zum Masterstudiengang darstellt. Anders ausgedrückt, die Zulassung zum Masterstudiengang wird durch diese Bachelorstudierenden als unvorhersehbar eingeschätzt. Es kann angenommen werden, dass die Einschätzung der Unvorhersehbarkeit mit einer Aktivierung der Hypothalamus-Hypophysen-Nebennierenrinden-Achse (HHNA) einhergeht. Es wurde bisher noch nicht untersucht, ob Studierende des Bachelorstudiengangs im Unterschied zu den Studierenden des Masterstudiengangs eine erhöhte Aktivierung der HHNA aufweisen.
Methoden. In der Pilotuntersuchung sammelten insgesamt fünf Studierende aus dem Bachelor- und aus dem Masterstudiengang Psychologie während des laufenden Semesters an zwei aufeinanderfolgenden Tagen Speichelproben zur Einschätzung der Aktivität der HHNA und notierten aufgetretene alltägliche Stressereignisse. An jedem der beiden Tage entnahmen die Studierenden sowohl fünf Speichelproben in einem Abstand von fünfzehn Minuten unmittelbar nach dem Aufwachen als auch weitere sieben Speichelproben in einem Abstand von zwei Stunden zwischen 10Uhr und 22Uhr. Die Bestimmung der freien Cortisolkonzentration im Speichel erfolgte unter Verwendung des zeitverzögerten Fluoreszenzimmunoassays (DELFIA).
Ergebnisse. Bei den Studierenden des Bachelorstudiengangs konnten im Cortisoltagesprofil im Vergleich zur Normstichprobe erhöhte Cortisolkonzentrationen nach einem vorausgegangenen all-täglichen Stressereignis detektiert werden.
Schlussfolgerungen. Auf der Basis der vorliegenden Pilotuntersuchung kann die Frage, ob es sich bei dem Bachelorstudiengang Psychologie um einen psychologischen Stressor handelt, nicht beantwortet werden. Dazu sollten in zukünftigen Untersuchungen neben einer größeren Stichprobengröße auch konfundierende Variablen wie z.B. der Studienabschnitt der Studierenden berücksichtigt werden.

Session II

Topic 1: Computational and Neuroimaging Methods

P2.001 - Ear-EEG compares well to cap-EEG in recording auditory ERPs: a quantification of signal loss

A. Meiser[1], **M. Bleichner**[1]

University of Oldenburg, Deutschland

Ear-EEG (Electroencephalography) allows to record brain activity using only a few electrodes located close to the ear. Ear-EEG is comfortable and easy to apply, facilitating beyond-the-lab EEG recordings in everyday life. With the unobtrusive setup, a person wearing it blends in, allowing EEG recordings in social situations. However, compared to classical cap-EEG, only a small part of the head is covered with electrodes. Only few scalp positions known from established EEG research are covered by ear-EEG electrodes, complicating the comparison between the approaches and hinder the transition from cap-based lab studies to ear-based beyond-the-lab studies.
We here provide a reference data-set comparing ear-EEG and cap-EEG directly for four different auditory event-related potentials (ERPs): N100, MMN, P300 and N400. We show how the ERPs are reflected when using only electrodes around the ears.
We find that significant condition differences for all ERP-components were recorded using only ear-electrodes. Effect sizes were moderate to high on the single subject level. Morphology of signals recorded from around-the-ear resemble highly those from standard scalp-EEG positions. We found a reduction in effect size (signal loss) for the ear-EEG compared to cap-EEG of 21-44%. The amount of signal loss depended on the ERP-component; we observed the lowest signal loss for the N400 and the highest signal loss for the N100. Our analysis further shows that no single channel position around the ear is optimal for recording all ERP-components or all participants, speaking in favour of multi-channel ear-EEG.
Our study provides reference results for future studies employing ear-EEG.

P2.002 - The P600 and P3 are linked to noradrenergic activity: Evidence from EEG and pupillometry

F. Contier[1], **M. Weymar**[1], **I. Wartenburger**[1], **M. Rabovsky**[1]

Universität Potsdam, Deutschland

The P600 ERP component typically observed in linguistic paradigms and the domain-general, oddball-sensitive P3 component have both been studied extensively but separately and their neurobiological basis is still under debate. It has been proposed that the two components belong to the same family of late positivities, whose latency depends on stimulus complexity (Coulson et al., 1998, Lang Cogn Process). In particular, both components might reflect phasic noradrenaline release from the locus coeruleus (LC/NE) to motivationally significant stimuli (Nieuwenhuis et al., 2005, Psychol. Bull.; Sassenhagen & Bornkessel-Schlesewsky, 2015, Cortex). In this preregistered study, we tested this hypothesis by relating both components to the dilation of the pupil, a putative biomarker of LC/NE activity (Joshi et al., 2016, Neuron). 36 participants completed a sentence comprehension task containing 25% morphosyntactic violations and a non-linguistic oddball task, while EEG and pupil size were co-registered. Our results show that the task-elicited pupil dilation and the ERP amplitudes of both components are similarly affected by both experimental tasks. Crucially, the size of the pupil dilation predicts the amplitude of both ERP components on a trial-by-trial basis. This observed relationship supports the idea that both ERP components might rely on a shared neural generator and, more specifically, that they may both be linked to phasic NE release. Generally, our findings further inform the debate on whether language-related ERPs such as the P600 are indeed specific to linguistic processes and provide further insights into the role of neuromodulators in cognition.

P2.003 - Brain Dynamics And The Relationship to Conspiracy Theories

Z. Razzaghpanah[1,2], P. Kirsch[2], D. Durstewitz[2], M. Gerchen[2], G. Koppe[2]

[1] Heidelberg Academy of Sciences and Humanities, Heidelberg, Germany
[2] Central Institute of Mental Health (ZI), Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany

Belief in conspiracy theories is a widespread phenomenon that increases in times of crisis and societal instability. It is linked to individual instability and we hypothesize that it might serve as a means for individual stabilization. The underlying processes are, however, unexplored and computational models combined with neuroimaging might help to elucidate them. In this work we aim to employ the tools of computational and mathematical modeling, namely, artificial neural networks (ANN) and dynamical systems (DS) theory, to shed light on the relationship between brain dynamics and conspiracy theories.
We record brain activity during two consecutive 6-minute resting state sessions using Magnetoencephalography (MEG) and functional Magnetic Resonance Imaging (fMRI). Since fMRI provides great signal source location accuracy and MEG provides high temporal resolution, combining these data modalities may bear particular potential for recovering dynamics associated with specific brain regions. Dynamics are assessed by inferring state-of-the-art piecewise linear recurrent neural network (RNN) models. The inferred RNNs are designed to be interpretable in the DS sense, and enable the analytic derivation of different properties of the DS itself, such as its stability (e.g., analytic derivation of border collision bifurcations of the system). We relate DS properties to questionnaire data about the belief in conspiracy theories to study its mechanistic underpinnings. In this contribution the general concept and first results of the analyses will be presented.

Topic 2: Individual Differences and (Epi)Genetics

P2.004 - Epigenetic modulation of psychobiological stress in everyday life: The moderating role of neuroticism

M. Stoffel[1], E. Gardini[2], S. Rahn[1], M. Moessner[3], C. Aguilar-Raab[1], B. Ditzen[1]

[1] Institut für Medizinische Psychologie, Universitätsklinikum Heidelberg, Deutschland
[2] Psychologisches Institut, Universität Zürich, Schweiz
[3] Institut für Psychosoziale Prävention, Forschungsstelle für Psychotherapie, Universitätsklinikum Heidelberg, Deutschland

Epigenetic states can dynamically change in response to stressful demands. While there have been some studies investigating the moderating role of genetic dispositions (i.e., SNPs) for the association of stress and epigenetics, the role of stress-associated psychological dispositions, such as neuroticism, remains unclear. Thus, we investigated whether associations of epigenetic states in candidate genes with psychobiological stress would be moderated by neuroticism.
Data from two studies (study one: N = 61; study two: N = 74) were analyzed. On two consecutive days, healthy participants provided six saliva samples and concurrent self-reports on momentary stress per day. Peripheral tissue was used to quantify CpG methylation at several CpG sites on FKBP5 and NR3C1 (study one) as well as on SLC6A4 (study two). Multilevel models were used to analyze the data.
For all three genes, the associations of epigenetic states with stress in everyday life were moderated by levels of neuroticism. These associations were particularly consistent (all $p < 0.05$) for FKBP5 (to a lesser extent for NR3C1) and CpG sites closely surrounding the transcription start on SLC6A4. Neuroticism also moderated the association of methylation with diurnal levels of cortisol in some cases.
These results suggest that the psychological susceptibility to stress (neuroticism) might play an important role in how epigenetic states translate into altered levels of psychobiological stress in everyday life. Beyond that, alterations in epigenetic states may also compensate for high levels of stress susceptibility.

P2.005 - Epigenetic signatures of war-related trauma - a study of refugee families in Africa

K. Mattonet[1,2,3], **F. Scharpf**[1,2], **K. Block**[1,2], **T. Hecker**[1,2], **R. Kumsta**[3,4]

[1] Institute for Interdisciplinary Research on Conflict & Violence (IKG), Bielefeld University, Germany
[2] Department of Clinical Developmental Psychopathology, Faculty of Psychology and Sports Science, Bielefeld University, Germany
[3] Genetic Psychology, Faculty of Psychology, Ruhr-University Bochum, Germany
[4] Department of Behavioural and Cognitive Sciences, Faculty of Humanities, Education and Social Science, Université du Luxembourg, Luxemburg

In refugees, the exposure to war-related trauma has been associated with high risk for mental health problems, including posttraumatic stress disorder (PTSD). However, there exists significant variability in the prevalence of PTSD following trauma exposure. The development of PTSD after traumatic stress is thought to result from the interaction between environmental and personal risk (i.e., trauma exposure, genetic risk) and resilience factors (i.e., family cohesion, stress coping strategies). One mechanism for gene by environment interactions discussed to differentiate risk versus resilience is the epigenetic process of DNA methylation. Compelling human evidence linking war-related trauma and PTSD to epigenetic alterations remains sparse. In the research project of Burundian refugee families, who experienced multiple severe war-related trauma, epigenome-wide DNA methylation profiles (EPIC-chip) were associated with war-related trauma and PTSD to identify PTSD-associated alterations in DNA methylation. However, in these epigenome-wide association studies (EWAS) controlling for confounders including cell type composition, neither in 110 children nor in 207 caregivers significantly differently methylated signatures were identified (FDRs > .05). Interestingly, in an additional exploratory EWAS of the children's samples, parental maltreatment as covariate of war-related trauma was significantly associated with one differentially methylated position (annotated for gene DIS3L2 [DIS3-Like-3'-5'-Exoribonuclease-2]; FDR = .02). The results are discussed in terms of methodological challenges in the research of DNA methylation as epigenetic biomarker of gene by environment interaction in the development of PTSD after traumatic stress exposure.

P2.006 - Context Effects, Skin Conductance Responses and Personality Traits - Influencing Variables on Risk-Taking within a Modified Version of the Balloon Analog Risk Task

A. T. Henn[1], **P. Hüpen**[1,2], **S. Boccadoro**[1], **L. Wagels**[1,2], **L. Ritter**[1], **T. D. Satterthwaite**[3,4,5], **U. Habel**[1,2]

[1] Department of Psychiatry, Psychotherapy and Psychosomatics, School of Medicine, RWTH Aachen University, Aachen, Germany
[2] Institute of Neuroscience and Medicine, JARA-Institute Brain Structure Function Relationship (INM 10), Research Center Jülich, Jülich, Germany
[3] Department of Psychiatry, University of Pennsylvania, Philadelphia, USA
[4] Department of Psychology, University of Pennsylvania, Philadelphia, USA
[5] Penn Lifespan Informatics and Neuroimaging Center, University of Pennsylvania, Philadelphia, USA

When individuals take risks, they must weigh the costs and benefits potentially associated with a decision. Differences in risk-taking appear to be influenced by contextual, and inter-individual factors. However, it is still ambiguous to what extent individual characteristics jointly influence risk-taking. We investigated how risk-taking varies as a function of context effects, incentives, skin conductance responses (SCRs), and personality traits such as impulsivity and sensitivity to reward and punishment. Sixty-eight healthy participants conducted a modified version of the Balloon Analogue Risk Task (BART) composed of a gains- (G-BART) and losses-framed (L-BART) context, each with a low (lOM) and high outcome magnitude condition (hOM). While the goal in G-BART was to maximize earnings, the goal in L-BART was to minimize losses. We conducted trial-by-trial mixed model analyses to account for within- and between-participant effects and the considerable intra-individual variability associated with SCRs. Participants showed greater risk-taking when playing L-BART than G-BART; more risk-taking was observed in the hOM compared to the lOM. Furthermore, higher SCRs were associated with less risk-taking. Lower impulsivity was associated with a greater difference in risk-taking in both contexts, with greater risk-taking in L-BART. Likewise, sensitivity to reward was associated with a greater difference in risk-taking in both contexts, with greater risk-taking in G-BART. Finally, sensitivity to punishment was related to risk-taking among participants describing themselves as sensitive to rewards. Our results support a multidimensional state-trait model of risk-taking suggesting that risk-taking is favored by loss-aversion, but is further animated by incentives, psychophysiological arousal, and personality traits.

P2.007 - On the Highway of Human Cognition: Brain Structure-Function Coupling and its Relation with General Cognitive Ability

J. Popp[1], **J. Thiele**[1], **J. Faskowitz**[2], **C. Fraenz**[3], **E. Genc**[3], **K. Hilger**[1]

[1] Julius-Maximilians-University, Würzburg, Germany
[2] Department of Psychological and Brain Sciences, Indiana University, Bloomington, USA
[3] Leibniz Research Centre for Working Environment and Human Factors (IfADo), Technical University, Dortmund, Germany

Individual differences in general cognitive ability have a biological basis within the structure and function of the human brain. Network neuroscience investigations revealed neural correlates in various properties of structural and functional brain networks. However, whether the agreement between structural and functional connections, the structural-functional brain network coupling, is related to individual differences in general cognitive ability remains an open question. In this preregistered study, we used open data from 1026 adults of the Human Connectome Project, derived structural connectivity from diffusion weighted imaging (DWI), functional connectivity from resting-state fMRI, and estimated general cognitive ability with a latent g-factor derived from 12 cognitive ability tests. Structural-functional brain network coupling was assessed with communication measures that model potential functional interactions on the basis of structural networks and do thus allow for direct mapping of structural to functional connectomes. At the whole brain level, we observed no significant associations between general cognitive ability and structural-functional brain network coupling for any of the communication models. However, respective associations varied critically between different communication models and at the level of distinct brain regions. We therefore constructed a 5-fold cross-validated prediction model to show that brain region- and communication model-specific coupling features can significantly predict individuals' general cognitive ability scores (correlation between predicted and observed scores: $r = .30$, $p < .001$). Our results provide new insights into the neural underpinnings of efficient information processing by proposing optimal region-specific network communication strategies as a neural basis of individual differences in general cognitive ability.

P2.008 - Structural architecture and brain network efficiency links polygenic scores to intelligence

E. Genç[1], D. Metzen[2], C. Fraenz[1], C. Schlüter[2], M. Voelkle[3], L. Arning[4], F. Streit[5], H. P. Nguyen[4], O. Güntürkün[2], S. Ocklenburg[2,6,7], R. Kumsta[8,9]

[1] Nachwuchsgruppe Neuroimaging und interindividuelle Unterschiede, Leibniz-Institut für Arbeitsforschung and der TU Dortmund (IfADo), Deutschland
[2] Biopsychologie, Institut für kognitive Neurowissenschaften, Fakultät für Psychologie, Ruhr-Universität Bochum, Deutschland
[3] Psychologische Methodenlehre, Institut für Psychologie, Humboldt Universität, Berlin, Deutschland
[4] Humangenetik, Fakultät für Medizin, Ruhr-Universität Bochum, Deutschland
[5] Genetische Epidemiologie in der Psychiatrie, Zentralinstitut für Seelische Gesundheit, Medizinische Fakultät Mannheim, Universität Heidelberg, Deutschland
[6] Department of Psychology, Medical School Hamburg, Deutschland
[7] ICAN Institute for Cognitive and Affective Neuroscience, Medical School Hamburg, Hamburg, Deutschland
[8] Genetic Psychology, Fakultät für Psychologie, Ruhr-Universität Bochum, Deutschland
[9] Department of Behavioural and Cognitive Sciences, Laboratory for Stress and Gene-Environment Interplay, University of Luxemburg, Luxemburg

Intelligence is highly heritable. Genome-wide association studies (GWAS) have shown that thousands of alleles contribute to variation in intelligence with small effect sizes. Polygenic scores (PGS), which combine these effects into one genetic summary measure, are increasingly used to investigate polygenic effects in independent samples. Whereas PGS explain a considerable amount of variance in intelligence, it is largely unknown how brain structure and function mediate this relationship. Here we show that individuals with higher PGS for educational attainment and intelligence had higher scores on cognitive tests, larger surface area, and more efficient fiber connectivity derived by graph theory. Fiber network efficiency as well as surface of brain areas partly located in parieto-frontal regions were found to mediate the relationship between PGS and cognitive performance. These findings are a crucial step forward in decoding the neurogenetic underpinnings of intelligence, as they identify specific regional networks that link polygenic predisposition to intelligence.

P2.009 - Resting-state networks of believers and non-believers: An EEG microstate study

K. Nash[1], T. Kleinert[1], J. Leota[1], A. Scott[1], J. Schimel[1]

University of Alberta, Canada

Atheism and agnosticism are becoming increasingly popular, yet the neural processes underpinning individual differences in religious belief and non-belief remain poorly understood. In the current study, we examined differences between Believers and Non-Believers with regard to fundamental neural resting networks using EEG microstate analysis. Results demonstrated that Non-Believers show increased contribution from a resting-state network associated with deliberative or analytic processing (Microstate D), and Believers show increased contribution from a network associated with intuitive or automatic processing (Microstate C). Further, analysis of resting-state network communication suggested that Non-Believers may process visual information in a more deliberative or top-down manner, and Believers may process visual information in a more intuitive or bottom-up manner. These results support dual process explanations of individual differences in religious belief and add to the representation of non-belief as more than merely a lack of belief.

P2.010 - Trait curiosity is associated with schizotypy in human adults

T. Steiger[1], **N. Bunzeck**[1]

Universität zu Lübeck, Institut für Psychologie

Psychotic patients often respond with enhanced attention to otherwise irrelevant information. This has been attributed to a hyperdopaminergic state in the mesolimbic system, and formally described in the aberrant salience hypothesis for schizophrenia. In line with this notion, dopamine has further been linked with schizotypy, a constellation of personality traits that is thought to resemble the subclinical expression of schizophrenia in the general population. Importantly, curiosity, which is also characterized by attributing incentive salience to novel stimuli, recruits the dopaminergic mesolimbic system, too. Therefore, a link between both domains, curiosity and schizotypy, seems plausible. To test this hypothesis, 215 participants successfully finished an online study, consisting of sociodemographic questions, the Eppendorfer-Schizophrenia-Inventar (ESI), the Launay Slade Hallucination Scale, an epistemic curiosity questionnaire (trait curiosity) and a paradigm, in which the subjects had to rate how curious they were to get the answer to a trivia question (state curiosity). As main findings, we can show that trait curiosity is associated with two dimensions of the ESI: negatively with attention and speech impairment, and positively with deviant perception ($p<0.001$). State curiosity, however, was not significantly associated with schizotypy. In conclusion, we can show that trait curiosity has specific links to different aspects of schizotypy, probably via shared activity levels in the dopaminergic mesolimbic system.

P2.011 - From hands to heart: a trend for higher interoceptive accuracy in left-handed as compared to right-handed female participants

S. Bernard[1], M. Barnabo[1], M. Boos[1], F. Leufgen[1], J. N. Goergen[1], E. Schramm[1], J. L. Steinmetzer[1], A. Schulz[1]

University of Luxembourg, Luxemburg

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. This right hemispheric dominance is supported, for example, 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, which manifests among other traits, predominantly in right-handedness. Left-handed individuals (presumably showing a right-hemispheric dominance) 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 (e.g., by investigating HEPs).

Topic 3: Learning, Memory, and Sleep

P2.012 - Exercise-induced increase in cytokine levels correlates with implicit learning in young adults

K. Hötting[1], L. A. Kuhne[1], A. Ksiezarczyk[2], K. Braumann[2], R. Reer[2], T. Jacobs[3], B. Röder[1]

[1] Universität Hamburg, Biologische Psychologie und Neuropsychologie, Deutschland
[2] Universität Hamburg, Sport- und Bewegungsmedizin, Deutschland
[3] Bernhard-Nocht-Institut für Tropenmedizin, Protozoen-Immunologie, Deutschland

Physical exercise has been shown to enhance memory and to increase neuroplasticity. In rodents, the most robust effects of physical exercise on brain structure and functions have been demonstrated for the hippocampus, a key structure for learning and memory. Modulating effects of signaling molecules of the immune system (cytokines) on hippocampal plasticity and memory have been reported. Exercise has been found to alter the number and function of immune cells. Thus, the positive effects of physical exercise on neuroplasticity might be partially mediated by an altered immune response to exercise.
The present study tested whether cardiovascular training scheduled immediately after a learning task enhances learning and whether such gains are related to exercise induced acute changes in peripheral cytokine levels.
Forty-eight participants (20 – 40 years) were randomly assigned to a cardiovascular exercise group (cycling) or a control group (stretching). During the ten-week training period, participants completed eighteen learning-exercise sessions. In each session, an implicit learning task was followed by a 45-minute exercise session. Blood sampling was performed at rest and immediately after one exercise session to assess exercise-induced changes in cytokine levels.
Learning success over ten weeks did not differ between groups. The cycling group showed a relatively larger acute increase in IL-6, IL-1ra, IL-4 and IFN-γ compared to the stretching group. Explorative analyses revealed significant positive associations between within-session learning and acute exercise-induced increases in IL-6 and IL-1ra in the cycling group only. Results suggest that the immune system may be a moderator of exercise-induced learning benefits.

P2.013 - Increases in theta power precede successful formation of crossmodal associative memory

J. Ostrowski[1], **M. Rose**[1]

Universitätsklinikum Hamburg-Eppendorf, Deutschland

Neuronal activations in the brain preceding the presentation of a stimulus can modulate the perception and processing, and can predict subsequent memory effects. Specifically, increases in the theta frequency band (4 – 8 Hz) before stimulus onset have been shown to be related to increased memory performance. While research has started to include the theta band to explain associative memory, results regarding the role of pre-stimulus theta oscillations in crossmodal associations vary. In this study, we investigated the involvement of the theta frequency band in associative crossmodal memory. A group of 48 participants took part in a Subsequent Memory Effect Task (SME). The signal of an electroencephalogram (EEG) was recorded while participants were presented with stimulus pairs consisting of images and sounds of real-life objects and animals, preceded by a cue. Associative memory was assessed during a recognition phase. Results show that power in the theta band before stimulus onset during encoding was significantly increased for stimuli that were later remembered compared to later not remembered stimuli. These differences were especially high in the signal recorded over frontocentral, as well as parietal and parieto-occipital regions. These findings indicate that the activation in the theta band preceding a stimulus can predict the memory of crossmodal associations.

P2.014 - Attentional control and pattern reinstatement: on-going processes during long-term memory retrieval

M. Sabo[1], **D. Schneider**[1]

Leibniz Research Centre for Working Environment and Human Factors, Germany

It has been long argued that episodic long-term memory (eLTM) retrieval involves the reinstatement of neural patterns from the encoding phase, a process shown to be reflected in alpha/beta (8-20 Hz) oscillatory activity. Nevertheless, comparable cortical patterns were also observed during switches in the focus of attention within working memory representations. The current study aims to assess independently the two processes associated with alpha/beta-band activity. In the encoding phase, subjects were presented with an object on a certain position on the screen (left, tight, top or bottom) and their task was to imagine it on a new position for later report. In each trial, either the task-irrelevant presentation position or the task-relevant imagination position was lateralized. In the retrieval phase, objects from the encoding phase, interleaved with previously unseen ones were centrally presented. Subjects were required to make an old/new judgement, followed by the report of the imagination position associated with each old object. Two competing hypotheses were formulated. According to the pattern reinstatement account, changes of lateralized alpha/beta activity reflecting pattern reinstatement would entail similar topographical effects during encoding and retrieval. Conversely, the influence of attentional control processes during retrieval would be associated with: (i) suppression of alpha/beta power contralateral to the to-be-reported imagination position (task-relevant information) and (ii) an increase of activity relative to the irrelevant presentation position. Our results support this latter pattern. This shows that an experimental differentiation between selective attention and pattern reinstatement is necessary when studying on-going processes during eLTM retrieval.

P2.015 - Investigating the functional specialization of human declarative memory subsystems

S. Klinkowski[1], A. Seewald[1], B. Fath[1], P. Iliopoulos[1], F. Voss[1], S. Schmidt[1], M. Erb[2], K. Scheffler[2], S. Gais[1], S. Brodt[1]

[1] University of Tuebingen
[2] Max Planck Institute for Biological Cybernetics, Tuebingen

Introduction. While traditional models of systems memory consolidation postulate the reliance of freshly encoded memories on the hippocampus, recent evidence in humans and animals has shown that there are conditions under which the neocortex can rapidly acquire genuine memory engrams. The current study investigates the idea of concurrent memory encoding in the entire network, and specialized subsystems coding for different aspects of the memory.
Methods. 80 participants encoded the same abstract visual stimuli during fMRI scanning and were instructed to either remember the detailed item-context combinations (DET) or to identify conceptual categories (CEP). 24h later performance was tested in a categorization and an item-context recognition task.
Results. CEP performed better in categorizing novel stimuli ($t(78)=-6.91$; $p<0.001$), whereas DET had better memory for item-context combinations ($t(78)=6.31$; $p<0.001$). In both groups, repetitions activated the precuneus, for exact items ($p<0.05$) as well as conceptual repetitions ($p<0.05$). Contrasting the two groups, exact item repetition elicited higher bilateral activation of the superior frontal gyrus ($t=7.03$; $p<0.05$), caudate and thalamus in DET ($t=5.88$; $p<0.05$), and higher activation in visual cortex extending towards precuneus and fusiform gyrus ($t=7.51$; $p<0.05$) in CEP. Comparing CEP with DET, activation in medial occipital cortex ($t=6.83$, $p<0.05$) increased over category repetitions only in CEP.
Discussion. Our data suggest the precuneus as a hub for detailed as well as conceptual memory representations. Additionally, differences in memory performance and neural differences between the two groups indicate a functional specialization of neocortical and subcortical areas during prioritized encoding of similar vs. differential features.

P2.016 - Reactivation of Sequential Head Direction Memory Traces in Humans

J. K. Schaefer[1], **B. J. Griffiths**[1], **T. Schreiner**[1], **T. Staudigl**[1]

Department of Psychology, Ludwig-Maximilians-Universität München, Munich, Germany

Episodic memory and navigation both operate along the dimensions of time and space, thus an increasing number of studies examines these processes with study designs of sequential memory. Human and non-human studies have shown that, on a neuronal level, the reactivation of prior encoded sequential memories accompanies their retrieval. In humans, testing the reactivation of sequential spatial memories has been mostly done in virtual reality neuroimaging experiments, which lack the information of self-motion cues, an indispensable part of real-world navigation. The present study sets out to resolve some of these limitations by incorporating real-world navigational movements in a sequence memory paradigm. Participants associate sequences of images with specific head direction (HD) information by turning their head to different screens where the images are presented. This is followed by a three-step short-term memory test: (i) retrieving the sequence, (ii) performing the correct HD sequence and (iii) sorting the images according to order of the HD. After a distractor task, the same three retrieval steps are performed for all encoded sequences to test episodic memory. Throughout the experiment, EEG, head motion tracking and eye tracking are recorded simultaneously. Using multivariate decoding, we expect to identify a reactivation of the encoded sequences in both the short-term and episodic memory tasks. The combination of images and true HDs allows us to investigate the characteristics of how distinct features within a sequence are reactivated. Ultimately, our results will contribute to the understanding of how real-world navigation and memory processes overlap on a neuronal level.

P2.017 - (Re)learning of self-related beliefs

A. Schröder[1], **N. Czekalla**[1], **S. Krach**[1], **L. Müller-Pinzler**[1]

University of Lübeck, Deutschland

People constantly receive feedback about their behavior and performances which shapes the perception of their own abilities. But how do those self-related beliefs change when they are challenged? In this study we conducted a trial-by-trial performance learning task on two consecutive days and assessed self-related belief updating. The first day was used to establish novel beliefs. On the second day, participants were confronted with the same task but received contradicting feedback. A computational modeling approach showed significantly lower learning rates for self-related belief updating on the second day when the feedback contradicted the former learning experience. These findings suggest that opportunities to update self-related beliefs are less effectively used once a concept about one's own abilities is already established. Our findings could potentially contribute to the understanding of how negative beliefs are maintained in psychiatric conditions.

P2.018 - Reward responsiveness (BAS) facilitates gaining contingency awareness in appetitive, yet not aversive, conditioning

J. Finke[1], **T. Klucken**[1]

Universität Siegen, Deutschland

Little is known about how interindividual differences, particularly regarding reinforcement sensitivity, shape basic learning processes, including the transition from implicit to aware associative learning. The distinction between (partially independent) Behavioral Activation and Inhibition Systems (BAS/BIS) has been proposed to reflect the neurocognitive underpinnings of 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 learning. 58 participants who were 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 based on additional self-report data), 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 recorded during acquisition (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.

P2.019 - Spatio-temporal theta pattern dissimilartiy in superior parietal cortex during memory generalization

H. Heinbockel[1], **C. Quaedflieg**[2], **J. Wacker**[1], **L. Schwabe**[1]

[1] Universität Hamburg, Deutschland
[2] University of Maastricht, the Netherlands

Generalization across experiences may guide our action in novel situations. Although it is commonly assumed that overlapping memory representations of similar events form the basis for generalization, the exact neural underpinnings of memory generalization are not fully understood. Here we combined Electroencephalography (EEG) with multivariate representational similarity analysis (RSA) to determine in particular the role of spatio-temporal patterns of theta oscillations in memory generalization, known to be highly relevant for associative memory processes. Healthy participants (n = 56) performed an acquired equivalence paradigm in which they first acquired multiple associations among antecedent and consequent stimuli before they were required to transfer the acquired knowledge to novel stimulus pairs. Our behavioural data indicated that participants learned the initial associations well and transferred these associations successfully to novel test stimuli, thus demonstrating successful memory generalization. RSA data showed that, compared to simple retrieval trials, generalization trials were associated with significantly increased pattern dissimilarity of theta activity in the right superior parietal lobe. This pattern was specific to theta and not observed in other frequency bands. These findings suggest a role for theta oscillations in memory generalization. The discussion focusses on potential mechanisms including that memory generalization might rely on the reactivation of distinct events that are then integrated through specific patterns of theta oscillations.

P2.020 - How far would you go to survive? An Approach-avoidance foraging task in immersive virtual reality

A. Kastrinogiannis[1], **T. B. Lonsdorf**[1]

University Medical Center Hamburg-Eppendorf, Germany

Avoidance is typically considered a maladaptive behavioral response to excessive fear and anxiety, potentially leading to the maintenance of anxiety disorders. Recent experimental work has focused on approach-avoidance (AA) conflicts by simulating foraging tasks under predation, often targeting on decision making strategies. However, little has been known about the impact of individual differences upon the AA strategies within a threatening environment. Here, we present data from 60 healthy subjects from a novel AA paradigm induced in a virtual foraging task. The task is built on a matrix designed environment, which enables us to track and visualize the AA-behavior as a function of spatial movement. Individuals are required to survive a 24-trial period by collecting the necessary amount of food (tokens) within three different nature-related contexts. Each context is assigned to a different probability of encountering an aversive (electrical) stimulus while collecting a token. To encourage approach behaviour, the amount of potential reward is similarly linked to the probability of receiving the aversive stimulus. Thus, each individual is required to perform a certain AA behaviour to achieve the task's goal, as to the time spent in each context and the spatial movement along the field. In the present sample, we evaluate the effectiveness of the developed AA task, by hypothesizing that each behaviour results in a unique "tipping point" between the time spent per context and the maximum achieved reward. We additionally explore the skin conductance responses (SCR) as a measurement of fearful arousal across the different threatening contexts.

P2.021 - The Role of Source Memory for Reward-Motivated Learning

J. Tkotz[1,2,3], **D. P. Morgan**[1,2,3], **G. B. Feld**[1,2,3]

[1] Department of Clinical Psychology, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany
[2] Department of Addiction Behavior and Addiction Medicine, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany
[3] Department of Psychiatry and Psychotherapy, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany

The Motivated Learning Task is a paradigm designed to measure the influence of reward anticipation on memory, and the underlying neural mechanisms. During learning, participants memorise pictures associated with different amounts of reward, which is paid out for later recognising the previously learned pictures among a set of new pictures in the test phase. It has been found that the hit rate (% correctly identified old pictures) increases as a function of reward, which suggests that reward anticipation improves memory performance. However, even though participants were only instructed to memorise the pictures, they might still remember the reward a picture was associated with (source memory). If participants have source memory, an increased hit rate could also reflect a reward-induced response bias. In a preregistered online study (N = 201), we validated a modified version of the Motivated Learning Task for later use in the MRI. Whenever participants identified a picture as old in the test phase, we asked them how much reward they expected to receive. This way, we aimed to determine whether participants remember the reward-picture associations, and to gain insights of how reward expectations influence false alarms (new pictures wrongly identified as old). We found that participants show indications of source memory, especially when they are confident in their decisions. This suggests that the reward-related increase in hit rate is the result of a reward-induced response bias. However, participants were biased towards expecting a medium reward, which prevented us from calculating a reward-dependent false alarm rate.

P2.022 - Characterization of slow oscillations and spindles during sleep from the juvenile to the peri-adolescent developmental stage in rats

J. Fechner[1], **M. P. Contreras**[1], **C. Zorzo**[1], **J. Born**[1], **M. Inostroza**[1]

Institut für Medizinische Psychologie und Verhaltensneurobiologie, Universität Tübingen

Sleep supports memory consolidation through the precise temporal coordination of cortical slow oscillations (SOs) and thalamic spindles during slow-wave sleep. Although these oscillatory hallmarks have been well investigated in adulthood, a description of their temporal coordination across early development is missing. To fill this gap, we recorded the electroencephalogram (EEG) from skull electrodes over the frontal and parietal cortex in rats from postnatal day (PD)24 to PD31 roughly corresponding to human early childhood and late childhood. Comparing these two-time points, we found an increase in the amplitude of frontal and parietal SOs from PD24 to PD31. There was also an increase in the number and density of frontal spindles from PD24 to PD31, while no such increase was observed for parietal spindles. Spindle power increased in both frontal and parietal regions in parallel with the increase observed in SO amplitude. As the temporal synchrony between SOs and spindles, we found a similar percentage of spindles coupled to a SOs at both ages, in frontal and parietal recordings. However, phase-locking spindles to the upstate of an SO showed a different topographical trajectory, i.e. at frontal recording sites consistent SO-spindle phase-locking was still absent at PD24 and emerged only at PD31 whereas at parietal recording sites, SO-spindle phase-locking was present already at PD24 without further changes at PD31. These results in rats shed light on a gradual emergence of the SO-spindle coupling during development with different trajectories in frontal and posterior cortex regions.

P2.023 - Neural signatures of serial dependence emerge during cued selection in working memory

C. Fischer[1], **J. Kaiser**[1], **C. Bledowski**[1]

Institut für Medizinische Psychologie, Goethe-Universität Frankfurt am Main

Serial dependence describes the phenomenon that current object representations are attracted to previously encoded and reported, but now irrelevant representations. Until now, it remains unclear whether serial dependence occurs during an early stage in the object processing hierarchy, i.e., when an object is encoded into the visual system, or during later stages, i.e., when an object is retained in working memory or selected for action. To determine when an object representation becomes biased during processing, we recorded neuronal activity using MEG while subjects encoded and memorized two sequentially presented motion directions and, after a short delay, selected one direction for a report based on a retro-cue. Using a model-based MEG decoding approach, we found that the neural representation of a current motion direction was shifted toward the previous motion direction only after the retro-cue, when a direction was selected for a subsequent report. On a single-trial level, the shift of the decoded motion direction predicted the magnitude and direction of subjects' response errors during continuous recall. These results show that the object representation is susceptible to serial dependence especially at a late stage of object processing. During this stage a representation that is held in memory transitions to a representation that is selected and prepared for a specific use. Therefore, this transition process seems to be crucial for the emergence of serial dependence, which underlines the involvement of high-level processes in this attraction to the recent past.

P2.024 - Cerebellar involvement in memory formation

E. Stroukov[1], **D. Kumral**[1], **M. Schönauer**[1]

Institut für Psychologie, Abt. Neuropsychologie, Albert-Ludwigs-Universität Freiburg, Germany

In recent years evidence has accumulated that the cerebellum is not only involved in processing of motor tasks but also in a variety of complex cognitive functions such as memory processing. Whether the cerebellum shows learning-induced plasticity for declarative memory tasks and how these changes relate to behavioral performance remains unclear. We reanalyzed data collected by Brodt et al. (2018) to investigate whether learning induced functional and structural changes in the cerebellum satisfy important mnemonic criteria, indicating that memory engrams are formed in this region. In that study, participants performed an item-location association task in which they encoded and recalled pairings of cards depicting different objects as well as their respective location. The experiment took place over two sessions separated by a delay of 12 hours, with each session containing several repetitions of encoding and retrieval blocks. Functional MRI was employed during the memory tasks while structural data in form of diffusion-weighted MRI was acquired before and after the memory tasks. Multimodal analyses of the data show short-term and long-term structural plasticity and an experience-dependent increase in functional activity in the cerebellum. The amount of both functional and structural changes correlated with behavioral improvements. Importantly, the sites showing functional and structural changes were partially overlapping. Our results thus corroborate recent findings of cerebellar involvement in memory formation and retrieval and indicate that physical memory traces reflecting a declarative learning experience are formed in this brain region.

P2.025 - Heuristic-Based Strategic Exploration in Sequential Reinforcement Learning

A. M. Brands[1], **D. Mathar**[1], **J. Peters**[1]

Department Psychologie, Universität zu Köln, Deutschland

Introduction: The two-step task (TST) is widely used to study model-based (MB) and model-free (MF) learning and decision processes (Daw et al., 2011). Findings from related reinforcement learning paradigms have stressed the influence of uncertainty and potential mechanisms by which uncertainty can guide decisions, e.g. via directed exploration (Daw et al., 2006; Chakroun et al., 2020). Thus far, computational models of TST-behavior lack such considerations.
Methods: We extended standard hybrid models of MB and MF control (Daw et al.,2011; Otto et al., 2013) by incorporating and comparing two second-stage learning mechanisms: Q-learning (Daw et al., 2011) and the Kalman-Filter (Kalman 1960) and different model-based exploration strategies. Nine nested models were evaluated in two independent data sets. N=39 subjects completed the TST using fluctuating reward magnitudes (see Kool et al., 2017) and a subset (N=100) from previously published work (Gillan et al., 2016) using binary outcomes (Daw et al., 2011).
Results: In both data sets, we found evidence for strategic exploration. The model employing a SARSA learning algorithm combined with a heuristic-based strategic exploration bonus in the choice component provided the best fit. Model parameters exhibited associations with corresponding indices from model-agnostic analyses.
Discussion: Results support criticism regarding simplistic demarcations of two learning systems (MB & MF; da Silva & Hare, 2019), underlining the influence of uncertainty on human decision-making instead. We extend findings from related paradigms (Daw et al., 2006; Chakroun et al., 2020) and provide evidence for heuristic-based directed exploration across two TST-variants. Conceptual and methodological implications are discussed.

P2.026 - Auditory closed- loop stimulation of slow oscillations and delta waves during sleep

N. Niethard[1], **H.-V. V. Ngo**[2], **J. Born**[1,3,4]

[1] Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen, Tübingen, Germany
[2] Department of Psychology, University of Lübeck, Lübeck, Germany
[3] Center for Integrative Neuroscience, University of Tübingen, Tübingen, Germany
[4] German Center for Diabetes Research (DZD), Institute for Diabetes Research and Metabolic Diseases, of the Helmholtz Center Munich at the University Tübingen (IDM), Tübingen, Germany

Slow oscillations (SO, 0.1-2 Hz) and delta waves (2-4 Hz) are hallmarks of slow wave sleep. Ample evidence has shown that SOs support memory consolidation during sleep and that enhancing their occurrence by means of closed loop stimulation leads to memory improvement. Importantly, research in rodents suggests that delta waves do not support memory consolidation but instead facilitate memory loss. Here we aimed for a closed loop stimulation protocol that can selectively enhance SO or delta activity in humans by using auditory stimulation. Participants were presented with brief acoustic clicks during NREM sleep in four different conditions. The clicks occurred either in the upstate of an online detected SO or in the upstate of one of three types of delta waves, which differed in the maximum negative amplitude within a time window of -500 ms – 0 ms relative to the stimulation onset. We found that independent of condition, acoustic stimulation induced comparable down state amplitudes. However, for one of the delta stimulation protocols slow and fast spindle (9 - 12 Hz and 12 – 16 Hz) power differed significantly between SO and delta conditions after stimulation onset . Our results suggest that auditory stimulation reliably induces cortical down states independent of the preceding oscillation while spindle power increases only for stimulations during the upstate of SOs.

P2.027 - Removal of reinforcement reduces propensity to respond in instrumental learning

H. Kurtenbach[1], E. Ort[1], M. Froböse[1], G. Jocham[1]

Heinrich-Heine Universitaet Duesseldorf, Deutschland

Acquisition of knowledge during instrumental learning is usually measured by performance during reinforced behavior. However, recent work in rodents found that instrumental performance was enhanced during periods when reinforcement was withheld, suggesting that reinforcement may mask acquired knowledge and lead to impaired performance. In the present study, we aimed to investigate whether such a beneficial effect of removing reinforcement translates to humans. Specifically, we tested whether performance during learning is improved during non-reinforced relative to reinforced task periods. Sixty healthy volunteers performed a novel visual go/no-go learning task with deterministic reinforcement. To probe acquired knowledge in the absence of reinforcement, we interspersed blocks without feedback. Even though performance in these non-reinforced task periods was indeed increased, as evidenced by an increased sensitivity-index d', computational modeling showed that this improvement in performance was not due to an increased sensitivity of decision making to learned values. Instead, our modeling results suggest that the improved performance during non-reinforced blocks can fully be accounted for by a more cautious mode of responding, as evidenced by a reduction of a general response bias. Together with non-zero value initialization, this is sufficient to drive differential changes in hit and false alarm rates that jointly lead to an increased d'. To conclude, these results demonstrate that improved instrumental performance does not result from unmasking latent knowledge in humans. Instead, they suggest that the absence of reinforcement leads to a reduction of an overall bias to act.

P2.028 - Effects of Acute Stress on Item and Source Emotional Memory: an fMRI Study

C. Ventura-Bort[1], J. Wirkner[2], J. Wendt[1], L. Schwabe[3], F. Dolcos[4], A. O. Hamm[5], M. Weymar[1]

[1] Department of Biological Psychology and Affective Science, University of Potsdam, Potsdam, Germany
[2] Department of Clinical Psychology and Psychotherapy, University of Greifswald, Greifswald, Germany
[3] Department of Cognitive Psychology, Universität Hamburg, Hamburg, Germany
[4] Department of Psychology, University of Illinois at Urbana-Champaign, Champaign, USA
[5] Department of Biological and Clinical Psychology, University of Greifswald, Greifswald, Germany

Prior research suggests that acute stress around the time of encoding enhances long-term memory, particularly for emotionally arousing events. Despite its positive effects on emotional memory, however, acute stress may come with cognitive costs, hampering the integration of contextual details. In the current fMRI study, we examined the impact of stress on item and source emotional memory. Participants (N= 77) underwent either a stress (social evaluator cold pressure test; SECPT) or a control protocol shortly before encoding a series of neutral objects that were paired with either pleasant, unpleasant, or neutral background scenes (context). One week later, the previously seen objects were presented, intermixed with novel ones, and memory for both objects and contexts was tested using the Remember/Know procedure. In the absence of a stress effect, we observed better item memory performance for objects from pleasant compared to neutral and unpleasant contexts. For source memory, we found enhanced recollection for emotional, compared to neutral, contextual information (correct scene). At the neural level, correctly retrieved objects produced a larger activation in recollection-related brain regions (e.g., PFC, PCUN) that was particularly enhanced for participants from the stress group. Retrieved source information for unpleasant compared to neutral contexts, however, was related to lower activation in some recollection regions (e.g., AG, PFC, HC) in the stress compared to the control group, which was also related to cortisol increase during stress exposure (for AG). These results suggest that acute stress may differentially modulate the retrieval of item and source information encoded in emotional contexts.

P2.029 - Interindividuelle Unterschiede bei der Generalisierung von Extinktionslernen entlang des Spektrums der Trait Anxiety

E. Nazarenus[1,2], **E. Brakemeier**[1], **J. Richter**[2]

[1] Universität Greifswald, Deutschland
[2] Universität Hildesheim, Deutschland

Extinktionslernen gilt als ein Wirkmechanismus der expositionsbasierten kognitiven Verhaltenstherapie. Angesichts der begrenzten Psychotherapie-Behandlungsdosis ist der Transfer des Extinktionslernens auf gefürchtete Auslösereize und Kontexte, die während begleiteter Übungen nicht berücksichtigt werden konnten, für dauerhafte und effektive Behandlungserfolge entscheidend. Über den spezifischen Prozess der Generalisierung des Extinktionslernens ist jedoch wenig bekannt. Daher untersucht diese Studie die Existenz von Extinktionsgeneralisierungsgradienten, wie sie bereits beim Angstlernen beobachtet wurden. Drei Gruppen von 25 gesunden Proband:innen, die jeweils ein niedriges, mittleres bzw. hohes Maß an Trait Anxiety aufweisen, werden untersucht und mit einer Stichprobe von 25 Patient:innen mit Angststörungen verglichen. Alle Proband:innen werden an zwei neu entwickelten Paradigmen teilnehmen – eines ist darauf zugeschnitten, die Generalisierung des Extinktionslernens über ein Spektrum von Hinweisreizen hinweg zu untersuchen, einschließlich eines furchtkonditionierten/gelöschten Hinweisreizes, eines konditionierten/nicht gelöschten Hinweisreizes und mehrerer ähnlicher Generalisierungshinweisreize sowie eines nicht-furchtkonditionierten Sicherheitsreizes. Das andere Paradigma dient der Untersuchung von kontextbezogener Extinktionsgeneralisierung, dies meint den Recall des Extinktionslernens in mehreren Generalisierungskontexten, die dem präsentierten Kontext während des Extinktionstrainings ähnlich sind. Beide Versuchsprotokolle beinhalten eine instruierte Furchtkonditionierung und eine 24-stündige Konsolidierungsphase des Angstgedächtnisses vor dem Extinktionstraining und dem Generalisierungstest. Zu den physiologischen Ergebnissen gehören Hautleitfähigkeitsreaktionen, angstpotenzierte Schreckreflexe und Herzratenveränderungen. Zusätzlich werden unkonditionierte Stimulus (US)-Erwartungsbewertungen und Hautleitfähigkeitsreaktionen (SCR) während US-Auslassung (omSCR) verwendet, um Vorhersagefehlerprozesse abzubilden. Für die Gesamtstichprobe erwarten wir bei Proband:innen mit einer höheren Angstlast weniger stark ausgeprägte hinweisreiz- und kontextbezogene Generalisierungsleistungen des Extinktionslernens. Während der diesjährigen Konferenz wird die Datenerfassung noch nicht abgeschlossen sein. Daher wird dieses Poster unser Studiendesign detailliert darstellen und die vorläufigen Ergebnisse präsentieren.

P2.030 - Successful mnemonic discrimination: linked to decreased functional connectivity between hubs in the frontoparietal and default mode network

P. Iliopoulos[1,2], **J. Güsten**[1], **A. Maass**[2], **E. Düzel**[1,2]

[1] Institut für Kognitive Neurologie und Demenzforschung (IKND), Magdeburg, Germany
[2] Deutsches Zentrum für Neurodegenerative Erkrankungen e.V. (DZNE), Magdeburg Germany

Successful memory depends on the process of mnemonic discrimination to establish discrete memory representations of similar episodes. Although previous neuroimaging research has focused on the well-known role of the hippocampus, less is known about how brain areas belonging to the frontoparietal (FPN) and default-mode network (DMN) interact during this process. The present study investigated the functional connectivity between the hubs of these networks during a mnemonic discrimination task. Our sample consisted of 55 young adults (age: M = 23.67 years, SD = 3.38, 61.8% female), who had to discriminate similar objects and scenes ('lures') from identically repeated items ('repeats'). Stimuli were presented in sequences of 4 items. The first two stimuli were always new images, while the following two stimuli could be either a lure or a repeat trial. During the task, 3T functional magnetic resonance imaging data were collected (resolution 2 mm, TR = 2.2 s). The imaging data were preprocessed using the standard 'fmriprep' pipeline (MNI152 normalization) and statistically modelled using generalized psychophysiological interaction. We performed region of interest (ROI) to-ROI analyses. During successful mnemonic discrimination (lures versus repeats contrast), we found decreased functional connectivity between the lateral prefrontal cortex (LPFC; FPN hub) and the lateral parietal cortex (DMN hub). Our results implicate a role of functional communication between DMN and FPN hubs for mnemonic discrimination during task, extending previous findings in the literature. In future studies, we will examine its relationship to behavioral mnemonic discrimination measures and the potential role of hippocampal subfields activity in these two key networks connectivity.

P2.031 - Association of Spermidine Blood Levels with Slow-Wave Sleep Physiology

S. Wortha[1], J. Ladenbauer[1], J. Hanna[1], C. Schwarz[2,3,4], N. Friedrich[5,6], B. Stubbe[7], A. Flöel[1,8]

[1] Department of Neurology, University Medicine Greifswald, Greifswald, Germany
[2] Institute for Molecular Medicine Finland (FIMM), HiLIFE, University of Helsinki, Finland
[3] Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Humboldt-Universität zu Berlin, Department of Neurology, Berlin, Germany
[4] Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Humboldt-Universität zu Berlin, NeuroCure Clinical Research Center, Berlin, Germany
[5] German Centre for Cardiovascular Research (DZHK), Partner Site Greifswald, Greifswald, Germany
[6] Institute of Clinical Chemistry and Laboratory Medicine, University Medicine Greifswald, Greifswald, Germany
[7] Department of Internal Medicine B–Cardiology, Intensive Care, Pulmonary Medicine and Infectious Diseases, University Medicine Greifswald, Greifswald, Germany
[8] German Centre for Neurodegenerative Diseases (DZNE), Site Rostock/Greifswald, Greifswald, Germany

Deteriorations in slow-wave sleep, particularly the temporal interplay between slow oscillations (SO) and spindles, have been linked to deficits in the consolidation of novel memories. Recent preclinical studies have shown that the polyamine spermidine is crucial for regulating and modulating circadian rhythm which in turn has been linked with long-term memory formation. However, the association of spermidine with sleep and memory formation across the adult lifespan remains poorly understood. Therefore, we aimed to investigate the association of spermidine blood levels with parameters of sleep physiology and cognitive performance in healthy adults. Polysomnography, cognitive performance (assessed with the Nuremberg-Age-Inventory) and spermidine plasma levels from 375 healthy adults (mean age: 51 years, range: 22 to 81 years) of the population-based SHIP study were included in our analysis. We ran three regression models adjusted for age and gender to investigate the associations between ratio of SO- and delta nested spindles (SO/δ spindle ratio) and spermidine levels, recollection performance and SO/δ spindle ratio, as well as recollection performance and spermidine levels. We found an inverse association between spermidine levels and SO/δ spindle ratio. SO/δ spindle ratio was positively associated with recollection performance. No significant association was observed between spermidine levels and recollection performance. Our results suggest an association between higher spermidine levels and degraded slow-wave sleep. These findings are in line with our recent observation of association of higher spermidine plasma levels with more pronounced brain aging. They do not support the previously found beneficial associations of spermidine tissue levels with sleep.

P2.032 - Identifying sequential memory reactivation during sleep in humans

M. Kutlu[1], **J. Schäfer**[1], **T. Schreiner**[1], **T. Staudigl**[1]

Ludwig Maximilian University of Munich, Germany

Sleep is assumed to benefit memory consolidation by the reactivation of previous experiences. In line with this assumption, animal models have repeatedly demonstrated that sequences of prior learned spatial trajectories are replayed during sleep. However, research into human memory reactivation during sleep generally lacks both sequential and spatial components. In this study, we aim to close this gap by implementing a sequential spatial-learning paradigm during wake and using targeted memory reactivation (TMR) to trigger sequential reactivation of spatial memories during sleep in humans. Participants are instructed to learn 24 sequences of images that are associated with specific head directions (HD) by displaying the images on screens with different orientations. Each sequence is preceded by a unique sound serving as a reminder cue during subsequent retrieval and TMR. Memory performance is tested before and after a night of sleep, as well as 24 hours later than the first morning retrieval. During non-rapid eye movement sleep (NREM), participants are presented with half of the previously learned sounds to trigger sequential reactivation of spatial memories. EEG is recorded during whole experiment. We hypothesize that both spatial and non-spatial memories are reactivated during NREM sleep. Using multivariate decoding we aim for identifying the sequential reactivation of HD and image related memories. Furthermore, we expect a beneficial effect of TMR on subsequent memory performance. Using HD related information that could provide distinguishable spatial contexts and thus enrich memory traces, this study aims to provide a novel insight into characterizing sequential reactivation during NREM sleep in humans.

P2.033 - The structure of experience: Examining the emergence of value-weighted schematic representations in the mPFC

P. C. Paulus[1,2], **A. N. Williams**[2,3], **S. Wiese**[2], **R. G. Benoit**[2]

[1] Department of Psychology, Neuropsychology, University of Freiburg, Germany
[2] Max Planck Institute for Human Cognitive and Brain Sciences, Max Planck Research Group: Adaptive Memory, Leipzig, Germany
[3] Nottingham Trent University, School of Social Sciences, Department of Psychology, Nottingham, UK

How we perceive our environment and the people that live in it is shaped by our past experiences. In a previous study, we have demonstrated that generalized knowledge about personally familiar people and locations is encoded in schematic representations in the rostral and ventral medial prefrontal cortex (mPFC). Critically, within these representations, knowledge about the respective environment is closely intertwined with a representation of value. Here, we examine how such value-weighted schemas are constructed from series of overlapping individual experiences. Specifically, we tracked the emergence of schematic representations of a new and complex naturalistic environment. Over the course of two weeks, participants were exposed to the entire first season of the character-rich TV show "The Wire". We modelled the social network structure of the featuring characters, both directly from the video material and from behavioral arrangements provided by the participants. Moreover, participants rated how well they know and how much they like the characters. We used these variables to model the expected structure of participants' value-weighted schematic representations. After seeing the final episode, participants underwent tasks that reinstate the representations of the individual characters. During these tasks, we measured functional MRI. We take the ensuing multi voxel activation pattern as a proxy measure of the neural representation. Preliminary analyses indicate that schematic representations are encoded in the mPFC and are influenced by our liking of the encoded individuals.

Topic 4: Cognition

P2.035 - Der Einfluss von Reappraisal (Hochregulation) auf Emotionsverarbeitung und emotionale Schmerzmodulation

P. Reicherts[1], **L. Wagemeyer**[2], **M. Kunz**[1]

[1] Lehrstuhl für Medizinische Psychologie und Soziologie, Medizinische Fakultät, Universität Augsburg
[2] Universität Würzburg

Das Erleben von Schmerz ist häufig begleitet von einem distinkten Gesichtsausdruck, ähnlich wie beim Erleben bzw. der Kommunikation anderen negativer affektiver Zustände. Ferner stehen Emotions- und Schmerzverarbeitung in einem wechselseitigen Verhältnis zueinander, so dass Emotionen Schmerz verstärken bzw. reduzieren vermögen und gleichzeitig Schmerz als motivationaler Kontextreiz die emotionale Verarbeitung beeinträchtigt. In der vorliegenden Studie sollte untersucht werden, inwiefern die willentliche Hochregulation emotionaler Reaktionen - in Folge der Betrachtung negativer Emotions- und Schmerzausdrücke - durch Neubewertung, subjektive und neurophysiologische Korrelate der Emotions- sowie Schmerzverarbeitung beeinflussen kann. Hierfür betrachteten Versuchsteilnehmenden faziale Stimuli die Angst, Schmerz oder einen neutralen Ausdruck präsentierten, während Ihnen gleichzeitig kurz elektrische Schmerzreize verabreicht wurden. Die Versuchsteilnehmenden sollten die Stimuli entweder bloß anschauen oder aber ihre Reaktionen hochregulieren. Neben Valenz und Arousal Ratings wurden Bewertungen der Schmerzreize erfasst und gleichzeitig EEG gemessen.
Die Auswertung emotionssensitiver visueller ereigniskorrelierter Potentiale (EPN und LPP) ergab eine signifikante Modulation in Folge der Regulationsinstruktion im Vergleich zur neutralen Kontrollbedingung, sowohl für Schmerz- als auch Angstausdrücke. Dies spiegelte sich gleichermaßen in negativeren Valenz- bzw. erhöhten Arousalratings in der Hochregulieren Bedingung wider. Die Schmerzreize wurde sowohl während der Betrachtung hochregulierter Schmerz- als auch Angstausdrücke intensiver und angenehmer bewertet im Vergleich zur neutralen Kontrollbedingung. Die Befunde zeigen damit, dass die (maladaptive) Bewertung von emotionalen Reizen und damit einhergehende Reaktionen sich auch auf die Schmerzverarbeitung auswirken können. Im vorliegenden Fall zeigte sich für beide Stimuluskategorien ein ähnliches Muster. Inwiefern sich potentiell modulatorische Effekte für spezifische Schmerzausdrücke und damit verbunden Reaktionen unterscheiden, bleibt zu untersuchen.

P2.036 - Eye Did This! Sense of Agency in Eye Tracking Tasks

J. Gutzeit[1], **L. Huestegge**[1], **J. Kürten**[1], **L. Weller**[1]

Julius-Maximilians-Universität, Deutschland

Sense of agency is the phenomenon when feeling in control over one's actions and their outcome effects. We investigated implicit and explicit sense of agency in eye tracking tasks.
In our study, participants fixated one of several stimuli on the screen. Shortly after fixation, the fixated stimulus changed its color. Participants then reproduced the delay between saccade-landing and the color-change by pressing and holding down a key. In different conditions, participants were led to believe that they could or could not influence the timing of the color-change with their eye movements. We analyzed interval reproductions as a measure of temporal binding, which might be linked to implicit sense of agency and explicit agency ratings.
Explicit agency ratings were higher in conditions in which participants believed that they had caused the color change with their eye movements compared to conditions in which they could not control the color change. However, temporal binding was not stronger in those conditions.
These findings indicate that oculomotor actions may generate a sense of agency comparable to, for example, manual actions as measured via agency ratings. Temporal binding, however, seemed to depend on other factors than intentionality and sense of agency in our study. It might better be explained as a phenomenon of multisensory integration.

P2.037 - Classifying Cognitive Load in a Quasi-Realistic Scenario Based on Multimodal Neurophysiological Data

S. Gado[1], **K. Lingelbach**[2,3], **M. Vukelić**[2]

[1] Julius-Maximilians-Universität Würzburg, Deutschland
[2] Fraunhofer-Institut für Arbeitswirtschaft und Organisation IAO, Stuttgart, Deutschland
[3] Carl von Ossietzky Universität Oldenburg, Deutschland

When situational demands exceed available cognitive resources, people experience cognitive overload which often leads to stress, exhaustion, fatigue, and consequently erroneous behavior. This is particularly problematic in safety-critical contexts, where people are confronted with various, potentially distracting, demands that may deteriorate goal-directed behavior.
Therefore, robust measures of the experienced cognitive load are needed that not only account for task-induced demands but also consider situational-environmental influences. For this aim, we need to be able to correctly classify (high) cognitive load using a variety of continuous and unobtrusively measured variables. We here present a multimodal study with 18 participants (nine female, mean age = 25.9 $\pm$ 3.8 years) of whom ocular, cardiac, respiratory, and brain activity (using fNIRS) were recorded during the execution of an adapted warship commander task with concurrent emotional speech distraction. These emotional speech stimuli have a high salience and are, thus, perceived as especially distractive.
Our cross-subject multilevel classification approach comprises feature engineering, model optimization and selection as well as sensor fusion methods with the goal of reliably identifying the currently experienced cognitive load. We used a leave-one-out strategy to test the generalizability of the final proposed classifier. Because the architecture combines information from different modalities, the final cognitive load prediction can be considered robust against noise, artifacts, and temporal sensor dropouts. Our approach contributes to the ecologically valid identification of cognitive overload and paves the way towards state monitoring in realistic applications and to systems that can adapt flexibly to the current cognitive resources of their users.

P2.038 - Identifying Interacting Cognitive and Affective Processes – Effects of Emotional Distractions on Different Cognitive Load Levels

K. Lingelbach[1,2], **S. Gado**[3], **M. Wirzberger**[4], **M. Vukelić**[2], **J. W. Rieger**[1]

[1] Applied Neurocognitive Psychology Lab, Department of Psychology, Carl von Ossietzky University, Oldenburg, Germany
[2] Fraunhofer Institute for Industrial Engineering IAO, Stuttgart, Germany
[3] Experimental Clinical Psychology, Department of Psychology, Julius-Maximilians-University of Wuerzburg, Wuerzburg, Germany
[4] Department of Teaching and Learning with Intelligent Systems, Institute of Educational Science, University of Stuttgart, Stuttgart, Germany

A thorough knowledge of interacting cognitive and affective processes is essential to understand how our brain processes complex stimulus-rich environments. Previous studies investigating the effects of emotional distraction revealed attenuated brain activity in task-relevant prefrontal areas for emotionally negative distractions. To overcome interferences evoked by the distractions, cognitive control mechanisms try to suppress the influence of such task-irrelevant stimuli and ensure the maintenance of goal-directed cognitive processes. However, under which circumstances such control mechanisms are triggered and how efficiently they inhibit distractions is not yet sufficiently understood. To investigate the interaction of emotional speech distractions (positive, neutral, and negative) and different cognitive load levels (low and high), we conducted a study with 18 participants (nine female, mean age = 25.9 +/- 3.8) using functional near-infrared spectroscopy (fNIRS) and an adapted version of the warship commander task. We observed a lateralization effect with increased left frontopolar, orbitofrontal activity for positive compared to negative distractions during low cognitive load as well as similar activation patterns for neutral and emotionally negative distractions but only during high load. Interestingly, there was an interaction revealing different interference effects for positive stimuli depending on the current cognitive load level as well as indicators of different levels of semantic processing and evaluation. The effectiveness of control mechanisms as well as residual interference effects, thus, depend not only on the valence of the distraction but also on the cognitive load level to which a person is currently exposed.

P2.039 - Conflict related midfrontal theta in an approach avoidance task is independent from midfrontal theta in a Flanker task

L. Lange[1], **R. Osinsky**[1]

Differential Psychology & Personality Research, Institute of Psychology, Osnabrück University

Midfrontal theta (FMθ) in the human EEG is commonly viewed as a generic and homogeneous mechanism of cognitive control in general and conflict processing in particular. However, the role of FMθ in approach avoidance conflicts and its cross-task relationship to simpler stimulus-response conflicts remains to be examined more closely. Therefore, we recorded EEG data while 59 healthy participants completed both, an approach avoidance task and a Flanker task. Participants showed significant increases in FMθ power in response to conflicts in both tasks. To our knowledge, this is the first study to show a direct relationship between FMθ and approach avoidance conflicts. Crucially, FMθ activity was task dependent and showed no cross-task correlation. To assess the possibility of multiple FMθ sources, we applied source separation (Generalized Eigendecomposition; GED) to distinguish independent FMθ sources. While we were able to extract different FMθ components, the activity of these components was again task-specific, indicating independent FMθ acitivity in the different tasks. Our findings contradict the assumption that FMθ is a unitary need-for-control signal and rather support more recent ideas of multiple, fine grained and independent generators of FMθ or a generic conflict sensitivity at an interindividual level.

P2.040 - A non-linear temporal discounting drift diffusion model accurately accounts for rodent choices and response times and yields parameter estimates with high test-retest reliability

J. Peters[1], **M. Carr**[2,3], **T. Pattij**[2,3]

[1] Department Psychologie, Universität zu Köln, Deutschland
[2] Amsterdam UMC location Vrije Universiteit Amsterdam, Dept Anatomy & Neurosciences, Netherlands
[3] Amsterdam Neuroscience, Compulsivity Impulsivity and Attention, Amsterdam, Netherlands

Introduction. Sequential sampling models are powerful models for decision-making that jointly account for choices and associated response time (RT) distributions (Forstmann et al., 2016). Based on recent human findings (Wagner et al., 2020; Peters & D'Esposito, 2020; Bruder et al., 2021), we explored the feasibility of modeling rodent temporal discounting data using temporal discounting drift diffusion models (DDM) and also examined parameter reliability (Enkavi et al., 2019).
Methods. Data were acquired in the context of an optogenetics study. Animals (n=25) completed a temporal discounting task (vanGaalen et al., 2006) involving smaller-sooner (1 food pellet available immediately) and larger-later rewards (4 food pellets with delays of 0, 5, 10 or 20sec) across multiple sessions. Choices and response times were modeled using a hierarchical Bayesian temporal discounting DDM (Wagner et al., 2020; Peters & D'Esposito, 2020).
Results. Model comparison and posterior predictive checks confirmed previous results in humans (Wagner et al., 2020). Two-month test-retest correlations were >= .7 for the discount rate log(k), boundary separation, starting point and non-decision time. This was not the case for drift rate components (coefficient: r=.024; maximum: r=.30).
Discussion. We show that, similar to human results, a non-linear DDM accurately accounts for rodent choices and RTs during temporal discounting. Test-retest reliability was mostly acceptable, highlighting the feasibility of using the DDM in the context of rodent studies of inter-temporal choice.

P2.041 - Distraction prevents decoding of auditory working memory contents

P. Deutsch[1], **S. Czoschke**[1], **C. Fischer**[1], **J. Kaiser**[1], **C. Bledowski**[1]

Institut für Medizinische Psychologie, Goethe-Universität Frankfurt

Working memory enables the temporary storage of relevant information in service of behavior. Neuroimaging studies have suggested that the sensory cortex is involved in the storage of information in working memory. This raised the question of how sensory regions maintain memory representations during the presentation of distracting stimuli. Multivariate pattern analysis of functional magnetic resonance imaging (fMRI) signals in visual cortex has shown that the contents of visual working memory could be decoded concurrently with passively viewed distractors. The present fMRI study tested whether this finding extends to auditory working memory and also to active distractor processing. We asked participants to memorize the pitch of a target sound and to compare it with a probe sound presented after a 13-s delay period. In separate conditions, we compared a blank delay phase (no distraction) with either passive listening to or active processing of an auditory distractor presented throughout the memory delay. Consistent with previous reports, we found that pitch-specific memory information could be decoded from fMRI signals in the auditory cortex throughout the delay in trials without distraction. In contrast, we failed to find neural evidence for distractor-resistant representations of the target sound under both passive and active distraction. Moreover, this was also the case when we applied different analysis strategies or tested signals in other brain regions. While our findings do not necessarily prove the absence of persistent auditory memory coding during distraction, they may indicate a difference between the neural correlates of visual and auditory working memory.

P2.042 - New insights into the neural correlates of error processing as revealed by the Speeded Inference Game

E. Niessen[1,2], **M. Barddakan**[2], **M. Bell**[2], **P. H. Weiss**[2,3], **J. Stahl**[1]

[1] Universität zu Köln, Deutschland
[2] Forschungszentrum Jülich, Deutschland
[3] Uniklinik Köln, Deutschland

Classical conflict tasks like the Erikson Flanker task are often used to investigate error processing. The additional assessment of error detection, i.e., the immediate performance evaluation by participants, is challenging, because the frequency of detected and undetected errors is vastly different making a comparison between these two error types difficult. To address this problem and to evoke a high number of undetected errors, we created the Speeded Inference Game (SIG). The (online available) SIG is a complex gamified experimental task with a high cognitive load, where participants need to apply two hierarchically-organised rules to choose the correct amongst four targets. An adaptive algorithm enabled a stable error rate for each participant. More importantly, the number of undetected errors was satisfactory high – allowing a fair comparison between detected and undetected errors. In two behavioural studies, we investigated the SIG on its suitability and specific behavioural features (doi: https://doi.org/10.1101/2022.03.01.481617). Using EEG, we further explored the neural mechanisms of error awareness by analysing the event-related potential components error(-related) negativity (Ne/ERN) and error positivity (Pe) in a sample of 24 young participants performing the SIG. At the behavioural level, the two hierarchically-organised rules led to similar error rates, but differed in response speed and error awareness. Importantly, the higher order rule triggered larger Ne/ERN amplitudes than the lower order rule, but similar Pe amplitudes, suggesting two distinct error types.
Complementary to classical tasks, the SIG has many useful features, which will enable interesting future applications and research questions.

P2.043 - Using Computational Models of Reinforcement Learning and Choice Frequency to Study Human Habits

S. Nebe[1], **A. Kretzschmar**[1], **P. N. Tobler**[1]

University of Zurich, Schweiz

Habitual behavior is characterized by responses elicited directly by contextual stimuli without deliberation or reliance on the predicted value of the outcome. Thus, habits reduce cognitive load in everyday life, but they also dominate behavior in psychopathologies like substance use or obsessive-compulsive disorders. Due to the ubiquity and clinical importance of habits, it is essential to study them in the lab. Current operationalizations require that outcome values and contingencies are no longer considered when defining behavior as habitual but neglect that habit strength should be proportional to the past frequency of performance.
We developed a new experimental task, which assesses habit strength as a function of previous choice frequency while controlling for the impact of reinforcement value. In two initial studies with 34 participants in total, we tested the influence of previous choice frequency on preferences in binary decisions. The development of habits was facilitated by five training sessions on consecutive days. Mixed-effects regression showed an effect of past choice frequency on behavior during test on the fifth study day. Computational modeling of participants' behavior allowed a more detailed understanding showing inter-individual differences in choice strategies. Half of the participants combined reinforcement-based and frequency-based values to inform their choice during test. The other half seemed to ignore past choice frequency and solely relied on expected reinforcement values. Thus, our method quantifies individual propensity to show habits and has potential to identify subgroups of the population prone to a pathological overexpression of habits.

P2.044 - Interaction of negative, visual primes with cognitive control

M. Kampa[1,2], A. Sebastian[3,4], O. Tüscher[3,4], R. Stark[2], T. Klucken[1]

[1] Universität Siegen, Deutschland
[2] Bender Institute of Neuroimaging, Justus Liebig Universität, Giessen, Deutschland
[3] Psychatrie and Psychotherapie, Universitätsmedizin der Johannes Gutenberg Universität, Mainz, Deutschland
[4] Leibniz Institut für Resilienzforschung (LIR), Mainz, Deutschland

Being able to inhibitit impulses in highly emotional situations, is crucial for social and cognitive functioning. Impulsivity in negative, emotional states is a characteristic of many mental disorders, like borderline personality disorder and addiction. The interaction of negative, visual primes with cognitive control was investigated in N=57 healthy students with a combined stop-signal and Simon-task. Fotographs of humans and animals with low valence and high arousal normative ratings served as negative, visual primes. In the current replication study, functional magnetic resonance imaging was acquired during task performance. An effect of emotional interference was found in the behavioral data. Reaction times and stopping latencies were prolonged for negative primes, whereas no significant differences were found for error rates and ommision rates. In line with former studies negative, visual primes led to increased salience processing in bilateral amygdalae, right inferior frontal gyrus, brainstem and bilateral inferior occipital cortices. Concerning the interaction of negative emotion and cognitive control, fMRI data revealed reduced activation in executive control regions in negative trials. On the other side, concurrent motor response inhibition downregulated amygdala responses to negative pictures. In summary, parallel cognitive and emotional processing seem to impact each other by limiting processing ressources.

P2.045 - Effects of visual appetitive cues on neural reward circuits and intertemporal decision-making

K. Knauth[1], **D. Mathar**[1], **B. Kuzmanovic**[2], **M. Tittgemeyer**[2], **J. Peters**[1]

[1] Universität zu Köln, Deutschland
[2] Translational Neurocircuitry Group, Max Planck Institute for Metabolism Research Cologne, 50931 Cologne, Germany

Introduction. Humans and many animals devalue future rewards as a function of time (temporal discounting; TD). Pronounced discounting behavior is associated with a wide range of psychiatric conditions and problematic behaviors – including gambling disorder, substance abuse and impulse control disorders. Despite the trait-like character of TD, various studies suggest that it can be affected by environmental factors and cues. For example, highly appetitive (erotic) stimuli, which are known to upregulate activity in reward-related dopaminergic brain areas (e.g. Stark et al., 2019), have been shown to increase TD in male participants. However, the extent to which neuronal (erotic) cue-reactivity in these areas directly impacts changes in TD remains unclear.
Methods. In two different sessions we assessed the differential effect of visual erotic (vs. neutral) cue exposure on activity in several a-priori defined regions of interest (ROI) encompassing key regions of the reward circuit based on previous work (Stark et al., 2019). Next, we evaluated whether cue exposure directly affected TD.
Results. Erotic, in contrast to neutral stimuli, increased hemodynamic responses in multiple ROIs. Amongst others, those include bilateral visual cortices, superior parietal cortex, thalamus, nucleus accumbens (NAcc) and ventromedial prefrontal cortex (vmPFC), replicating previous results. We also replicated main effect of subjective value in vmPFC (Kable & Glimcher, 2007) pooled across testing sessions.
Outlook. In further planned analyses we test whether increased reward-system-reactivity within key dopaminergic regions (NAcc, VTA) and reduced lateral prefrontal cortex (LPFC) activity in response to visual erotic cues predicts cue-induced changes in TD.

P2.046 - Measuring individual differences in electrophysiological correlates of executive functions

C. Löffler[1,2], K. Sadus[1], G. T. Frischkorn[3], D. Hagemann[1], A. Schubert[2]

[1] Institute of Psychology, Heidelberg University , Germany
[2] Department of Psychology, University of Mainz, Germany
[3] Department of Psychology, University of Zurich, Switzerland

The three-factor model of executive functions has become one of the most prominent models in cognitive control research. However, a growing body of recent studies demonstrated psychometric problems of behavioral measures of executive functions. Some studies did not find a coherent factor structure of executive functions and were not able to find sufficient individual differences in certain executive functions. Thus, current behavioral research has been questioning the usefulness of established measures of executive functions. In the We analyzed individual differences in the three most common executive functions and tried to replicate the three-factor model of executive functions by Miyake et al. (2000) using event-related potentials (ERPs). For this purpose, we assessed the relations between N2 and P3 amplitudes measured in a battery of executive function tasks using structural equation models in a sample of 148 participants. Preliminary results revealed three independent factors of executive functions. Updating was related to Shifting and Inhibition but Shifting and Inhibition were not related to each other. ERP amplitudes in none of the three executive functions were related to individual differences in cognitive abilities.
We conclude that ERP amplitudes are a suitable measure of individual differences in executive function tasks. However, their usefulness for individual differences research remains unclear, as ERP amplitudes were unrelated to individual differences and cognitive abilities.

P2.047 - Stress and the cardiac cycle: Influence on conflict processing in a Simon task

L. v. Haugwitz[1], **E. Wascher**[1], **M. Larra**[1]

Leibniz-Institut für Arbeitsforschung an der TU Dortmund (IfADo), Deutschland

Stress is assumed to facilitate automatic over cognitively controlled behavior by modulating prefrontal cortex activity. However, performance in conflict tasks is often found to be unaltered or even improved by stress. Stress also increases cardiovascular activity, and it is known that cardioafferent signals are relayed to frontocentral brain regions. Interestingly, these regions are postulated to play a decisive role in conflict monitoring and detection. Here, we investigated whether stress induced modulations of cardioafferent traffic alter conflict processing. In a within-subjects-design, 30 participants underwent the automated feet cold-pressor test (CPT) and a warm water control condition on two separate dates, one week apart. Immediately after, they performed a visuospatial Simon-task in which processing conflicts are induced by a mismatch between stimulus and response location. Stimuli were presented either during cardiac systole or diastole to target phases of high vs. low cardioafferent activity, respectively. Response times, errors and electroencephalogram were assessed. The CPT successfully increased cortisol, cardiovascular parameters, and subjective ratings of stress and arousal compared to the control condition. As expected, increased frontocentral activity 200 – 300 ms after stimulus presentation was observed in the conflict compared to the no-conflict condition. Importantly, this frontocentral activity was increased during systole compared to diastole. Moreover, this effect was amplified by stress. While behavioral data showed strong conflict related effects, an influence of stress or cardiac cycle could not be observed. These results indicate that stress may increase sensitivity to conflicts and that cardioafferent mechanisms may play a role in mediating such an effect.

Topic 5: Attention and Perception

P2.048 - Dissociable neuronal mechanism for different crossmodal correspondence effects

C. Jaap[1], **M. Rose**[1]

NeuroImage Nord, Department for Systems Neuroscience, University Medical Center Hamburg Eppendorf

Crossmodal correspondences (CMC's) refer to associations between seemingly arbitrary stimulus features in different sensory modalities. Pitch-size correspondences refer to the strong association of e.g. small objects with high pitches. Pitch-elevation associations refer to the strong association of e.g. visuospatial elevated objects with high pitches. We used fMRI to study the neuronal components, which underlie the CMC in pitch-size and spatial pitch-elevation correspondences. The study focuses on answering the question of whether or not different CMC's are driven by similar neuronal mechanisms. The comparison of congruent against incongruent trials allows the estimation of CMC effects across different tasks. The analysis of the measured neuronal activity in both tasks strongly pointed towards different mechanisms which are involved in associations of pitch-size and pitch-elevation correspondences.

P2.049 - Spontaneous Necker-cube Reversals are not that Spontaneous – An EEG Study

M. Wilson[1,2,3,4], **L. Hecker**[2,3,4], **E. Joos**[5], **L. T. v. Elst**[3,4], **J. Kornmeier**[2,3,4]

[1] Faculty of Biology, University of Freiburg, Germany
[2] Perception and Cognition Lab, Institute for Frontier Areas of Psychology and Mental Health, Freiburg, Germany
[3] Department of Psychiatry and Psychotherapy, Medical Center - University of Freiburg, Germany
[4] Faculty of Medicine, University of Freiburg, Germany
[5] INSERM U1114, Cognitive Neuropsychology and Pathophysiology of Schizophrenia, University of Strasbourg, France

During passive observation of the Necker-cube, our perception reverses between two interpretations. Despite the spontaneous character of reversals, theoretical approaches postulate slow destabilization of neural representations as a precondition for spontaneous reversals of ambiguous figures. The endogenous character of spontaneous reversals makes it difficult to separate neural processes preceding reversals from processes following. We addressed this with an onset-paradigm allowing high temporal resolution of reversal processes and focused on possible EEG correlates of perceptual destabilization preceding it.
We presented ambiguous Necker-cubes and contrasted EEG correlates of endogenous reversals with correlates of perceptual stability across two consecutive stimulus presentations. In a separate experiment, we contrasted exogenously induced reversals and stability of disambiguated cube variants. EEG contrasts before and during the reversal trials were compared.
We found the earliest EEG differences between reversal and stability trials already with the stimulus before a perceptual reversal at bilateral parietal and right-hemispheric electrodes. The traces start to differ about 1100 ms before a perceived reversal, become maximally different at around 875 ms ($p = 4*10\text{-}6$, Cohen's $d = 0.85$) and stay different until shortly after onset of the reversed stimulus. No such patterns were found in disambiguated cube variants.
Our experimental paradigm allows to locate these EEG effects clearly before an endogenous reversal. Together with the absence of such effects before exogenous reversals, our findings probably reflect destabilized states of neural representations as a necessary precondition of an upcoming endogenous reversal. Spontaneous Necker-cube reversals are thus probably not as spontaneous as generally thought.

P2.051 - The phase of prestimulus alpha oscillations causally modulates the causal prior in multisensory perception

T. Rohe[1,2], **A. Ehlis**[2,3]

[1] Institute of Psychology, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Erlangen, Germany
[2] Department of Psychiatry and Psychotherapy, University of Tübingen, Tübingen, Germany
[3] Tübingen Center for Mental Health (TüCMH), Tübingen, Germany

To veridically combine stimuli across the sensory channels into multisensory perceptions, humans infer the causal structure of multisensory stimuli by combining causal evidence from the stimuli's spatiotemporal structure and prior causal assumptions (causal prior). Our previous study demonstrated that the causal-prior parameter of the causal-inference model is correlated with the phase of prestimulus alpha oscillations, yet remarkably the neurobehavioral link functions between alpha phase and the causal prior were individually specific. Here, we investigated whether the phase of prestimulus alpha oscillations has a causal influence on the causal prior when individual neurobehavioral link functions were taken into account: Participants (N = 26) counted the number of flashes and beeps of audiovisual sequences and judged their causal structure. Before stimulus onset, we successfully entrained alpha oscillations at two opposite phase angles by rhythmic visual stimuli (10 Hz) as verified by EEG. In a control condition, we did not entrain alpha oscillations using a static visual stimulus to measure individual neurobehavioral link functions between alpha phase and the causal prior. At group level, participants inferred a common cause in case of small audiovisual numeric disparities equally for both alpha-phase manipulations as reflected in equivalent causal priors in both conditions. Yet, when individual neurobehavioral link function predicted the individual effects of the two alpha-phase manipulations, we found that the manipulated alpha phase led to differential causal priors in both conditions between 200-300ms before stimulus onset. Our data suggest that the prestimulus phase of alpha oscillations has a causal influence on the causal prior.

P2.052 - SOA-dependent spatial pre-cueing effects of emotional face distractors on target performance and event related potentials

V. Shivani[1], J. Schmuck[1], H. Kirsten[1], R. Schnuerch[1], H. Gibbons[1]

University of Bonn, Germany

Attention allows us to selectively process the vast information given to us, by focusing on relevant and ignoring irrelevant information. Task-irrelevant information may lead to impaired performance on ongoing tasks and involve both automatic/bottom-up and controlled/top-down mechanisms. Investigations of attentional control via spatial cueing paradigms revealed that prior information of a target or distractor location facilitates target processing and/or distractor inhibition. However, little is known about the interaction of top-down and bottom-up attentional control in the presence of an emotionally salient face, and how attentional biases are governed.
We investigated the ERP effects of SOA dependent pre-cueing of emotional face distractors on target performance while participants (N = 30) completed a modified spatial cueing task. They were presented with pairs of one neutral target face that had to be categorized for gender, and one emotional (fearful, happy, neutral) distractor face.
We expected an SOA-dependent influence of pre-cued emotional distractor faces on spatial attention. Efficient distractor inhibition for the long cue-face SOA (900 ms) should lead to increased performance, reduced distractor ERPs (P1, N1, EPN, LPP) and increased target ERPs (P1, N1, P300). In contrast, with short cue-face SOA (100 ms), the effect of directing attention to the distractor location may initially dominate a potential advantage related to distractor inhibition. This should be accompanied by reduced performance, increased early distractors ERPs (P1, N1, EPN), increased later ERP indices of conflict processing (MFN), and reduced/delayed target ERPs (P300).
Data analysis is in progress, results will be presented in the conference.

P2.053 - Auditory attention in workplace-related complex sound environments

M. Rosenkranz[1], **M. Bleichner**[1]

Neurophysiology of Everyday Life Group, Department of Psychology, University of Oldenburg, Oldenburg, Germany

In demanding work situations (e.g., during a surgery) the processing of complex soundscapes varies over time and can be a burden for the medical personnel. Here we study, using electroencephalography (EEG), how humans process workplace-related auditory scenes while performing a complex audio-visual-motor task (3D Tetris). Specifically, we want to know how the attentional focus (either narrow or wide) changes the processing of the acoustic scene as a whole. Participants played a game of 3D-Tetris (implemented in MATLAB) in which they had to use both hands to control the falling blocks. At the same time, participants listened to a complex auditory scene, similar to what is found in an operation theatre (i.e., sound of machinery, people talking in the background, alarm sounds, and instructions). Participants had to react to instructions (e.g., "place the next Block in the upper left corner") and to additional sounds depending on the experimental condition. In this within-subject design, participants either had to only react to a specific alarm sound originating from a fixed point in space ("narrow attentional focus") or they had to react to a sound that had no specific origin and that required the participants to monitor multiple different sound streams ("wide attentional focus"). Preliminary results show differences in the temporal response functions (TRF, i.e., the neural response to the acoustic scene as a whole) between the conditions. This work is a step towards studying workplace-related noise disturbance in the operation theatre using mobile EEG.

P2.054 - Allocating spatial attention in multisensory environments: insights from ERPs and neural oscillations

L. Klatt[1], **A. Begau**[1], **D. Schneider**[1], **S. Getzmann**[1]

Leibniz Research Centre for Working Environment and Human Factors, Deutschland

Although it is widely acknowledged that our senses do not act in isolation, it remains elusive how unisensory attentional selection mechanisms interact in multisensory environments. Using the EEG, we investigated the interplay of auditory and visual spatial attention in an audio-visual cocktail-party environment. In each trial, two concurrent, lateralized speech stimuli were presented. Subjects (N=36) were instructed to indicate the lateral position (left/right) of a pre-defined target word. In three separate blocks, the acoustic speech stimuli were either presented with congruent visual speech (AVcong), with unspecific visual speech (AVunsp), or without any visual information (Aonly). Overall, participants performed close to ceiling. Response times revealed a typical audio-visual facilitation effect, with fastest response times for AVcong stimuli compared to Aonly and AVunsp stimuli. ERP analyses showed that audiovisual events elicit both auditory (N2ac component) and visual (N2pc component) attentional orienting, even if only the auditory modality contains meaningful information. However, N2ac/N2pc amplitudes and onset latencies did not differ between conditions. Time-frequency analyses revealed modulations primarily in the theta frequency range. Theta power was increased for AVunsp and Aonly compared to AVcong stimuli, indicating reduced demands for cognitive control in the latter condition. Preliminary analyses of functional connectivity point toward a wide-spread increase in theta phase-based connectivity for Aonly and AVunsp (vs. AVcong) task blocks. In sum, the study shows that the behavioral audio-visual facilitation effect is not reflected in EEG-correlates of attentional orienting. Further, the results corroborate the relevance of neural oscillations and large-scale connectivity networks for multisensory processing.

P2.055 - Effects of self-generated positive and negative pain-related expectations on pain processing: Multivariate analyses of pre- and post-stimulus EEG activity

C. Wittkamp[1], **M. Wolf**[1], **M. Rose**[1]

Department of Systems Neuroscience, University Medical Center Hamburg Eppendorf Germany

Pain-related expectations influence the perception of painful stimuli, as reflected by the placebo effect. Moreover, these expectations shape neural activity as indexed by changes in oscillatory activity in the EEG domain in anticipation of and during pain processing. However, it is unclear if and how voluntarily generated pain-related expectations influence pain perception on the neural and behavioral level. In this ongoing study, we recorded 64-channel EEG data in healthy participants. Participants were instructed to consciously generate either the expectation of an upcoming highly painful stimulus, weakly painful stimulus, or no expectation at all on a trial-by-trial basis based on a visual cue. Then, they were presented with brief heat pain stimuli at an individually calibrated fixed target intensity. EEG activity in anticipation and pain phase as well as expectation and pain ratings were measured. Analyses revealed that participants successfully built up expectations in line with the cues and reported more pain when consciously expecting more pain. Crucially, this was also reflected by changes in the EEG domain in both anticipation and pain phase. In part of the participants, multivariate analyses using a support vector machine trained on all electrodes using single-trial frequency spectra resulted in a significant classifier performance when contrasting expectations of high vs. low pain. Gamma and alpha band activity were of maximal importance for classification in the anticipation and pain phase, respectively. These findings suggest that it is possible to consciously modulate pain susceptibility to some extend and highlight the role of pre-stimulus activity in pain perception.

P2.056 - Effects of inhibitory TMS over visual area V5/MT on visual speech recognition

L. Jeschke[1], **B. Mathias**[1,2], **K. v. Kriegstein**[1]

[1] Technische Universität Dresden, Germany
[2] University of Aberdeen, United Kingdom

The middle temporal visual area (V5/MT) plays a critical role in the perception of nonbiological or simple motion stimuli such as random dot patterns, supported by studies using transcranial magnetic stimulation (TMS; e.g., Beckers & Zeki, 1995). In addition, functional magnetic resonance imaging (fMRI) studies demonstrate V5/MT responses to the rather complex biological motion that characterizes visual speech (Borowiak et al., 2018). However, whether there is a causal influence of V5/MT on visual speech recognition remains unclear. Here, we investigated the contribution of V5/MT to visual speech recognition by using neuronavigated TMS over area V5/MT in two separate experiments. In both experiments, participants received offline continuous theta burst stimulation over bilateral V5/MT in one session, and control stimulation in another session. Subsequently, we administered a visual speech recognition task, and a face recognition (Experiment 1) or a motion direction task (Experiment 2). No effects of TMS were observed on visual speech recognition or face recognition performance compared to control stimulation in Experiment 1. However, in Experiment 2, both visual speech and motion direction recognition were delayed following TMS over V5/MT. We conclude that the area V5/MT not only functionally contributes to the recognition of non-biological visual motion but may also contribute to the processing of complex visual human communication signals.

P2.057 - The role of conflicting motor plans in sensory attenuation: Comparison of N1 amplitude reduction for sounds elicited by pro- and anti-saccades

A. Seidel[1], **C. Bellebaum**[1]

Heinrich-Heine Universität Düsseldorf, Deutschland

Altered processing for self-produced compared to external sounds is assumed to rely on forward model predictions generated on the basis of efference copies of executed motor commands. Reduced event-related potential (ERP) amplitudes have recently not only been found for button-press-, but also saccade-elicited sounds. As the presentation of a visual stimulus is thought to automatically initiate a plan for a fast (pro-) saccade, which is suppressed in case of an anti-saccade, the efference copy of the executed anti-saccade might be impaired by conflicting motor plans for a pro-saccade. To investigate if this affects the reduction of the auditory N1 ERP component for saccade-generated sounds, we tested 32 participants and examined the processing of sounds that were either generated by participants' pro- or anti-saccades or, in two separate control conditions for pro- and anti-saccades, by a computer. Employing linear-mixed-effect models, we found a significant interaction between the saccade type and the type of sound (self-/ computer-generated), $F(1, 20957.7) = 7.47$, $p = .006$. While this interaction and the descriptive pattern underlying it indicate that the N1 amplitude difference between self-generated sounds and external sounds is stronger for pro-saccades than anti-saccades, post-hoc tests including the sound-type random effect were not able to confirm this pattern ($t[27.1] = 0.85$, $p = .405$). Nevertheless, the data might indicate that conflicting motor-information during sound production can result in the impairment of forward-model-generated predictions. This could be seen as further support for the assumption that the N1 reduction is reflecting the sensory integration of such predictions.

P2.058 - Development of distraction by emotional sounds —between costs of orienting of attention and benefits of arousal

C. Bonmassar[1], **F. Scharf**[2], **A. Widmann**[1,3], **N. Wetzel**[1,4,5]

[1] Leibniz-Institut für Neurobiologie (LIN), Deutschland
[2] University of Kassel, Germany
[3] Leipzig University, Germany
[4] Center for Behavioral Brain Sciences Magdeburg, Germany
[5] University of Applied Sciences Magdeburg-Stendal, Germany

Task-irrelevant and unexpected sounds can involuntarily capture attention and can cause impaired performance. However, highly arousing emotional distractor sounds may prioritize information processing and reduce distraction effects due to benefits of arousal enhancement. The present study investigates the relation of distraction effects on performance and benefits of emotion-related arousal enhancement reflected by changes in pupil size. We examined whether children and adults can similarly benefit from such arousal-related facilitation effect. In an auditory-visual oddball paradigm, frequent standard sounds and rare emotional highly arousing and neutral moderately arousing novel sounds were presented, while children (5-8 years, N=39) and adults (N=57) performed a visual categorization task. Preliminary multilevel analyses revealed increased reaction times and enhanced pupil dilation responses (PDRs) following novel sounds in comparison to standard sounds in both groups. The distraction effect decreased in response to emotional sounds in adults but not in children. However, enhanced PDRs following emotional in comparison to neutral novel sounds were present in both groups. At the trial level the data provided evidence for a positive correlation between reaction times and PDR amplitudes in general but evidence against a negative correlation for reaction times and PDR for emotional sounds. Thus, we suggest that effects of the behavioral emotion-related facilitation and the increase in arousal reflected by pupil dilation are at least partly independent mechanisms. Moreover, an exploratory analysis revealed an impact of the tonic level of arousal as indicated by the baseline pupil diameter on performance and distraction effects. Children data collection will conclude in June.

P2.059 - Investigating lip-movement modelling on cortical speech tracking in virtual environments with mobile EEG

M. Daeglau[1], J. Otten[2], B. Mirkovic[1], G. Grimm[2], H. Volker[2], D. Stefan[1]

[1] Neuropsychology Lab, Department of Psychology, University of Oldenburg, Germany
[2] Auditory Signal Processing, Department of Medical Physics and Acoustics, University of Oldenburg, Germany

In the presence of irrelevant but speech-related background noise, congruent lip-movements can aid speech comprehension. It is currently uncertain whether these positive effects extend to virtual reality environments (VEs), which combine the reproducibility of laboratory settings with the complexities of everyday conversation.
A mobile EEG experiment in a VE will be presented. Participants will be shown audio-visual sequences either with a real speaker or an animated avatar presenting stories in different visual and audio situations, with and without background noise. Conditions cover audio-only, visual-only, and lips-covered for both avatar and real speaker conditions. Additionally, audio-visual conditions with congruent lip-movements by the real speaker and two different lip-animation conditions for the avatar. For the avatar conditions lip-movements will be displayed consistently, either as is (mixing blend shapes based on relative formant energies) or via a new machine learning method. We will assess speech cortical tracking and see whether the upgraded lip-movement animation has a benefit over the previous one. Further we will investigate whether the previous found audio-visual benefit of congruent lip-movements in noise for speech comprehension will extend for VEs. Preliminary results suggest comparable cortical tracking between real speaker and avatar conditions, as well as a benefit in cortical tracking for the recent lip-synchronization approach compared to the previous version.
Our findings will help to clarify the ecological validity of VE paradigms and pave the way for more interactive scenarios in the future.

P2.060 - Investigating the neural correlates of personally familiar scenes

H. Klink[1], **G. G. Ambrus**[2], **G. Kovács**[1]

[1] Friedrich-Schiller-Universität Jena, Deutschland
[2] Bournemouth University, United Kingdom

The investigation of visual recognition processes for faces has led to crucial insights into the nature of neural familiarity representations. However, faces are not the only stimulus category for which a differentiation of familiar and unfamiliar is important. Navigating an environment relies on the integration of one's surroundings into a familiar spatial context. The nature of this familiarity component in scene perception is still unclear. In this experiment we investigated if personally familiar scenes elicit similar neural familiarity components as those that have been established for faces. We showed participants pictures of their apartment, an unknown apartment, as well as personally familiar and unfamiliar faces during an EEG session. MVPA was then applied to the data to examine the time course of activation during stimulus perception. The results suggest that scenes were similarly decodable as faces. In accordance with their respective neural networks, the local foci of scene decoding were slightly different than those of face decoding. Familiarity as a construct thus not only applies to faces but also to scenes, albeit in a slightly different manner possibly due to inherent differences in the nature of the stimuli.

P2.061 - Orienting in an uncertain world: pupil-linked neuromodulation and temporal dynamics of expected and unexpected uncertainty

A. Marzecová[1,2], **E. V. d. Bussche**[3], **T. Verguts**[1]

[1] Heinrich Heine Universität Düsseldorf, Germany
[2] Ghent University, Belgium
[3] KU Leuven, Belgium

The concept of attention can be formalised as Bayesian inference about which spatial locations are considered to be relevant in the near future. Theoretical computational work (Yu & Dayan, 2005) proposes that attentional inferences may rely on estimating two forms of uncertainty, linked to distinct neuromodulatory systems. Expected uncertainty (EUn), signaled by acetylcholine (Ach), is thought to track the unreliability of predictive relationships within a familiar context. Unexpected uncertainty (UUn) signals, originating from the locus coeruleus-norepinephrine (LC-NE) system, are elicited by sudden changes of the environmental context. Their specific behavioural consequences and underlying neurophysiological mechanisms are not yet understood. We combined computational modelling, pupillometry, and EEG, with the aim to characterise temporal dynamics of uncertainty estimates, and to probe their link with neuromodulatory brainstem responses. Participants performed a spatial cueing task with two cues. Only one of them reliably predicted the spatial location of a sinusoidal grating. Participants' task was to infer which of the cues predicted the grating's location and to respond to the grating. UUn was induced by cue switches - the validity of the previously relevant cue dropped to chance level, while the other cue became predictive. EUn was related to reliability of the currently relevant cue (70% and 85%, respectively). EUn and UUn levels were modelled using an approximate Bayesian learning algorithm. Our results suggest that attentional orienting relies on Bayesian estimates of uncertainty. EUn and UUn are distinctly tracked by phasic pupil size fluctuations, and they appear to be characterised by different temporal profiles.

P2.062 - Re-analyses of auditory N1 response in an auditory oddball paradigm with slow presentation rate

S. Berti[1]

Johannes Gutenberg-Universität Mainz, Deutschland

The poster presents a re-analyses of EEG data from Berti, Gamer & Vossel (2017) in which an auditory oddball presentation was applied to test for age effects on the orienting response. Here, the focus lies on the long inter-stimulus interval (ISI) condition with an average of 10 sec ISI. In all participants, novels elicit higher global field power compared with standards within 100 and 200 ms, mirroring a stronger N1 following novels irrespective of the slow presentation rate. Therefore, the question is whether additional auditory processing is triggered by the novel stimuli. EEG data of 37 participants will be analyzed within different frequency bands in order to unravel potential differences in the processing of standard and novels and to identify novel-specific auditory processing.

Topic 6: Brain and Periphery, Neuroendocrinology, and Stress

P2.063 - Interoception and pain perception across the menstrual cycle in young healthy women

A. Dierolf[1], M. v. d. Meulen[1], D. Bärenz[2], V. Joachim[2], C. Junk[2], S. Kiefer[2], M. Michels[2], A. Sturgeon[2], K. Opdensteinen[3], T. Hechler[3]

[1] University of Luxembourg, Department of Cognitive Neuroscience and Behavioral Science; Research Group: Stress, Pain and Gene-Environment Interplay
[2] University of Luxembourg, FHSE
[3] Universität Trier, Abteilung Klinische Psychologie und Psychotherapie des Kindes- und Jugendalters

The menstrual cycle is accompanied by various physiological and psychological changes beyond the female reproductive system- such as the digestive system, the immune system and the cardiovascular system- as well as by psychological changes. Although women report variations in well-being, fitness levels and physical awareness, including pain perception across the menstrual cycle, near to nothing is known about the impact of the phases of the menstrual cycle on interoception and its relation to pain perception.
Changes in three dimensions of interception and pain perception were investigated across the menstrual cycle. 14 healthy young females were invited three times: during the follicular phase (menses), ovulation and the luteal phase. They performed the Schandry task to measure interoceptive accuracy (IAc) and awareness (IA, via confidence ratings) and filled out a questionnaire on interoceptive sensibility (IS). Thermal pain thresholds and pain tolerance was measured using a thermode and pain sensitivity and tolerance was determined with the cold pressor test (CPT).
For changes of IAc and heat pain thresholds (by tendency), we observed in the luteal phase the lowest IAc (eta2 =.211) and highest heat pain thresholds (eta2= .195) compared to highest IAc and lowest pain thresholds in the follicular phase. Pain tolerance (CPT) during the menses was positively correlated with IAc during all three phases (rs .69 - .73, ps < .05). In sum, our results suggest a selective impact of the menstrual cycle on interoceptive dimensions and their relation to pain perception. Future research into underlying mechanisms for this finding is warranted.

P2.064 - The impact of a tailored mindfulness-based program for resident physicians on distress, hair cortisol secretion, and the quality of care: A randomised controlled trial

J. C. Fendel[1,2], **V. M.-J. Aeschbach**[1,2], **S. Schmidt**[2], **A. S. Göritz**[1]

[1] Department of Occupational and Consumer Psychology, Institute of Psychology, University of Freiburg, Freiburg, Germany
[2] Department for Psychosomatic Medicine and Psychotherapy, Medical Faculty, Medical Centre, University of Freiburg, Freiburg, Germany

Background: Many resident physicians suffer from distress, which endangers their individual health and the quality of care.
Objective: To examine the impact of a tailored mindfulness-based program (MBP) for resident physicians on distress, hair cortisol secretion, and the quality of care.
Methods: The intervention group took part in an eight-week, tailored MBP that included a course book and that was followed by a four-month maintenance phase. The active control group received the course book for self-study. Assessments were at baseline (t0, 0 months), after the intervention (t1, 2 months), after the maintenance phase (t2, 6 months), and at follow-up (t3, 12 months). The primary outcome was change in burnout at t2. Secondary outcomes included hair cortisol secretion, perceived stress, mental distress, perceived job strain, depression, anxiety, self-reported medical errors, and third-party ratings by patients, supervisors, and colleagues.
Results: Seventy-six participants were randomised to the intervention- and seventy-one to the control group. The intervention group showed greater improvements in the primary outcome (burnout at t2, $d = 0.32$, $p = .046$), in perceived stress ($d = 0.31$, $p = .046$) and perceived job strain ($d = 0.33$, $p = .026$) at t1, and in supervisor-rated empathy ($d = 0.71$, $p = .037$) and colleague-rated attentiveness ($d = 0.85$, $p = .006$) at t2. There was no difference between groups in the other outcomes.
Conclusion: A tailored MBP for resident physicians improved burnout, might have improved other aspects of distress and the quality of care, and did not influence hair cortisol secretion.

P2.065 - Stability and Durability of Human Salivary Alpha Amylase Across Different Storing Conditions

K. Heyers[1,2], L. S. Pfeifer[1], D. Moser[1], S. Ocklenburg[3], O. T. Wolf[1]

[1] Ruhr-Universität Bochum, Deutschland
[2] Universität Osnabrück, Deutschland
[3] Medical School Hamburg, Deutschland

Introduction: Data collection in remote or field settings gains relevance and popularity in contemporary stress research. This dynamic has led to adaptations of stress induction procedures. Stress research relies on the assessment of biomarkers such as cortisol and salivary alpha amylase (sAA). Thus, their proper assessment is crucial to ensure valid and reliable data. In above-mentioned settings, however, swift freezing - which is typically recommended for saliva samples - is not guaranteed. Remote and field studies further involve the return of saliva samples to the laboratory which is occasionally organized through postal delivery. For cortisol, data indicate a certain robustness to various external conditions. In contrast, evidence is sparse for sAA.
Methods: We exposed samples from a saliva pool to (1) several cycles of freezing and thawing, (2) different temperatures over varying time periods, and (3) postal delivery. All conditions were implemented with saliva stored in (a) Salivette® sampling devices (Sarstedt) or (b) Eppendorf vials accounting for the factor of absorbent material (synthetic fiber for Salivettes®). We compared sAA concentrations between the saliva pool and treated samples.
Results: Results suggest sAA to be vulnerable to higher temperatures over longer periods of time. In contrast, sAA seems to be stable over several cycles of freezing and thawing.
Discussion: Our results have implications for the use of sAA in remote or field settings. Researchers should aim at minimizing the temporal delay with which samples are frozen and avoid transportations at higher temperatures. Researchers should further concern the collection method (passive drooling/absorbent materials).

P2.066 - Stress effects on memory retrieval of aversive and appetitive instrumental counterconditioning in men

J. Caviola[1], K. Beck[1], S. M. Drexler[1,2], O. Wolf[1], C. Merz[1]

[1] Ruhr-Universität Bochum, Deutschland
[2] St. Mauritius Therapieklinik Meerbusch, Deutschland

Extinction training creates a second inhibitory memory trace and effectively reduces conditioned responding. However, acute stress inhibits the retrieval of this extinction memory trace. It is not known whether this also applies to other forms of associative learning such as instrumental counterconditioning, where previously learned associations are reversed and paired with the opposite valence. Therefore, the current pre-registered study investigates whether stress decreases the retrieval of instrumental counterconditioning memories with aversive and appetitive consequences. Fifty-two healthy men were randomly assigned to either a stress or control group and took part in a two-day instrumental learning paradigm. During a first phase, participants learned that pressing specific buttons in response to the presentation of four neutral stimuli either leads to gaining or losing money. During a second phase, two stimuli reversed their contingencies (counterconditioning). One day later, participants were exposed to acute stress or a control condition prior to the same task, which no longer included feedback about gains or losses. Stressed participants showed more approach behavior towards appetitive and less avoidance behavior towards aversive stimuli as compared to non-stressed participants. Regarding reversed stimuli, both groups exhibited guessing behavior and did not differ between each other. Our findings indicate that stress effects on memory retrieval differ depending on the associative learning approach. These differences might be related to stress effects on decision making and different motivational systems involved.

P2.067 - The Influence of a Glucose Administration on Stress Responsivity and Memory After a Socially Evaluated Cold Pressor Test

T. Rüttgens[1], **O. T. Wolf**[1]

Ruhr-Universität Bochum, Institut für Kognitive Neurowissenschaft, Deutschland

Acute stress activates the Hypothalamus-Pituitary-Adrenal axis, leading to a release of the glucocorticoid cortisol. The availability of energy in the form of glucose has been demonstrated to influence cortisol reactivity. So far, studies investigating this relationship made use of primarily physical stressors, like the Cold Pressor Task, or primarily psychosocial stressors, like the Trier Social Stress Test. The goals of the present study were twofold: First, we investigated the influence of glucose availability on stress responsivity utilizing the Socially Evaluated Cold Pressor Test. This stress test combines physical and psychosocial elements, which allowed us to extend the existing literature. Second, because acute stress as well as glucose consumption can affect memory performance, we tested our participants' memory in long-term memory retrieval and working memory tasks. After a fasting period of at least six hours, participants (N = 72) took part either in the laboratory stressor or a non-stressful control condition. Thirty minutes prior they consumed 75g of glucose or a placebo beverage consisting of stevia-sweetened water. Glucose consumption prior to stress exposure did not influence salivary cortisol levels, blood pressure, and subjective stress ratings. While working memory was impaired by stress, glucose consumption did not moderate this effect. Long-term memory retrieval was not influenced by stress or glucose consumption. Our results suggest that the effects of a glucose administration on stress reactivity might depend primarily on the intensity of a stressor, rather than the presence of a psychosocial stress component or the participants' nutritional state.

P2.068 - Effects of Chronic Stress on Path Integration

O. Akan[1], A. Bierbrauer[2], P. D. Gajewski[3], S. Getzmann[3], J. G. Hengstler[3], E. Wascher[3], N. Axmacher[1], O. T. Wolf[1]

[1] Ruhr-Universität Bochum, Deutschland
[2] Universitätsklinikum Hamburg-Eppendorf, Deutschland
[3] TU Dortmund, Deutschland

Chronic stress impairs cognition, as shown in the context of hippocampal dependent memory. Structurally, this is accompanied by dendritic atrophy, impaired synaptic plasticity and inhibited neurogenesis, mainly affecting hippocampus and prefrontal cortex. The relationship between chronic stress and human spatial navigation is less understood. In spatially scarce environments with little information and absence of external cues, path integration plays an important role (for spatial navigation). Path integration is related to grid cell firing in the entorhinal cortex, but additional neural systems can be recruited dependent on the environment. Whereas pure path integration mainly rely on entorhinal functioning, landmark-supported or boundary-supported path integration additionally activates retrosplenial cortex, hippocampus or striatum.
Here, we investigated the association between chronic stress and path integration. We assessed chronic stress via the Perceived Stress Questionnaire (subjective) and hair cortisol concentrations (physiological) in 52 females between 22-65 years from the Dortmund Vital Study. Participants completed a virtual path integration task on a desktop computer, which included different environments. We observed associations between chronic stress and path integration dependent on error type and environment. Subjective stress, but not hair cortisol concentrations, was related to higher drop error. Further, we observed interactions involving both measures of chronic stress for the distance error. Here, higher hair cortisol concentrations potentiated the relationship between incoming distance and distance error, predominantly in environments with little spatial information and in participants reporting subjective stress. Altogether, we provide first evidence for impaired path integration, possibly due to compromised grid cell activity, in chronically stressed individuals.

P2.069 - Optimal timing of stress cortisol suppression by oral metyrapone

L. Drost[1], D. Rebeck[1], Q. Laura[1], B. Andreas[1], J. B. Finke[2], D. Gregor[1], S. Hartmut[1]

[1] Universität Trier
[2] Universität Siegen

Stressors activate the autonomic nervous system (ANS) and the hypothalamus-pituitary-adrenal (HPA) axis, the latter resulting in cortisol release. Metyrapone suppresses cortisol synthesis by reversible blockade of adrenal 11-beta-hydroxylase. In psychobiological research this adrenocorticostatic agent is used to disentangle ANS and HPA stress effects. However, the optimal timing between oral metyrapone intake and start of stress induction has never been established. Therefore, 53 young healthy males were randomly assigned to one of five experimental groups, receiving either placebo or 750mg oral metyrapone 60, 45, or 30 minutes prior to a bilateral-feet «Cold Pressor Test» (CPT), or undergoing a warm-water protocol. In all groups, the intervention was combined with a mental arithmetic task («Paced Auditory Serial Addition Task», PASAT). Saliva samples (for cortisol measurement) were collected at 10-min intervals before and after stress onset. Heart rate and blood pressure were assessed continuously (Finometer MIDI System). Metyrapone significantly reduced stress-induced salivary cortisol responses as a linear function of latency of drug intake to stress onset, causing the greatest suppression of stress-related cortisol when stress started 30 min after drug intake. Heart rate and blood pressure were unaffected by metyrapone. This data will guide future experiments in timing metyrapone intake with respect to stress onset.

P2.070 - Movement during the Trier Social Stress Test

B. Denk[1,2], U. U. Bentele[1], S. J. Dimitroff[1], M. Meier[1], A. B. E. Benz[1], R. Gärtner[1], E. Unternaehrer[1,3], J. C. Pruessner[1,2]

[1] Department of Psychology, University of Konstanz, Germany
[2] Centre for the Advanced Study of Collective Behaviour, University of Konstanz, Germany
[3] Child and Adolescent Research Department, Psychiatric University Hospitals Basel (UPK), University of Basel, Switzerland

During the Trier Social Stress Test (TSST) participants are instructed to stand in one place while giving a mock job interview and completing a mental arithmetic task. However, participants nevertheless show some movement, e.g. shifting their weight from one leg to the other. Here, we want to test a novel approach of quantifying these movement patterns. For this, we explore data from a study during which participants (N=86, all female) underwent the TSST with instructions to either positively reappraise their experience during the task (reappraisal condition) or focus on sensory input (control condition). N=30 participants had experiences of early life adversity (ELA). We used videos from the TSST to investigate movement during stress. A pose estimator algorithm was employed to infer body coordinates of each person over time. We used wavelet transform to estimate the power of movement across time and frequencies. Using a linear model, we detected significantly more movement during the interview part of the TSST than during the mental arithmetic task. This increased movement may be due to the arithmetic part demanding more focus, translating into less body movement. While there were no differences between persons with high vs low ELA in the control condition, in the reappraisal condition persons with high ELA showed stronger movement in the second part. These results highlight how movement may be a meaningful physiological signal related to stress and inter-individual differences. We hope to gain valuable insights in the experience of stress by further exploring inter-individual differences in movement patterns.

P2.071 - A pooled mega-analysis on the modulating effect of transcutaneous auricular vagus nerve stimulation (taVNS) on salivary alpha-amylase as indirect noradrenergic marker

M. Giraudier[1], C. Ventura-Bort[1], A. M. Burger[2], N. Claes[2], M. D'Agostini[2], R. Fischer[3], M. Franssen[2], M. Kaess[4,5], J. Koenig[6], R. Liepelt[7], S. Nieuwenhuis[8,9], A. Sommer[7,10,11], T. Usichenko[12,13], I. V. Diest[2], A. v. Leupoldt[2], C. M. Warren[14], M. Weymar[1,15]

[1] Department of Biological Psychology and Affective Science, Faculty of Human Sciences, University of Potsdam, Potsdam, Germany
[2] Research Group Health Psychology, KU Leuven, Leuven, Belgium
[3] Department of Psychology, University of Greifswald, Greifswald, Germany
[4] University Hospital of Child and Adolescent Psychiatry and Psychotherapy, University of Bern, Bern, Switzerland
[5] Department of Child and Adolescent Psychiatry, Centre for Psychosocial Medicine, University of Heidelberg, Heidelberg, Germany
[6] University of Cologne, Faculty of Medicine and University Hospital Cologne, Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Cologne, Germany
[7] Department of General Psychology: Judgment, Decision Making, Action, Faculty of Psychology, University of Hagen (FernUniversität in Hagen), Hagen, Germany
[8] Institute of Psychology, Leiden University, Netherlands
[9] Leiden Institute for Brain and Cognition, Leiden University, Netherlands
[10] The German Research Centre of Elite Sport, German Sport University Cologne, Cologne, Germany
[11] Department of Molecular and Cellular Sport Medicine, Institute of Cardiology and Sport Medicine, German Sport University Cologne, Cologne, Germany
[12] Department of Anesthesiology, University Medicine of Greifswald, Greifswald, Germany
[13] Department of Anesthesia, McMaster University, Hamilton, Canada
[14] Emma Eccles Jones College of Education and Human Services, Utah State University, United States
[15] Faculty of Health Sciences Brandenburg, University of Potsdam, Potsdam, Germany

Previous work has suggested a modulatory role of non-invasive transcutaneous auricular vagus nerve stimulation (taVNS) on cognitive and affective functions, which likely exerts its effects via activation of the locus coeruleus-noradrenaline (LC-NA) system. Reliable effects of taVNS on markers of LC-NA system activity, however, have not been demonstrated yet. The present study, therefore, aimed to shed light on this recent inconsistency by pooling raw data from a large sample of 10 taVNS studies (N=371) that collected sAA levels as potential marker of central NA release. We conducted linear mixed model analyses with log-transformed sAA data as predicted variable and explored a variety of modeling approaches. Results showed that afferent stimulation of the vagus nerve via taVNS increased sAA levels over time compared to sham stimulation, which supports the assumption that taVNS triggers NA release. When considering potential confounders of sAA, we further replicated previous findings on the diurnal trajectory of sAA activity with lower levels in the morning and an increase during the course of the day. This work points toward the potential value of sAA as a non-invasive, inexpensive and rather sensitive indirect marker of NA

system activation in the context of taVNS research. Moreover, our results highlight the benefits of data pooling and data sharing in research to draw stronger conclusions.

P2.072 - Elimination of salivary cortisol in female and male volunteers

H. Schächinger[1], **J. Finke**[2], **M. Larra**[3], **L. Drost**[1], **T. Schilling**[1], **J. Turner**[4]

[1] Universität Trier, Deutschland
[2] Universität Siegen, Deutschland
[3] Ifado Dortmund, Deutschland
[4] Luxembourg Institute of Health

Sampling for salivary cortisol assessment is standard practice in psychobiological stress research. Yet, little is known about crucial kinetic control parameters of cortisol time course in saliva, e.g. elimination constant (ke) and half-life (t50%). Eight female (body weight 60 +/- 5 kg) and eight male (79 +/- 3 kg) student volunteers received 3 mg of hydrocortisone (=cortisol) intravenously (IV) by 60 s bolus infusion. Salivary cortisol was assessed 15, 30, 45, 60, and 90 minutes thereafter. t50% of salivary cortisol was calculated from ke, which was determined according to a single compartment pharmacokinetic model by individual linear regression of salivary cortisol and post-infusion time in a semi-log space. Quality of regression fit (R-squared) was similar in females (0.96 +/- 0.01) and males (0.95 +/- 0.02). Salivary cortisol increased from pre-infusion baseline to 15 min post-infusion (females: 7.7 +/- 1.9 to 16.8 +/- 4; males: 3.7 +/- 0.5 to 8.7 +/- 1.1 nM/l). t50% of salivary cortisol in females was 51.2 minutes (coeff. vari. = 28%), and 50.1 (CV=9.5%) in males. After low-dose IV infusion of hydrocortisone, the mean terminal elimination of salivary cortisol is similar in females and males, but variability is greater in females.

P2.073 - Stability of Steroids in Hair Samples and Methodological Recommendations for Psychoendocrine Research

J. Eder[1], M. K. Wekenborg[1], A. Walther[1,2], N. Rothe[1], M. Penz[3], W. Gao[1], C. Kirschbaum[1]

[1] Biopsychology, TU Dresden, Dresden, Germany
[2] 2Clinical Psychology and Psychotherapy, University of Zurich, Zurich, Switzerland
[3] Institute for Education and Psychology, Johannes Kepler University Linz, Linz, Austria

The biochemical analysis of hair steroids is a method to assess long-term secretion of steroid hormones (i.e. cortisol, cortisone, dehydroepiandrosterone, progesterone, or testosterone) in psychoendocrine research. Goal of this study was to examine the longitudinal stability of the assessed hormone concentrations over several years. In addition, we investigated whether the intra-individual stability would vary as a function of batches or storage effects.
The study was based on hair steroid levels from five annual examination waves (Dresden Burnout Study; N=796) measured by LC-MS/MS. In order to examine the stability of the revealed hormone concentrations, spearman and intraclass correlations (ICCs) were performed for five and three waves respectively. Batch and storage effects on stability were examined using re-analysed samples (N=128) stored for 1-3 years. Hormone levels were z-standardized to enhance the comparability between batches and waves. To disentangle individual differences between and within the datasets, paired t-tests and ANOVAs with repeated measurements were computed for log-transformed and z-standardized data.
We found moderate to strong re-test correlations for cortisol/cortisone and moderate correlations for sex hormones, which are stable over time. Moreover, moderate ICCs for single and good ICCs for average cortisol/cortisone concentrations and poor ICCs for single and moderate ICCs for average sex hormones were observed. Almost all steroids differed significantly between and within the two datasets, which vanished after z-standardization.
We demonstrate that hormone concentrations measured in hair samples are moderately stable in a population-based sample. However, data should be z-transformed when performing intra-individual longitudinal analyses to avoid batch or storage effects.

P2.074 - Einfluss von Stress und Kortisolrezeptoren auf Entscheidungsprozesse

C. E. Deuter[1], **K. Wingenfeld**[1], **C. Otte**[1]

Charité Universitätsmedizin Berlin, Deutschland

In bisherigen Studien konnte aufgezeigt werden, dass akuter Stress die Bereitschaft erhöht, Risiken einzugehen. Diese erhöhte Risikobereitschaft zeigt sich jedoch nicht durchgängig und ist unter anderem auch vom Zeitabstand zwischen Stressor und Testung abhängig. Dies wirft die Frage nach vermittelnden physiologisch-endokrinen Mechanismen auf. Vorherige Arbeiten legen eine Beteiligung von HHNA-Achse und Kortisol an diesen Zusammenhängen nahe.
Die vorliegende Studie diente der Untersuchung des Einflusses von stressbedingter Kortisolausschüttung auf Risikobereitschaft sowie der spezifischen Vermittlung über die zwei bekannten Kortisolrezeptoren im ZNS: den Glukokortikoidrezeptor (GR) und den Mineralokortikoidrezeptor (MR). Hierzu wurden bei männlichen Probanden (N=318, between subjects) der MR oder der GR pharmakologisch blockiert bzw. Placebo verabreicht. Mit einem Zeitabstand von 90 min wurden die Probanden einem Trier Social Stress Test (TSST) bzw. Placebo-TSST unterzogen, 45 min nach Stressinduktion absolvierten die Probanden eine Entscheidungsaufgabe zur Erfassung von Risikobereitschaft (Iowa Gambling Task).
Es zeigte sich eine höhere Risikobereitschaft nach Stress (TSST vs. Placebo-TSST), jedoch kein Einfluss der pharmakologischen Blockade eines der beiden Kortisolrezeptoren.
Zusammenfassend lässt sich aus unserer Studie schussfolgern, dass Stress einen Einfluss auf Entscheidungsprozesse hat, dies jedoch nicht oder zumindest nicht ausschließlich über Kortisol vermittelt ist.

P2.075 - Stress effects on top-down vs. bottom-up control of attention

M. Larra[1], **L. v. Haugwitz**[1], **E. Wascher**[1]

IfADo, Dortmund

Stress is assumed to increase activity within the salience network but to inhibit prefrontal structures supporting executive functions. Therefore, it has been proposed 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 cold-pressor-test 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 the opposite screen position. Moreover, the target position in each trial was either predicted by a symbolic cue or was not known in advance. Stimulus-evoked potentials in the EEG were 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. Posterior 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.

P2.076 - Evaluation of a short respiration focused training to help others during stress

P. Gras[1,3], E. S. Schädler[1,3], D. L. Garcia[1], P. Kirsch[1], R. Kriz[2], V. Zamoscik[1]

[1] Zentralinstitut für Seelische Gesundheit, Deutschland
[2] FH Krems, Österreich
[3] haben gleichermaßen beigetragen

Respiration is associated to emotional experiences like anxiety and stress and linked to well-being. Training programs that include a short focus on respiration seem to be helpful and related to changes in respiration pattern variability (RPV) during stressful situations.
We developed a respiration focused training, the deliberate breathing training (Bewusstes Atem-Training, BAT) addressing several aspects of RPV to help trainees to better cope with negative emotions in challenging situations. Two versions of this training exist: an 8-week version that we apply to depressed patients with and without anxiety or post-traumatic stress disorder, and a 3-week training for healthy individuals (peers) who like to help stressed friends or colleagues. Here we report on the peer training which takes at least 10h and uses mainly two breathing techniques: passive expiration and rescue breath. Currently, we implement this training in 7 small groups out of which the first one with 6 peers completed it so far and probably 40 in May.
Peers fill in questionnaires about mood, anxiety, stress and bodily symptoms, as well as their intention to help others before and after the training and at a three weeks follow-up. Furthermore, peers use a training app, which records training time and questions about mood and anxiety in an ambulatory assessment. People who were in stress are also requested to answer few questions online how they experienced the help offered by peers. We expect positive effects e.g. on stress for the peers as well as for people who were guided by the peers.

Topic 7: Social and Environmental Neuroscience

P2.077 - Developing an Autonomous Driving Paradigm for Electrophysiological experiments

M. Weil[1], **L. Weber**[2], **C. Herrmann**[1]

[1] Carl von Ossietzky Universität Oldenburg, Deutschland
[2] OFFIS – Institut für Informatik

Due to recent technological advances in the automotive industry, autonomous vehicles (AVs) are getting closer to road use. However, for AVs to be used they need to behave in a socially acceptable fashion and hence it is desirable to assess whether they are perceived as such. In perspective, we want to explore whether (peripheral) physiological measurements contain useful unobtrusive markers for potential future AVs to adapt their behavior to be perceived as acceptable. To achieve this, we developed a paradigm that manipulates social acceptance of AVs. Participants are seated in a highly immersive driving simulator environment in which an automation repeatedly takes left turns through upcoming traffic at an acceptable or unacceptable pace. The acceptable automation performs the left turn at the first appropriate gap in the upcoming traffic, whereas the unacceptable automation leaves out appropriate gaps, which produces unnecessarily long waiting times. The latter is consistent with frequent erratic behaviors from current AV prototypes. In contrast to other simulations on erratic AV behavior, our left turn paradigm is especially suited for physiological experiments as it allows for frequent repetition without becoming implausible. During our driving simulator paradigm, physiological signals (EEG, pulse oximetry, galvanic skin response, and respiration) as well as the trial wise acceptance of the individual driving maneuvers are collected. First behavioral pilot data descriptively suggests that our paradigm successfully manipulates social acceptance. We describe the measures that had to be taken to record electrophysiology in the driving simulator. Visual event-related potentials demonstrate that we were successful.

P2.078 - Another's pain vs. my gain: Evidence of absence for a causal role of the dorsolateral prefrontal cortex in costly decision-making

H. Hartmann[1,2], L. Lengersdorff[2], R. Paracampo[1], C. Lamm[2], C. Keysers[1], G. Valeria[1]

[1] Social Brain Laboratory, Netherlands Institute for Neuroscience, Royal Academy of Arts and Sciences, Amsterdam, Netherlands
[2] Social, Cognitive and Affective Neuroscience (SCAN) Unit, Institut für Psychologie der Kognition, Emotion und Methoden, Fakultät für Psychologie, Universität Wien, Wien, Österreich

Empathy and harm avoidance for conspecifics are considered important for human social behavior and significant factors in moral decision-making. How the brain implements these functions and how they flow into decisions remains incompletely understood. The dorsolateral prefrontal cortex (dlPFC) has been implicated in such moral decisions, specifically regarding cognitive control and weighing of costs and benefits. With previous studies finding the dlPFC to either promote or suppress prosociality, causal evidence on its specific contribution is needed. We stimulated the dlPFC in 33 individuals using 6Hz repetitive transcranial magnetic stimulation while they made binary choices between receiving 0.50 EUR and delivering a low-intensity shock to a second participant vs. receiving more money and delivering a high-intensity shock to that person. To operationalize prosociality and choice behavior, we measured 1) the indifference point (IDP), i.e. the amount of money for which people chose both options equally, and 2) the slope, i.e. how sharply variations in money alter the decision, and compared them to a condition of sham vertex stimulation. An independent validation study (n = 22) showed a high correlation when measuring the IDP and slope twice (Spearman rho's > 0.7), showing the reliability of the measurement. In the TMS study, we observed no significant differences between the TMS conditions (p's > .324) and report moderate evidence for the null hypothesis using Bayesian analyses (BF01: IDPs = 3.44; slopes = 4.97). These results point to the conclusion that perturbing the dlPFC with our particular protocol does not alter such conflicting moral decisions.

P2.079 - Does personal significance impact social modulation?: An EEG Study of Early Auditory Components in Joint Action

G. A. L. Montoya[1], **P. Baess**[1]

Hildesheim University, Germany

When two participants perform a Go/NoGo task together, one's own and partner's actions have to be precisely turned to one another. In these kinds of task, stimuli are arbitrary associated with the different co-actors, for example through assigning one particular stimulus color to each co-actor. Both participants carry out this Go/NoGo task together (joint condition) or alone (individual condition). Previous research (Baess & Prinz, 2015) showed an N1 modulation for action-associated stimuli depending on the social contexts. The present EEG experiment assigned different auditory stimuli to each participant. Across two separate sessions, the participants received either arbitrary tones (i.e. sinus tones) or personal significant tones (i.e. message tone of one's own mobile phone). In both cases, one tone was mapped with one's own response (Go-trial), whereas two other tones, i.e. partner-associated tone and a neutral tone, did not require a response (NoGo-trials). The research question was two-folded: i) whether similar early top-down influences of social setting could be obtained in the auditory domain; and ii) whether the personal significance of the stimulus material modulates the early auditory responses further. In this way, it is discussed the significant differences presented in the ERP's reponses and their impact in co-representation, as well as, their early effect realted to personal significance.

P2.080 - My Brain knows Me: Neural Oscillatory Markers for the Self-Prioritization Effect

C. Haciahmet[1], **M. Golubickis**[2], **S. Schäfer**[3], **B. Pastötter**[1]

[1] Universität Trier, Deutschland
[2] University of Plymouth, United Kingdom
[3] Psychologisches Forum Münster, Deutschland

Self-relevance is one of the most influential modulators of human attention, episodic memory, and information processing, although only little is known about the neural basis of the self-attention network in EEG oscillations. Exploring the time course, topography, and frequency bands of self-referential processing is of particular interest for the current investigation. The perceptual matching task by Sui et al. (2012) associates arbitrary geometric shapes with the self or with a stranger label, thereby avoiding confounds with the familiarity of the own name or face. In behavioural data (N = 40), we replicated a robust self-prioritization effect (SPE) in reaction times, as well as in accuracy rates, with the result that self-matching trials evoked a faster and more accurate response than stranger-matching trials. In EEG cluster analysis, two significant effects related to the SPE appeared in theta power (4-8 Hz) and beta power (13-30 Hz) over parietal, midfrontal and occipital sites, respectively. Intriguingly, the direction of the SPE effects reversed in stimulus-locked compared to response-locked analysis: First, shortly after stimulus onset, self-matching trials lead to a theta and beta power increase. Second, right before response onset, self-matching trials lead to a theta and beta power decrease. Implications for ERP components such as the self-referential P300 are discussed in light of our findings.

P2.081 - Measuring the effect of familiarity on state anxiety and related changes in heart rate (HR) and heart rate variability (HRV) in everyday life

M. Gründahl[1], M. Weiß[1], J. Deckert[1], G. Hein[1]

Center for Mental Health, Department of Psychiatry, Psychosomatics and Psychotherapy, Translational Social Neuroscience Unit, University of Würzburg, Würzburg, Germany

Social interactions affect our physical and mental well-being and functioning. There is evidence that social interaction effects are altered by the familiarity of the interaction partner. One group of studies showed a decrease in anxiety and related autonomic responses with increasing familiarity. Others reported a larger reduction of anxiety in the presence of an unfamiliar compared to a familiar interaction partner. Taken together, the results are inconsistent and mainly derived from laboratory studies. Here, we investigated the effect of social familiarity on state social anxiety and related changes in heart rate (HR) and heart rate variability (HRV) in everyday life using Ecological Momentary Assessment.

On five consecutive days, healthy participants (aged 18-35) continuously wore a portable electrocardiogram (ECG) sensor and answered six randomly timed, smartphone-based surveys a day. The questions targeted aspects of their latest social interaction, including indices of social anxiety and the interaction partner's familiarity and gender. Control variables (e.g., movement) were also assessed.

Preliminary results (N = 80, 65% women) show higher HR and lower HRV in female vs male participants. State social anxiety correlated positively with HR and negatively with HRV, unaffected by gender. Higher familiarity was related to higher HRV and lower anxiety. In women, interaction partner familiarity increased HRV and decreased HR. In men, however, higher familiarity decreased HRV while not effecting HR. We conclude that more familiar interaction partners may reduce physiological reactivity in women, but not men. The stability of these effect will be explored in a sample with an equal gender distribution.

P2.082 - Hohe Reliabilität der Gehirnaktivierung in einer monetären und einer sozialen Risiko-Aufgabe

S. N. L. Schmidt[1], **A. Wolber**[1], **B. Rockstroh**[1], **D. Mier**[1]

Klinische Psychologie, Universität Konstanz

Personen unterscheiden sich in ihrer Bereitschaft zu riskantem Verhalten, etwa Wetten einzugehen, oder fremden Personen zu vertrauen. Um neuronale Korrelate von Risikoverhalten zuverlässig zu identifizieren, bedarf es geeigneter Paradigmen, die die verschiedenen Prozesse des Risikoverhaltens differenzieren können.
In einer präregistrierten fMRT-Pilotstudie (https://osf.io/b6uf5) mit 29 gesunden Freiwilligen haben wir die Gehirnaktivierung bei zwei Risikoaufgaben untersucht. Um (A) sozial-kognitives Risikoverhalten zu erfassen, schätzten die Versuchspersonen die Vertrauenswürdigkeit von unbekannten Personen ein. (B) Monetäres Risikoverhalten wurde in der BART (Balloon Analogue Risk Task) erhoben, wobei 3 Phasen experimentell getrennt wurden: Entscheidung (Decision), Gewinnerwartung (Antizipation), Rückmeldung (Feedback). Zur Reliabilitätsprüfung, wurden die Messungen nach ca. 4 Wochen wiederholt.
(A) Beim Anblick vertrauenswürdiger verglichen mit unvertrauenswürdigen Personen zeigt sich verstärkte Aktivierung in superiorem temporalen und orbitofrontalen Kortex. Sowohl auf Ganzkopf-Ebene als auch in frontalen ROIs ergibt sich gute bis sehr gute Reliabilität.
(B) Im BART zeigt sich in allen 3 Phasen Aktivierung in Nucleus Accumbens, Insula und anteriorem Cingulären Kortex. Die Aktivierung im Nucleus Accumbens ist während der Entscheidungsphase am stärksten. Die Intra-Klassen-Korrelation zeigt auf Gruppenebene für die Entscheidungsphase sehr gute Reliabilitäten - in den Regions of Interest (ROI) des Salienznetzwerks, und auch in den Ganzkopfanalysen. Für die Ganzkopf-Analyse erweist sich die Reliabilität in Erwartungs- und Rückmeldungsphasen ebenfalls als hoch.
Die Ergebnisse bestätigen die zentrale Rolle des Salienznetzwerkes bei Risikoverhalten. Zudem weisen sie auf eine aufgabenanhängige Modulierung der Aktivierung im Salienznetzwerk und weiterer frontaler Regionen hin. ROIs mit hoher Test-Retest-Reliabilität eignen sich für Längsschnittstudien zur Erfassung von riskantem Verhalten.

P2.083 - Event-related brain potentials of preparing and giving an untruthful response

H. Gibbons[1], **J. Schmuck**[1], **V. Shivani**[1], **H. Kirsten**[1], **R. Schnuerch**[1]

University of Bonn

Thirty-four participants correctly/incorrectly categorized repeatedly shown words denoting furniture or clothing, based on randomly presented cues calling for a truthful (80% of trials) or untruthful response (20%). This extends our previous work (Gibbons et al., 2018, Psychophysiology), in which one fixed word per category had to be responded to untruthfully whenever it appeared. Compared to this fixed design, the present task puts greater demands on spontaneous attentional control. Insofar, it models central aspects of lying in daily life, where a lie is often cued by a critical question, whereas other questions can be answered truthfully. We employed a rather long interval of 2 sec between a visual cue (color change of the fixation cross) and the word to be categorized. This served to monitor the mental processes involved in both the processing of the cue and the subsequent preparation of a truthful vs. untruthful response. 64-channel EEG was recorded. Compared to truthful cues, untruthful cues elicited strong increases of fronto-central P3a, parietal P3b, and word-preceding contingent negative variation (CNV). Words incorrectly categorized as per the instruction showed greater parietal N400 and fronto-central positive slow wave, compared to correctly categorized words. As effects of truthfulness on cue ERPs were extremely robust, with every single participant showing a P3b effect of 1.4 μV or greater, these findings offer a novel approach to lie detection. Future diagnostic tools might be based on brain processes accompanying the processing of deception cues and the preparation to lie, rather than, or in addition to, lying itself.

P2.084 - Electrophysiological correlates of social feedback processing in healthy and depressive individuals

S. Scholz[1], **S. Schindler**[1,2], **J. Kissler**[1]

[1] Universität Bielefeld, Deutschland
[2] Universtität Münster, Deutschland

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. During feedback processing, EEG activity was measured using 128 electrodes. 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 and earlier enhancements in the components, representing a specific alteration in social feedback processing in depression, that might reflect social feedback sensibility in depression.

P2.085 - Using EEG to measure shared audience engagement during real-life videos against distraction in road traffic

M. Imhof[1], **R. Schmälzle**[2], **B. Renner**[1], **H. Schupp**[1]

[1] Universität Konstanz, Deutschland
[2] Michigan State University, USA

Mass media health messages are a key strategy against risky health behaviors, such as, distracted driving or risky alcohol use. However, messages often vary in their ability to engage viewers and prompt elaborate processing. The inter-subject correlation (ISC) offers a neural measure of viewer engagement during message reception. Here, we expand on own EEG- & fMRI-ISC work and test relations between message effectiveness and EEG-ISC. Thirty-two participants viewed video messages against distraction in road traffic. The messages were comprehensively characterized in an online study (N = 29) in terms of message effectiveness. The perceived effectiveness ratings were confirmed in the EEG sample ($r = .97$, $p < 0.001$). Brain responses were recorded using 256-ch EEG and submitted to ISC analysis to obtain maximally correlated components. Additionally, we captured the participants' behavior in traffic and their risk perceptions towards distraction in road traffic prior to, and after video presentation, as well as in a one month follow up questionnaire. Based on their risk perception and behavior, participants were separated in homogenous groups. For each group, EEG-ISC was extracted for each video, and we assessed relations between message effectiveness and the brain responses captured by distinct correlated EEG components. The identified correlated components align with earlier work 2-4 and show how video health messages engage the brains of an audience. The EEG-ISC may offer an unobtrusive and temporally sensitive neural marker to track the grip of a message over time within an audience.

Topic 8: Development and Ageing

P2.086 - Multimodal prediction of cognitive performance differences in older age

C. Krämer[1,2], J. Stumme[1,2], L. da Costa Campos[1,2], C. Rubbert[3], J. Caspers[3], S. Caspers[1,2,4], C. Jockwitz[1,2,4]

[1] Institute of Neuroscience and Medicine (INM-1), Research Centre Jülich, Jülich, Germany
[2] Institute for Anatomy I, Medical Faculty & University Hospital Düsseldorf, Heinrich Heine University, Düsseldorf, Germany
[3] Department of Diagnostic and Interventional Radiology, Medical Faculty & University Hospital Düsseldorf, Heinrich Heine University, Düsseldorf, Germany
[4] These authors contributed equally.

Differences in brain structure and network (NW) architecture are supposed to partly explain cognitive performance differences during older ages and potentially serve as markers for healthy cognitive aging. Initial unimodal studies, however, reported mixed results in the prediction of cognitive performance based on these brain features using machine learning (ML). The current study investigated whether multimodal information, i.e. regionwise grey matter volume (GMV), resting-state functional connectivity (RSFC) and structural connectivity (SC) derived graph metrics, may improve predictability of global and domain-specific cognitive performance in 594 older adults between 55 and 85 years (from 1000BRAINS) using ML. Thereby, five commonly used regression algorithms were evaluated using cross-validation, with brain measures (GMV, RSFC- and SC-derived graph metrics) as features and cognitive scores (derived from Principal Component Analysis from 14 cognitive tests) as targets. The prediction potential was examined for each modality and all multimodal combinations, with and without confound (age, education and sex) regression. Prediction performance differed considerably between deconfounding strategies. In the no confounder condition, RSFC-derived graph metrics led to the lowest prediction performance, while the combination of different modalities improved predictability of cognitive performance. Importantly, the effects vanished in the strict confounder control condition. Multimodal ML models were found to predict cognitive performance in an older cohort in absence of confounder control, in line with studies examining younger adults. After confound adjustment, however, satisfactory ML performance was no longer observed. The results emphasize potential benefits of multimodal information integration, while highlighting the challenges in developing a biomarker for cognitive aging.

P2.087 - Interrelating differences of structural and functional connectivity in the older adult's brain

J. Stumme[1,2], **C. Krämer**[1,2], **J. Schreiber**[2], **S. Caspers**[1,2,3], **C. Jockwitz**[1,2]

[1] Institute for Anatomy I, Medical Faculty & University Hospital Düsseldorf, Heinrich Heine University Düsseldorf, Düsseldorf, Germany
[2] Institute of Neuroscience and Medicine (INM-1), Research Centre Jülich, Jülich, Germany
[3] JARA-BRAIN, Jülich-Aachen Research Alliance, Jülich, Germany

In the normal aging process, the functional connectome restructures and shows a shift from more segregated to more integrated brain networks, which manifests itself in highly different cognitive performance in older adults [1,2]. Underpinnings of this reorganization are not fully understood, but may be related to age-related differences in structural connectivity [3]. The structure-function relationship might be a promising factor to understand the neurobiological sources of interindividual cognitive variability, but remain unclear in older adults. To address this issue, we used diffusion weighted, resting-state functional magnetic resonance imaging and cognitive performance data of 573 older subjects from the 1000BRAINS cohort (55-85 years, 287 males [4]) and performed a partial least square regression on 400 regional functional and structural connectivity (FC and SC) estimates comprising seven resting-state networks [5]. Aim was to assessed region-wise FC and SC differences that are jointly age-characteristic and further, related to cognitive performance. Results revealed three different aging profiles to be prevalent in older adults. Thereby, FC was found to behave differently depending on the severity of age-related SC deteriorations. A functional overactivation, i.e. highly interconnected system, was particularly present as the underlying SC showed only minor age-related decreases. Because this connectivity profile was associated with the most severe age-related cognitive decline, a more interconnected FC system in older adults' points at a process of dedifferentiation [6]. Hence, the increasing integration of functional networks in older adults appears to be particularly related to SC decline, which however does not have a positive effect on cognitive performance.

P2.088 - Lifestyle-related differences in neurite morphology of white matter tracts in older adults

N. Bittner[1,2], **M. Agan**[1,2], **C. Jockwitz**[1,2], **S. Moebus**[3], **S. Caspers**[1,2]

[1] Institute for Anatomy I, Medical Faculty & University Hospital Düsseldorf, Heinrich-Heine-University, Düsseldorf
[2] Institute of Neuroscience and Medicine (INM-1), Research Centre Juelich, Juelich, Germany
[3] Institute of Urban Public Health, University of Duisburg-Essen, 45122 Essen

Maintaining a healthy lifestyle seems be one way to preserve cognitive functioning up to old ages potentially through preservation of fiber tracts. Here, a healthier lifestyle, e.g. less smoking and higher physical activity, has been associated to higher tract integrity, i.e. higher fractional anisotropy (FA) and lower mean diffusivity (MD). However, these differences in FA and MD are not attributable to specific biological mechanisms. Therefore, the present study aimed to disentangle biological contributors to preservation of fiber tracts in older adults by employing more complex diffusion models, i.e. Neurite Orientation Dispersion and Density Imaging (NODDI).
Smoking, social integration, alcohol consumption and physical activity were measured within 591 participants (273 females, mean age 67 years) from the population-based 1000BRAINS cohort and additionally summed up into one lifestyle risk score. General linear models were used to test associations between these lifestyle factors and FA and MD, as well as neurite density and neurite angular variation, measured with NODDI.
A generally healthier lifestyle was associated to higher FA and higher social integration was related to lower MD. Importantly, differences in neurite morphology were only found in association to physical activity: Here, with higher physical activity overlapping patterns of higher neurite density and lower angular variation, hinting at more coherently organized axons, were observed in almost all large-scale fiber tracts, which may be favorable for transmission capacities. Therefore, NODDI can contribute to a deeper biological understanding of why favorable lifestyle behavior may be beneficial for white matter tracts and hence also cognitive performance.

P2.089 - Lifespan trajectory of oscillatory power and phase-based connectivity

C. Stier[1,2], **C. Braun**[2,3,4], **N. K. Focke**[1,2]

[1] Clinic of Neurology, University Medical Center Göttingen, Göttingen, Germany
[2] Department of Neurology and Epileptology, Hertie Institute for Clinical Brain Research, University of Tübingen, Tübingen, Germany
[3] MEG-Center, University of Tübingen, Tübingen, Germany
[4] CIMeC, Center for Mind/Brain Sciences, University of Trento, Rovereto, Italy

Little is known about how rapid brain oscillations alter from adulthood into old age. Oscillatory power and phase synchronization map neuronal dynamics at different temporal scales and are widely studied for the description of the healthy or diseased brain.
To study linear and quadratic effects of age on power and phase-based connectivity in six frequency bands (~2-40 Hz), we examined a sex-balanced group of 350 individuals aged 18 to 88 years using magnetoencephalography during resting-state and with eyes-closed. The data was obtained from the Cambridge Centre for Aging and Neuroscience.
Significant linear age effects on connectivity showed either a positive association in theta and gamma frequencies or a negative association in alpha and beta, respectively, for posterior brain areas. In the beta bands, an inverted U-shaped model was significant for connectivity in frontotemporal and central regions. Significant linear age effects on power showed a decrease in the delta band in the cingulate and a gradual increase with higher frequencies emphasized in insular and central regions. The quadratic models for power were significant for a U-shaped course in frontal delta and an inverted U-shaped relationship in higher beta and gamma encompassing cingulate and central areas. The lifespan trajectory differed between the sexes for delta power and connectivity, and theta connectivity.
We demonstrate linear and nonlinear changes of electrophysiological markers with age and show frequency-specific patterns for lower- and higher-order brain areas. Thus, our study can form a basis for further neurocognitive and clinical studies using electrophysiology.

P2.090 - The Role of Maternal Mental Health on the Development of Infant's Self-Regulation: A prospective longitudinal Study

C. E. Schwarze[1], **S. v. d. Heiden**[1], **S. Wallwiener**[2], **S. Pauen**[1]

[1] Universität Heidelberg, Deutschland
[2] Universitätsfrauenklinik Heidelberg, Deutschland

Maternal perinatal strain impacts infant behavior and self-regulation, including crying-, sleeping-, and feeding problems.
Self-regulation is a fundamental precondition for mental and physical health later in life as well as overall life success, whereas dysfunctional self-regulation often results in behavioral problems, poor performance at school, social rejection or mental disorders.
Since evidence on specific perinatal risk factors for maladaptive self-regulation development is scarce, the role of pre- and postnatal maternal mental health should be assessed before and after birth in a longitudinal design.
This prospective longitudinal study investigates the effects of maternal symptoms of depression and anxiety on infants' self-regulation development in N=225 mother-infant dyads. Maternal psychopathological symptoms were assessed via online questionnaires (EPDS, STAI, PRAQ) at 5 prenatal and 3 postnatal time-points. Infant's self-regulation (crying, feeding, sleeping; SFS) was tested at 3 and 6 months postpartum.
Prenatal maternal symptoms of depression were associated with infant feeding problems ($p<.001$) whereas prenatal maternal anxiety and pregnancy-related worries predicted all aspects of self-regulatory problems ($p<.05$). Even when controlling for postnatal psychopathological symptoms, prenatal maternal mental health problems remained significant predictors of infant feeding problems ($p<.05$) whereas infant crying and sleeping problems were predicted by postnatal maternal anxiety only ($p<.001$).
Our results suggest that the prenatal and early postnatal environment plays a substantial role in the development of infant self-regulation in the first months of life; potentially mediated by biological mechanisms such as HPA axis programming and epigenetic modifications. Maternal psychopathology may impact this association even on a subclinical level which underlines the importance of early prevention and intervention for young mothers/families during pregnancy and postpartum.

P2.091 - Distraction from Pain in Aging – the Impact of Acute Stress

A. Dierolf[1], M. v. d. Meulen[1], A. Schulz[2], C. Vögele[2], W. Miltner[3]

[1] Universität Luxemburg; Department of Behavioural and Cognitive Sciences; Institute for Health and Behaviour; Stress, Pain, and Gene-Environment Interplay
[2] Universität Luxemburg; Department of Behavioural and Cognitive Sciences; Institute for Health and Behaviour; Self-Regulation and Health
[3] Friedrich-Schiller-Universität Jena, Klinische Psychologie

While older people report acute and chronic pain more often than younger people, and, therefore, would benefit significantly from non-pharmacological pain treatment, little is known about how age affects psychological strategies of pain modulation. Distraction from pain by cognitive engagement, an efficient pain modulation strategy, relies on the prefrontal cortex (PFC). The PFC, however, is an area affected by age-related cognitive decline, which might lead to reduced pain relief through distraction in older adults. Acute stress, a common concomitant phenomenon of pain, might additionally reduce the pain relief effect by its negative impact on PFC and PFC-based executive functions.
Healthy young (18-30 years) and older participants (65+ years) performed a pain distraction task before and after acute stress induction using the Trier Social Stress Test, or a respective control condition. An n-Back working memory task with low and high cognitive load served as the distraction paradigm, during which participants received non-painful and moderately painful stimuli. These stimuli were individually adjusted transdermal electrical pulse trains to the inner forearm and participants rated them regarding their intensity and unpleasantness. Pain-related evoked potentials were recorded with a 64-channel EEG, and several saliva samples were collected to measure hormonal stress responses. First analyses on the currently small sample suggest a negative impact of acute stress on distraction from pain in both age groups. Our final results will contribute to a deeper understanding on the efficacy of pain modulation in aging and potential influencing factors, helping to optimize pain treatments in this population.

P2.092 - Individual Alpha and Theta Frequency Across Age: In Search of Resting-State EEG Markers of Working Memory Capacity

P. Khader[1], **M. Hegert**[2], **S. Getzmann**[3], **E. Wascher**[3], **P. Gajewski**[3], **K. Jost**[2]

[1] Fresenius University of Applied Sciences
[2] Brandenburg Medical School
[3] Leibniz Research Centre for Working Environment and Human Factors at the TU-Dortmund (IfADo)

Theta oscillations have been discussed as a neurophysiological marker of working memory (WM) capacity: gamma oscillations, assumed to represent the items held in WM, become nested within theta cycles. Accordingly, the length of a theta circle determines how many gamma cycles can be nested. Thus, individual theta frequency may be the factor behind age-related decline and individual differences in WM, rendering it a potential marker for WM in numerous fields of application (such as in early diagnosis of Alzheimer's disease and other forms of cognitive decline). To evaluate this, we conducted a systematic analysis of resting-state EEG and WM functions of a large sample from the Dortmund Vital Study, a large-scale longitudinal study on the physiological background of cognition. Starting point was individual alpha frequency determined in eyes-closed periods as this is known to slow with age and relate to theta. Individual theta frequency, however, cannot be determined easily in raw EEG power spectra, because, unlike alpha, theta does not exhibit a pronounced peak. Therefore, we followed a different approach and utilized the finding that with eyes open theta increases while alpha decreases. Accordingly, the crossing of two power spectra from eyes-closed and eyes-open, the transition frequency, was taken as a proxy for individual theta frequency. We will present data on age-related changes of individual alpha and theta frequencies as well as their relation to WM functions. Moreover, we will provide information about the reliability of the measures as well as discussing pros and cons of our methodological approach.

P2.093 - Locus coeruleus-related insula activation supports implicit learning across the adult lifespan

M. J. Dahl[1,2], **M. Mather**[2], **M. C. Sander**[1], **M. Werkle-Bergner**[1]

[1] Center for Lifespan Psychology, Max Planck Institute for Human Development, 14195 Berlin, Germany
[2] Davis School of Gerontology, University of Southern California, 90089 Los Angeles, USA

Attention and learning help us in adjusting quickly to changing environments, yet adapting becomes more difficult with advancing age. Impairments in attention and learning have been associated with waning noradrenergic neuromodulation in animals, however methodological challenges have long impeded in-vivo human research.
Here we recorded simultaneous fMRI and pupil dilation, a non-invasive marker of noradrenergic neuromodulation, while younger and older adults (n = 77) completed an arousal-modulated oddball task.
Arousing stimuli elicited a pronounced dilation of the pupil and activation of the dorsal attention and saliency networks relative to perceptually matched control stimuli. Larger pupil dilations were related to a greater activation in the insula, indicating an effect of noradrenergic neuromodulation. Task-based functional connectivity analyses showed a close interconnection of the insula and other parts of the saliency network. Crucially, connectivity analyses further confirmed an association between the insula and the locus coeruleus, the main source of cortical noradrenaline, which we corroborated using locus coeruleus-sensitive structural magnetic resonance imaging (LC-MRI), a proxy for noradrenergic cell density.
On a behavioral level, initially naïve participants quickly inferred the likelihood of trial categories (i.e., standards, oddballs) and focused their behavior on more frequent events (i.e., standards), resulting in overall quicker reaction times. Combining behavioral and neural data, we observed that locus coeruleus–saliency network interactions, assessed using pupil dilation, insula activation, and LC-MRI, were associated with better adapting behavior to the statistical structure of the task.
Overall, our results suggest a prominent role of noradrenergic neuromodulation in attention and learning across the lifespan.

P2.094 - The neural basis of motor sequence learning in children and adults

M. Hille[1], **E. Wenger**[1], **Y. Fandakova**[1]

Center for Lifespan Psychology, Max Planck Institute for Human Development, Germany

Motor learning involves a number of brain areas, including prefrontal cortex (PFC) and motor cortex. These regions vary considerably in their maturation. PFC, involved early in learning when cognitive control demands are high, matures relatively late in childhood. In contrast, motor regions, which are more prominently engaged in late learning phases, mature relatively earlier. To examine how these maturational differences across regions affect motor learning in childhood, we investigated motor sequence learning in children (7 – 10 years, n = 39) and young adults (20 – 32 years, n = 39). In an associative visuo-motor task, participants saw four squares corresponding to four response buttons and via trial and error learned four- to eight-element motor sequences by practicing them until they were performed without errors for 17 repetitions. Adults demonstrated significantly greater decreases in reaction times over repetitions than children, indicating age-related improvements in learning. Compared to adults, children showed lower PFC activity early in learning as well as a less pronounced decrease in activity form the early to the late learning phase. Against our hypotheses, we found no activity increases in pre-defined regions of interest in the motor cortex in either age group. Together, our findings suggest that the general neural mechanisms underlying motor sequence learning are similar for children and adults. However, the age differences in reaction times and PFC activity suggest that in children, compared to adults, less cognitive control abilities are available during early phases of motor sequence learning, presumably due to ongoing PFC maturation.

Topic 9: Disorders and Interventions

P2.095 - Direct subthalamic nucleus stimulation influences speech and voice quality in Parkinson's disease patients

S. Frühholz[1], N. Sulzer[1], G. Bündler[1], M. Staib[1], L. Imbach[2], L. Stieglitz[2], P. Kraus[2], C. Baumann[2], M. Bobin[1]

[1] University of Zurich, Schweiz
[2] University Hospital Zurich, Switzerland

Deep brain stimulation (DBS) of the subthalamic nucleus (STN) considerably ameliorates primary motor symptoms in Parkinson's disease (PD). Here, we performed an assessment of secondary speech symptoms improvements elicited by direct STN stimulations. First, perceptual clinical assessments revealed that certain speech and voice symptoms could be improved, but this seems largely restricted to right STN-DBS. Second, computer-based acoustic analyses revealed that both left and right STN-DBS could improve dysarthric speech symptoms, but only right STN-DBS can improve dysphonic symptoms, with left STN-DBS being restricted to only affect voice intensity features. Third, several subareas in the motoric STN proper and close to the associative STN have optimal (and partly suboptimal) stimulation outcomes. Fourth, low-to-medium stimulation intensities showed the most optimal and balanced effects compared to high intensities. Overall, STN-DBS can considerably improve both speech and voice symptoms in PD based on a carefully arranged stimulation regimen along central stimulation features.

P2.096 - Verbal memory performance in euthymic patients with bipolar disorder – a reflection of mood?

T. D. Meyer[1], **C. Lex**[2], **R. H. Hinojosa**[1], **M. Hautzinger**[3]

[1] McGovern Medical School, Psychiatry & Behavioral Sciences, UT Health, Houston, TX, USA
[2] Villach General Hospital, Department of Psychiatry, Austria
[3] Department of Clinical Psychology & Psychotherapy, Eberhard Karls University, Tübingen, Germany

There is evidence that patients with BD show deficits when compared to healthy controls. The objective of this study was to explore predictors of verbal learning and memory in a sample of euthymic patients with BD to see if a) mood and anxiety at the time of testing explain performance, and b) clinical factors contribute to differences in performance.
Method: The patients (n = 95) were assessed with the Auditive Verbal Learning Test (AVLT), the short LPS, the CES-D and State Anxiety Scale (Aim A). The second set of regressions (Aim B) tested whether clinical baseline characteristics (HAMD, YMRS, age of onset, duration of illness and medication) predicted performance.
Results: Comparing the performance of our sample with other studies revealed that our euthymic sample was significantly better than bipolar depressed patients but did not differ from healthy controls Age at testing, gender and intelligence significantly predicted verbal learning and free recall but not state anxiety or self-reported depression. For delayed recognition, self-reported depressive symptoms showed a trend to predict lower performance. Clinician variables did not significantly predict performance.
Conclusion: Contrary to expectations, state anxiety and residual depression did not generally affect performance. Only medication level was marginally associated with less learning, but not age of onset or duration of illness. Furthermore, our sample seems cognitively to resemble healthy controls. Our results suggest that a) not all bipolar patients show cognitive deficits, b) that state anxiety is surprisingly irrelevant, and c) that medication level might need to be controlled for.

P2.097 - Larger N170 after Sad Faces in Individuals with Elevated Depressive Symptoms in a Facial Oddball Task

K. Riepl[1], **J. J.B. Allen**[2], **J. Rodrigues**[1], **J. Hewig**[1]

[1] University of Würzburg, Würzburg, Germany
[2] The University of Arizona, Tucson, AZ, USA

Research Question: According to Aaron Beck's cognitive model, depressed individuals show a negative bias. We hypothesized to find electrophysiological evidence for an attentional focus on happy faces in participants with low depressive symptoms and on sad faces for individuals high in depressive symptoms. We expected this effect both in comparison to neutral faces and in the comparison of frequent to rare faces in N170.
Methods: We recruited 103 participants who completed a facial oddball task. Participants saw a stream of 375 happy, neutral, and sad faces, divided into five blocks. Participants indicated the valence after each face presentation. Eighty percent of faces were in one gender, while the other 20% were in the other gender.
Results: Happy and sad faces elicited significantly larger N170 amplitudes than neutral faces. This effect interacted with depressiveness: The largest amplitude difference between happy and neutral faces occurred for people with low depressive symptoms (first quartile), whereas the largest difference between neutral and sad faces occurred in participants with high depressive symptoms (fourth quartile). The frequency of appearance of faces did not significantly impact N170 amplitudes.
Discussion: We observed an attentional bias towards happy faces in individuals low in depressive symptoms and towards sad faces in individuals high in depressive symptoms in N170 amplitudes. The early appearance of this bias suggests that mood effects regarding depressive symptoms are associated with variations in lower-level perceptual processing.

P2.098 - Potential use of the cEEGrid EEG for Tactile Brain-Computer Interfaces

M. Eidel[1], **M. Pfeiffer**[1], **P. Ziebell**[1], **A. Kübler**[1]

Universität Würzburg, Deutschland

Introduction: Brain-Computer Interfaces (BCIs) allow their users to interact with the environment without relying on intact muscle control. They are particularly relevant for motor-impaired patients. However, BCIs often use EEG to acquire brain activity, and the typical EEG setup is often considered too cumbersome for daily use. This might contribute to a persistent translational gap. Conversely, the cEEGrid is a novel, miniaturized EEG which is conveniently placed around the ears. Already, it was demonstrated that signals important for BCI (e.g. the P300) could be captured reliably. Still, the system needs more validation with established BCIs. With this study, we assess the cEEGrid's feasibility for the potential use in a vision-independent BCI based on vibrotactile stimulation.
Methods: Data was recorded from the cEEGrid and scalp EEG simultaneously from 20 healthy participants performing a tactile oddball task. The P300 was offline classified with a step-wise linear discriminant analysis algorithm.
Results: A clear P300 deflection was visible in the data of both systems. However, accuracies were significantly higher for the scalp EEG (M=84.5% vs. M=69.6%). Mean amplitudes were also higher at the 10-20 electrode positions, with up to 4.8 μV at Cz versus 2.3 μV at the bipolar cEEGrid channel R2R7.
Discussion: This study adds to the growing list of literature comparing the cEEGrid to conventional EEG-systems. It provides first evidence that the tactile P300 can be recorded with the cEEGrid and classified with above-chance accuracies. The cEEGrid may, thus, constitute another step toward a feasible daily use of a tactile BCI.

P2.099 - Verbale Gewalt in Institutionen: Zusammenhänge mit erlebter Diskriminierung und Depressivität

F. Hauck[1], **L. R. Gibu**[2], **S. Janse**[2], **N. Rohleder**[1]

[1] Lehrstuhl für Gesundheitspsychologie, Friedrich-Alexander-Universität Erlangen-Nürnberg, Deutschland
[2] Institut für Romanistik (Linguistik), Friedrich-Alexander-Universität Erlangen-Nürnberg

Einführung: Wahrgenommene Diskriminierung wirkt sich nachteilig auf die Gesundheit aus, da sie als unkontrollierbar eingeschätzt wird. Ob die Interaktion in Institutionen für Immigrierte ebenfalls eine solche unkontrollierbare Situation darstellt, ist kaum erforscht. Deshalb untersuchten wir in folgender Studie, wie wahrgenommene Diskriminierung und das Erleben von verbaler Gewalt in Institutionen mit der Gesundheit von Immigrierten in Deutschland zusammenhängen.
Methode: Es wurden 96 Personen (68 % weiblich) im Alter von 20 bis 71 Jahren (M = 37.71) für eine Online-Umfrage rekrutiert. Die Teilnehmenden lebten in Deutschland und stammten aus Hispanoamerika. Sie füllten Fragebögen zu wahrgenommener Diskriminierung, erlebter verbaler Gewalt in Institutionen, Depressivität und chronischem Stress aus.
Ergebnisse: Es zeigten sich signifikante Zusammenhänge zwischen allen Konstrukten, darunter Depressivität und chronischer Stress ($r = .71$, $p < .01$) sowie verbale Gewalt und Diskriminierung ($r = .74$, $p < .01$). Eine Mediationsanalyse wurde berechnet, um den Einfluss von verbaler Gewalt auf Diskriminierung und Depressivität zu überprüfen. Die Ergebnisse zeigen, dass der Zusammenhang von verbaler Gewalt und Depressivität vollständig über Diskriminierung mediiert wird ($\Delta R^2 = 52.25\%$, $F(1,83) = 90.81$, $p < .05$; ab = .15, 95% CI[0.05, 0.25]). Zwischen 50 und 60 % der Teilnehmenden berichteten als wahrgenommene Ursache für erlebte Diskriminierung und verbale Gewalt ihre Herkunft oder ihre gesprochene Sprache (z.B. Akzent).
Zusammenfassung: Wir konnten zeigen, dass das Erleben von Diskriminierung und verbaler Gewalt für lateinamerikanische Personen in Deutschland mit niedrigeren Ausprägungen von psychischer Gesundheit assoziiert ist. Diese Ergebnisse deuten darauf hin, dass wahrgenommene Diskriminierung und verbale Gewalt wichtige Einflussfaktoren für die langfristige Gesundheit von Immigrierten sein könnten.

P2.100 - Primed to Fail? An fMRI Study of Emotion Recognition After Affective Priming in Schizophrenia

A. H. J. Sahm[1], **S. N. L. Schmidt**[1], **D. Mier**[1]

Universität Konstanz, Deutschland

Research on impaired emotion recognition in schizophrenia shows evidence for hypermentalizing in response to neutral faces, which has been associated with hyperactivation of the amygdala. Here, we examined whether impaired cognitive control after negative affective priming would result in a stronger negative bias and according higher amygdala activation in response to neutral faces in schizophrenia patients compared to healthy controls.
We analyzed fMRI data from 11 patients and 14 controls (data collection ongoing). Participants were primed with neutral or negative IAPS-pictures before rating the valence of neutral, angry, or happy facial expressions. Data was collected with a 3 T Siemens MRI scanner.
Patients had a negative bias for happy and neutral facial emotions, but did not show stronger priming effects than controls. fMRI-results implicated the middle cingulate cortex, inferior and middle frontal gyri, middle occipital gyrus, inferior parietal lobule, thalamus, and amygdala in affective priming. gPPI-Connectivity results suggested strengthened interconnectivity of the amygdala with the striatum and with the fusiform gyrus after affective priming. No group differences in activation or connectivity reached significance.
These preliminary results replicate previous findings on affective priming, but fail to show aberrant priming effects in schizophrenia. Analysis of the complete data set will help to elucidate whether the processing of affective contextual information in emotion recognition represents an intact component of social cognition in schizophrenia.

P2.101 - Tonic pupil dilation during sustained attention in children with ADHD

U. Schöllkopf[1], K. Krauel[2,3], A. Widmann[1,4], N. Wetzel[1,3]

[1] Neurocognitive Development, Leibniz Institute for Neurobiology, Magdeburg, Germany
[2] Department of Child and Adolescent Psychiatry and Psychotherapy, Otto-von-Guericke University, Magdeburg, Germany
[3] Center for Behavioral Brain Sciences, Magdeburg, Germany
[4] Wilhelm-Wundt Institute for Psychology, Leipzig University, Leipzig, Germany

With a worldwide prevalence of around 5 %, attention deficit hyperactivity disorder (ADHD) belongs to the most common childhood-onset neurodevelopmental disorders and is characterized by symptoms of impaired attention, hyperactivity and impulsivity. Influential models postulate that a deficit in the regulation of activation states contributes to cognitive impairments in ADHD. In particular, recent studies pronounce the role of an unstable regulation of brain arousal in that respect. The level of arousal can be modulated by the tonic and phasic activity of the Locus Coeruleus-Norepinephrine (LC-NE) system. The pupil is closely linked to the activity of norepinephrine neurons in the Locus Coeruleus and therefore provides a promising tool for the investigation of arousal-related attention mechanisms in ADHD. In this study, we investigated slow changes of tonic pupil dilation across a visual sustained attention task in children with and without ADHD. Individuals with ADHD showed significantly reduced performance compared to controls. The pupil diameter was initially similar in both groups but decreased during the task in controls but not in children with ADHD. In conclusion, our results indicate a dysregulation of tonic activity of the LC-NE system and an insufficient adaptation to the requirements of the task with time in ADHD.

P2.102 - Chronic pain and its influence on Creative Ideation: An EEG study

D. A. Gubler[1], **M. g. Holtforth**[1], **S. J. Troche**[1]

Unversity of Bern, Schweiz

Chronic pain not only has physical effects but also leads to various cognitive impairments. Of particular interest is the frequent finding that chronic pain causes attentional impairments. However, how these attentional impairments affect higher cognitive abilities has hardly been addressed. The present study, therefore, examined whether chronic pain affects creative ideation and whether this effect might be explained by an influence of pain on the allocation of attention during creative ideation. For the study, 33 patients with chronic pain and 33 healthy controls completed an alternative use task (AUT). Participants were instructed to generate the most original ideas possible for 20 common objects. During the task, EEG was recorded to measure the degree of internally directed attention, as determined by changes in task-related power (TRP) changes in the upper alpha band. The results revealed that the ideas of patients with chronic pain were less creative than those of healthy controls. In addition, patients with chronic pain showed fewer TRP changes in the upper alpha band, especially in the right parietal area. These TRP differences explained about one-third of the inter-group variance in AUT performance. The results suggest that patients with chronic pain experience performance impairments in creative ideation. Furthermore, these performance impairments may be attributable, at least in part, to the attentional impairments caused by chronic pain.

P2.103 - Is the decrease in bodily response to negative auditory chills specific to insula damage?

L. M. Witt[1], K. Klepzig[1], U. Horn[2], B. v. Sarnowski[3], A. Hamm[4], M. Lotze[1]

[1] Functional Imaging Unit, Center for Diagnostic Radiology, University of Greifswald, Greifswald, Germany
[2] Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany
[3] Department of Neurology, University Medicine Greifswald, Greifswald, Germany
[4] Department of Psychology, University of Greifswald, Greifswald, Germany

Case studies suggested decreased emotional response to music for patients following cerebral stroke. Especially the insular cortex has been reported to integrate emotional experience (valence and arousal) with bodily responses. With respect to the arousal dimension indication of experienced chills in response to music is associated with an increase in the skin conductance response (SCR). In order to investigate the role of the insula for chill experience and bodily response we applied an auditory chill task already published before (6 pleasant excerpts of classical music and 6 harsh sounds; Klepzig, Horn et al., 2019) for patients with different lesion location in the chronic stage following stroke. We selected stroke patients with insular lesions (n=20), but also stroke patients without insular lesions (n=12), and age-matched healthy controls (n=14). Number of chill reports did not differ between groups but patients showed decreased bodily response (SCR) when compared to healthy controls (harsh sounds: $t(42)= 2.287$, $p=0.0135$; pleasant stimuli: $t(42)=1.559$, $p=0.063$). Further analyses will include voxelbased lesion mapping in association with SCR in stroke patients.

P2.104 - Social Skills following Deep Brain Stimulation in Treatment-Resistant Depression: An explorative study

H. Kilian[1], **B. Schiller**[2], **M. Heinrichs**[2], **T. Schläpfer**[1]

[1] Abteilung für Interventionelle Biologische Psychiatrie, Department für Psychische Erkrankungen, Klinik für Psychiatrie und Psychotherapie, Uniklinikum Freiburg
[2] Abteilung für Biologische und Differentielle Psychologie, Institut für Psychologie, Albert-Ludwigs Universität Freiburg

Background: Deep brain stimulation (DBS) of the supero-lateral medial forebrain bundle (slMFB) is associated with antidepressive effects in treatment-resistant depression (TRD). Beyond that, improvements in social functioning have been reported. However, it is unclear, whether these improvements represent an effect of treatment response or whether DBS itself influences social skills, the basis of successful social functioning. The current study investigates state and trait socio-affective and socio-cognitive skills in patients with TRD undergoing slMFB DBS.
Methods: 12 patients with TRD and 12 age and gender matched healthy controls performed the EmpaToM, a naturalistic paradigm based on videos comprising socio-affective (affective empathy, compassion) and socio-cognitive skills (theory of mind). Patients were assessed before and three months after DBS onset. Healthy controls were assessed twice to control for re-test effects. Trait social skills were assessed with the Interpersonal Reactivity Index.
Results: Three months after DBS onset, the preoperatively increased negative affect towards neutral but not emotional stimuli (reduced affective responsiveness) experienced by patients compared to healthy controls was diminished. DBS had no other effects on state or trait social skills. Deficits in compassion persisted while theory of mind abilities were intact before and after DBS onset.
Conclusion: Active slMFB DBS normalized feelings of affective empathy towards neutral stimuli pointing into the direction of a reduced depression-associated negativity bias. Persistence of reduced compassion and increased personal distress might hamper social re-integration and increase the risk of a relapse. Considering the explorative nature of these data, future studies are needed to prove these effects.

P2.105 - Reduced modulation of frowning muscle activity in stroke patients during an emotion induction paradigm

K. Klepzig[1], J. Wendt[3], B. v. Sarnowski[1], A. O. Hamm[2], M. Lotze[1]

[1] University Medicine Greifswald
[2] University of Greifswald
[3] University of Potsdam

Although it is well known that suffering from stroke frequently affects emotion processing (Urrutia et al. 2014), work on expressions of emotions in such cohorts is sparse. Actually, abnormal facial expressiveness has been occasionally reported in previous work which, however, mostly applied observational approaches (Borod et al. 1985). Therefore, in the present work stroke patients (n=35, mean age=63.1+/-12.2 years) with unilateral brain lesions at chronic stage and without facial paresis were examined using emotionally evocative pictures and electromyographic recordings of the corrugator and zygomatic muscle activities which are seen as indicators of unpleasant and pleasant states. Stroke patients – especially those with right-hemispheric lesions – showed abnormal corrugator activity (e.g. less decrease during pictures of pleasant and neutral content) compared to age-matched healthy controls (n=19) which was reflected by a trend significance of Group in a repeated measures ANOVA ($F(2,51) = 3.14$, $p=.052$), while zygomatic activity appeared unaffected. Our results confirm previous findings on distorted emotion experience in stroke patients and underline the relevance of considering such sequelae especially in the light of potential negative social consequences (Broussy et al. 2019).

Borod et al. (1985): Channels of emotional expression in patients with unilateral brain damage. In: Archives of neurology 42 (4), S. 345–348.

Broussy et al. (2019): Sequelae and Quality of Life in Patients Living at Home 1 Year After a Stroke Managed in Stroke Units. In: Frontiers in neurology 10, S. 907.

Urrutia et al. (2014): Relative importance of stroke sequelae according to patients and caregivers. In: Neurology 82 (10).

P2.106 - Meta-analysis of convergent macro- and microstructural white matter alterations in patients with Alcohol Use Disorder

C. Spindler[1,2], L. Mallien[3], S. Trautmann[1,4], N. Alexander[5,6], M. Muehlhan[1,2]

[1] Department of Psychology, Faculty of Human Sciences, Medical School Hamburg, Am Kaiserkai 1, 20457 Hamburg, Germany
[2] ICAN Institute for Cognitive and Affective Neuroscience, Medical School Hamburg, Am Kaiserkai 1, 20457 Hamburg, Germany
[3] Department of Human Medicine, Faculty of Medicine, Medical School Hamburg, Am Kaiserkai 1, 20457 Hamburg, Germany
[4] ICPP Institute for Clinical Psychology and Psychotherapy, Medical School Hamburg, Am Kaiserkai 1, 20457 Hamburg, Germany
[5] Department of Psychiatry and Psychotherapy, Philipps University Marburg, Rudolf-Bultmann-Str. 8, 35039 Marburg, Germany
[6] Center for Mind, Brain and Behavior, Philipps University Marburg, Hans-Meerwein-Str. 6, 35032 Marburg, Germany

Alcohol Use Disorder (AUD) has been linked to alterations in brain structure that may explain functional deficits in motor, cognitive, affective, and perceptual functions in numerous studies. Besides commonly described gray matter (GM) reductions in AUD, evidence for significant macro- and microstructural white matter (WM) changes in its volume, integrity and density is growing too. The present meta-analysis aims to summarize and spatially localize the results of previous studies that used either voxel-based morphometry or diffusion tensor imaging to analyse white matter differences between AUD patients and healthy controls. The systematic literature search revealed 18 studies eligible for inclusion (total N of 462 AUD patients and 416 controls), that reported results as peak-coordinates in standard reference space. Studies using approaches non-concordant with recent guidelines for neuroimaging meta-analyses or investigating patients with Korsakoff syndrome or other comorbid substance use disorder (except tobacco) were excluded. Anatomical likelihood Estimation (ALE) revealed four significant clusters of convergent macro- and microstructural WM alterations in AUD patients that comprised the genu and body of the corpus callosum, anterior and posterior cingulum, fornix, and right posterior limb of the internal capsule. These changes could to some extent explain aforementioned impairments in AUD patients, but it will need further investigations to clarify how WM alterations vary in the course of the disorder and whether they are reversible with prolonged abstinence.

P2.107 - An EEG Test Battery for the Early Diagnosis of Alzheimer's Disease

J. M. Meixner[1,2], H. J. Scheibner[2,3], V. Dahling[2,3], R. C. Schmidt[3], M. Heinze[2,3], K. Jost[1]

[1] Department of Psychology, Brandenburg Medical School Theodor Fontane, Neuruppin, Germany
[2] Department of Psychiatry and Psychotherapy, Brandenburg Medical School Theodor Fontane, Neuruppin, Germany
[3] Immanuel Klinik Rüdersdorf, Rüdersdorf, Germany

Dementia and its most common form Alzheimer's disease (AD) are becoming a major healthcare problem for ageing societies. Probable AD can be diagnosed already at the stage of mild cognitive impairment (MCI) or even subjective cognitive decline (SCD) using CSF measures of amyloidosis and tau-protein phosphorylation, which are, however, invasive measures. In contrast, EEG may provide a widely available, cost-effective, and non-invasive complementary tool for the early diagnosis of AD and its predecessors, whose potential has not yet been fully exploited. Here, we assessed groups of AD, MCI, SCD and healthy controls (HC) with a novel EEG test battery compromising eyes-closed and eyes-open resting-state periods, an expectancy paradigm (auditory oddball), a working-memory paradigm (n-back), and an episodic-memory paradigm (face-name association task). Selection and design of tasks were based on previous systematic reviews and meta-analyses. We will present preliminary ERP results addressing the hypothesized amplitude and latency reductions of oddball P300 and n-back P450 in patients compared to healthy controls as well as variations of the power distribution and of the individual alpha and theta frequency. Further ERP and frequency analyses are planned. Baseline EEG data collection will be finished late summer. Using machine learning algorithms we aim to create a hybrid score to predict SCD/MCI to AD conversion. To this end, clinical symptoms and cognitive/memory decline are assessed using the CERAD test battery, MoCA screening and CDR ratings at annual intervals at the memory outbound patient clinics of the Brandenburg Medical School.

P2.108 - Heart rate variability and attentional control in premenstrual syndrome

B. L. Blaser[1], **M. Weymar**[1], **J. Wendt**[1]

University of Potsdam, Deutschland

The majority of individuals with an active menstrual cycle suffer from a range of aversive symptoms in the days before their menstruation – the premenstrual syndrome (PMS). Biological and cognitive mechanisms of PMS are poorly understood. Recent work, however, found that heart rate variability (HRV), a physiological correlate of attentional control, decreases during the PMS-affected cycle phase only in individuals with strong PMS symptoms. In two ongoing studies, we further investigate the specific associations between HRV, PMS symptomology and attentional control.
In study 1 (between-subject design), participants complete an HRV baseline measurement, a reaction time paradigm to measure attentional control (attention network test revised, ANT-R) and provide information on the impact of PMS symptoms as well as their current menstrual phase. Study 2 additionally includes an N-back Task and salivary hormone determination to confirm menstrual phase, and participants are invited for two sessions in both their late luteal and follicular phase (within-subject design).
Preliminary Mixed Model analysis showed results on interaction effects in the hypothesized direction. HRV is decreased during the luteal phase only in individuals with higher PMS. Analogously, performance in the executive score of the ANT-R and N-2-back task is reduced in the luteal compared to the follicular phase only in individuals with increased PMS symptoms in both studies. Further analyses will inform our understanding of the extent to which differences in HRV may play a role in enhancing or protecting against PMS-associated changes in attentional control.

P2.109 - Belief formation in depression: reduced integration of positive feedback for self but not other-related information

N. Czekalla[1], A. Schroeder[1], J. Stierand[1], F. Paulus[1], B. Matthiessen[1], B. Zurowski[1], P. Klein[1], S. Krach[1], L. Müller-Pinzler[1]

Department of Psychiatry, University of Lübeck, Deutschland

Negatively biased information processing and self-related negative believes are a core symptom of depression (Beck et al., 1979; Korn et al., 2014). To better understand the mechanism behind the formation of self-related beliefs we recruited patients suffering from depression for a behavioral and an fMRI study (n=67 in total) and used computational modeling to describe their self-related belief updating behavior using a novel task, the learning of own performance (LOOP, Müller-Pinzler et al., 2019), in which participants continuously update beliefs about their own and another person's abilities in epistemologically novel behavioral domains. We found a negatively biased belief updating for self but not other-related information. Symptom severity was associated with reduced self-related belief updating after positive prediction errors but not stronger updating after negative prediction errors, i.e. learning was diminished when feedback regarding the own abilities was better than expected. This is in line with the theory of "cognitive immunization" against disconfirmatory information, which means that in the case of depression, people devalue the unexpectedly positive information (Kube et al., 2020). Implications for psychotherapy will be discussed.

P2.110 - Anhedonia Relates to Reduced Reward Anticipation in the Striatum in Patients with Major Depression

A. Daniels[1,2], S. A. Wellan[1,2], A. Beck[1,3], S. Erk[1], C. Wackerhagen[1], N. Romanczuk-Seiferth[1], K. Schwarz[4], J. Schweiger[4], H. Tost[4], A. Heinz[1], A. Meyer-Lindenberg[4], H. Walter[1,2]

[1] Charité – Universitätsmedizin Berlin, Department of Psychiatry and Neurosciences | CCM
[2] Humboldt-Universität zu Berlin, Berlin School of Mind and Brain
[3] Health and Medical University Potsdam
[4] Central Institute of Mental Health Mannheim

Background. Seeking out rewards ("wanting") and experiencing pleasure ("liking") are central to natural human function. Anhedonia, i.e., the loss of interest or the ability to experience pleasure in activities usually enjoyed, is a core symptom of major psychiatric conditions.
Objective. To extend previous findings on impaired reward processing in major depressive disorder (MDD), schizophrenia (SZ), and bipolar disorder (BD) by dimensionally relating anhedonia to neural activation during reward anticipation and consummation.
Method. Using the Monetary Incentive Delay paradigm, fMRI data sets were acquired in 227 participants (18-65 years), including patients with MDD (n=56), SZ (n=44), BD (n=47), and healthy controls (HC) (n=80). To capture anhedonia, three items from the Symptom Checklist-90-R (SCL-90-R) were entered into exploratory factor analysis, which resulted in a single anhedonia factor. We conducted correlation analyses with anhedonia across and within diagnostic groups corrected for multiple comparisons of the whole brain (pFWE<.05).
Results. Behaviorally, anhedonia was high in MDD, low in HC, and intermediate in SZ and BD. Across groups, we did not observe any significant correlation of the anhedonia score with brain activation during reward anticipation or consummation. However, within the MDD group only, higher anhedonia related to lower left putamen activity during reward anticipation; for consummation, no correlations were found.
Conclusion. A general anhedonia factor extracted from the SCL-90-R correlated negatively with striatal activation during reward anticipation only in patients with MDD. Future research should stratify participants by anhedonia levels to investigate whether this relation is transdiagnostic or an interaction effect of anhedonia by diagnosis.

P2.111 - Mindfulness-based instruction to improve real-time fMRI neurofeedback efficiency in problematic alcohol use

J. Zhang[1], **F. Weiss**[1], **A. Aslan**[2], **F. Kiefer**[2], **M. F. Gerchen**[1], **P. Kirsch**[1]

[1] Department of Clinical Psychology, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany
[2] Department of Addiction Behavior and Addiction Medicine, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany

Real-time fMRI neurofeedback (rt-fMRI NF) is a new non-invasive method in which participants receive their own brain activity as feedback and learn to actively regulate their brain processes. Existing studies have found its effects on decreasing craving for alcohol and modulating brain activity. Yet, the role of strategies that participants apply during NF training remains unclear. Mindfulness approaches might provide promising strategies to regulate brain activity elicited by alcohol triggers. Mindfulness aims at building insight and non-reactive acceptance of one's own experience and can reduce craving and craving-related neural reactivity. In our randomized, double-blind, sham-controlled study we thus investigate the role of mindfulness-based instructions on rt-fMRI NF regulation efficiency in non-treatment seeking participants with problematic alcohol use.
For the experiment, 111 participants will be enrolled and randomly assigned to one of three groups: NF with mindfulness-based instructions, NF without mindfulness-based instructions, and sham NF without mindfulness-based instructions. The NF training has two sessions and is performed using a 3 T whole body tomograph. Each session consists of three NF runs. Alcohol pictures and a thermometer representing feedback will be presented. The feedback signal is from the ventral striatum, while the sham NF signal is from the auditory cortex. Participants will listen to either mindfulness-based instruction or neutral information to help them downregulate the thermometer. Craving, impulsive behaviors, and self-efficacy will be measured before and after the training. The study is currently ongoing and first results from intermediate analyses will be presented.

P2.112 - Heart Rate and Heart Rate Variability in Patients With Obsessive-Compulsive Disorder and Healthy First-Degree Relatives

F. Jüres[1], J. Klawohn[1], B. Elsner[1], C. Kaufmann[1], N. Kathmann[1]

Department of Psychology, Humboldt-Universität zu Berlin, Germany

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. 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. 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. Altogether, these results support the clinical significance of HR and HRV and the involvement of the ANS in the pathophysiology of OCD.
Supported by the German Research Foundation, DFG-grant KA815/6-1.

P2.113 - Using mind control to modify cue-reactivity in AUD: The impact of mindfulness-based relapse prevention on real-time fMRI neurofeedback to modify cue-reactivity in alcohol use disorder

A. Aslan[1], F. Weiß[2,3], J. Zhang[2], M. F. Gerchen[2], F. Kiefer[1], P. Kirsch[2]

[1] Department of Addiction Behavior and Addiction Medicine, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany
[2] Department of Clinical Psychology, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany
[3] Chair of Addiction Research, Technical University Dresden, Dresden, Germany

Despite the high prevalence of alcohol use disorder (AUD) novel treatment options remain rather limited. In the context of the MiND-study, the secular tradition of mindfulness will be combined with cutting-edge technology to a state-of-the-art intervention. First, participants will receive mindfulness-based relapse prevention (MBRP), which uses the traditional concept of mindfulness to help regain control of feelings and decisions. The following intervention contains the use of real-time functional magnetic resonance imaging neurofeedback (rtfMRI NFB) to target the ventral striatum (VS), a brain region that is essentially involved in cue-reactivity to alcohol-related stimuli. The MiND study will use MBRP as means to improve the efficacy of the rtfMRI NFB intervention.
After inclusion, 88 participants will be randomly assigned to one of four groups. All groups will receive three rtfMRI NFB sessions, in which they either regulate the signal from the VS or the auditory cortex as sham NFB in a double-blind manner. Two groups will additionally receive five sessions of mindfulness-based relapse prevention prior to the NFB intervention. All participants will be followed-up monthly for a period of three months for an assessment of clinical effects.
Preliminary results will be presented at the conference. The results of this study will give further insight to the efficacy of rtfMRI NFB interventions for the treatment of AUD and provide insight on neurobiological changes caused by NFB and MBRP. The outcome might be useful to develop new treatment approaches targeting mechanisms of AUD with the goal to reduce relapse rates after discharge from hospital.

P2.114 - Benefits of Caffeine augmentation in Electroconvulsive therapy

M. D. Ridder[1,2], **A. Brühl**[1,2], **R. Vettermann**[1,2], **E. Schneider**[1,2]

[1] Universitäre Psychiatrische Kliniken (UPK) Basel, Schweiz
[2] Universität Basel, Schweiz

Electroconvulsive therapy (ECT) is considered the most effective treatment in psychiatry, with particular efficacy in the major psychoses depression, mania, schizophrenia, catatonia. However, a frequent problem of ECT is that the seizure threshold progressively rises during treatment and the duration of the electrically induced seizure decreases. To maintain an adequate seizure length and, thus, the efficacy of the ECT treatment, the applied charge is usually increased. Nevertheless, the charge applied during stimulation is also linked to cognitive side effects. Techniques to maintain adequate seizure length with low charge increase are therefore of considerable clinical relevance. One possibility to overcome the rising seizure threshold is the use of proconvulsive augmentation, in particular caffeine augmentation. Caffeine is thought to prolong the duration of a seizure. In the present study, we retrospectively investigated the effect of caffeine in 46 patients who underwent ECT treatment at the Psychiatric University Hospital of Basel and received caffeine intravenously (200 mg) during their ECT treatment. By comparing the mean seizure duration between the first two seizures with and the last two without caffeine, we found a significant increase in seizure duration ($t=2.79$, $p = 0.021$, $d=0.88$) and a significantly reduced charge increase after caffeine was administered ($t=-3.22$, $p=0.0024$, $d=0.49$). Further we found no significant difference in heart rate before and after caffeine administration ($t=1.14$, $p=0.26$, $d=0.18$). Our results suggest that a preictal caffeine augmentation is an effective way to increase the seizure duration without increasing the charge and, thus, to enhance the efficacy of ECT treatment.

Topic 10: (Brain) Stimulation

P2.115 - The Modulation of Attentional Control and Prospective Memory with Non-Invasive Brain Stimulation in Older Adults

N. Schmidt[1,2], **M. Kliegel**[3,4,5], **J. Peter**[1]

[1] University Hospital of Old Age Psychiatry and Psychotherapy, University of Bern, Switzerland
[2] Graduate School for Health Sciences, University of Bern, Switzerland
[3] Faculty of Psychology and Educational Sciences, Geneva University, Switzerland
[4] Centre for the Interdisciplinary Study of Gerontology and Vulnerability, Geneva University, Switzerland
[5] Swiss National Centre of Competence in Research: LIVES – Overcoming Vulnerability: Life Course Perspectives', Lausanne and Geneva, Switzerland

Background: Remembering to carry out future intentions is referred to as prospective memory. Older adults typically perform worse in laboratory prospective memory tasks as compared to younger adults. One possible reason may be that attentional control declines when people age. Attentional control comprises different cognitive functions including inhibitory control, shifting or divided attention. These functions were found to be linked to prospective memory on a behavioral and a neuronal level. In this ongoing study, we apply non-invasive brain stimulation on brain areas, known to be associated with attentional control or prospective memory to find out whether this would lead to performance changes in either of the two or both.
Method: In a double blind, sham-controlled, and parallel group study, we will include n=105 healthy older volunteers (60-75 years of age). Participants are randomly assigned to one of seven different groups: they receive either cathodal, anodal, or sham high-definition transcranial direct current stimulation of the left or right inferior frontal, or the right superior parietal gyrus for 20 min (1mA). During and after stimulation, subjects complete different attentional control and prospective memory tasks. So far, we completed measurements of around 45% of the aspired sample.
Outlook: In this study, we aim to clarify the role of different brain regions for attentional control and prospective memory in older adults. Our findings may help to better understand the relationship between attentional control and prospective memory.

P2.116 - Does Transcranial Alternating Current Stimulation at Alpha Frequency Induce Similar Alterations in Theory of Visual Attention Cognitive Functions as Video Games?

Y. Hilla[1], **F. Link**[1], **P. Sauseng**[1]

Ludwig-Maximilians-Universität, Department Psychologie, Biologische Psychologie, Deutschland

Video gaming might improve cognitive processing by training a function which several cognitive processes have in common. Attentional control, the ability to focus on relevant information processing while simultaneously suppressing irrelevant information, might be this function. Brain oscillatory activity around 10 Hz (alpha waves) correlates with attentional control given that alpha amplitude modulation is associated with (dis-) inhibition of information processing. Thus, we hypothesized that transcranial alternating current stimulation (tACS)-induced alterations of alpha activity might elicit changes in cognitive processing as observed in video game players. We recruited 19 volunteers to perform a visual short-term memory paradigm on five different days to investigate this. Individuals were to memorize two white shapes depicted on an invisible circle either in the left or right visual field, either with or without distractors, at one of three different exposure durations while either 10 Hz or 16.18 Hz tACS was applied to the left or right posterior parietal cortex (PPC) or sham stimulation. Participants' short-term memory capacity, speed of information processing, top-down control and visuospatial attention were modeled based on performances differences between conditions using theory of visual attention algorithms. While 10 Hz tACS applied to the left PPC altered individuals' orientation of visuospatial attention in comparison to sham stimulation, there were no additional modulations of cognitive processing, e.g. speed of information processing or top-down control, as typically observed in video game players. Thus, our results oppose the hypothesis that attentional control represents a mechanisms of cognitive enhancement related to video gaming.

Topic 11: Affective Neuroscience

P2.118 - Measuring the neural correlates of real-life fear using virtual reality and mobile EEG

J. Packheiser[1], Y. E. Basbasse[2], J. Peterburs[3], O. Güntürkün[2], E. Serow[2], C. Maymon[4], G. Grimshaw[4], S. Ocklenburg[1,3]

[1] Netherlands Institute for Neuroscience, Deutschland
[2] Ruhr-Universität Bochum, Deutschland
[3] Medical School Hamburg, Deutschland
[4] Victoria University Wellington, Neuseeland

Most studies on emotion induction rely on the presentation of emotional images or films putting the realness of the felt emotion into question. Recent developments in virtual reality (VR) technology allow for more ecologically valid settings in which emotions can be induced. This pre-registered study committed to open data and open code upon publication aimed at investigating the neuronal underpinnings of naturalistic fear using a mobile EEG system. 75 healthy subjects balanced on a virtual plank either on top of a skyscraper (fear condition) or on the ground floor (control condition). In addition, emotions were also induced under low ecological validity using fear-inducing or neutral IAPS pictures. Confirmatory analyses showed a significant elevation of self-reported fear during the fear VR condition compared to the neutral condition. On the neural level, we found indications towards right-hemispheric lateralization in the negative as opposed to the neutral VR condition at frontal electrodes. Furthermore, fear ratings and rightward asymmetry showed a time-dependent increase in the negative plank condition. Opposed to the hypotheses, stronger subjective fear ratings were positively correlated with stronger left- instead of right-hemispheric activation. Within the IAPS task, no significant differences in asymmetry were detected. Overall, our results confirm that negative emotions are dominantly processed in the right-hemisphere. Moreover, we demonstrate the feasibility of investigating the neural underpinnings of emotion processing using mobile EEG combined with VR. Our work supports the notion that emotional processing should be studied in more ecologically valid settings in the future.

P2.119 - Priming-Effekte auf subjektive und mimische Schmerzreaktionen

P. Göller[1], P. Reicherts[1], S. Lautenbacher[2], G. Zerbini[1], M. Kunz[1]

[1] Medizinische Psychologie und Soziologie, Universität Augsburg
[2] Physiologische Psychologie, Universität Bamberg

Einleitung: Es konnte gezeigt werden, dass durch Priming-Prozesse die Schmerzwahrnehmung beeinflusst werden kann. So fällt die subjektive Schmerzbewertung bei vorherigem Priming mit schmerzrelevanten Stimuli (schmerzhafte Gesichtsausdrücke, Schmerzbegriffe) stärker aus. Die subjektive Schmerzbewertung unterliegt kognitiven Prozessen (Top-down), wohingegen andere Schmerzreaktionen (z.B. Mimik, Schmerzreflexe) eher reflexhaft und automatisch (Bottom-up) ablaufen. Es ist bislang unklar, inwieweit auch diese automatischen Schmerzreaktionen durch Priming beeinflusst werden. In unserer Studie wollten wir daher nicht nur Priming-Effekte auf subjektive Schmerzbewertung, sondern auch auf automatische Schmerzreaktionen (Schmerzmimik) untersuchen.
Methode: Die subjektive und mimische Schmerzreaktion von 65 Proband*innen (35 weiblich) auf phasische Hitzereize von "schmerzhafter" und "nicht-schmerzhafter" Intensität wurde erfasst. Vor den Hitzereizen sahen Proband*innen computergenerierte Gesichtsausdrücke (3 verschiedene Schmerzausdrücke & neutrale Mimik) männlicher und weiblicher Avatare. Die Mimik der Proband*innen wurde während des gesamten Experiments aufgezeichnet und anhand des Facial Action Coding Systems ausgewertet.
Ergebnisse: Die Darbietung von mimischen Schmerzausdrücken führte wie erwartet zu erhöhten Schmerzratings. Ähnliche Priming-Effekte zeigten sich auch bei der mimischen Schmerzreaktion. Hier zeigte sich die mimische Schmerzreaktion deutlich erhöht bei vorherigem Betrachten der Schmerz-Primes im Vergleich zu den neutralen Stimuli. Ein reiner Mimikry-Effekt konnte ausgeschlossen werden, da sich diese Ergebnisse nicht bei "nicht-schmerzhaften" Hitzereizen zeigten.
Diskussion: Die Darbietung von mimischen Schmerz-Primes führt nicht nur zu höheren subjektiven Schmerzratings, sondern parallel dazu auch zu gesteigerten mimischen Reaktionen auf experimentell-induzierte Schmerzreize. Dies könnte auf eine gesteigerte Reagibilität des gesamten Schmerzsystems durch Priming-Prozesse hinweisen.

P2.120 - Kodierung individueller Belohnungswerte visueller sexueller Stimuli in Striatum und OFC

S. Klein[1], **O. Kruse**[1], **C. Markert**[1], **I. Tapia León**[2], **J. Strahler**[3], **R. Stark**[1]

[1] JLU Gießen, Deutschland
[2] Uni Siegen
[3] Albert-Ludwigs-Universität Freiburg

Im menschlichen Gehirn werden die Werte verschiedener Belohnungen in einem gemeinsamen neuronalen Netzwerk verarbeitet, zu dem Striatum und orbitofrontaler Kortex (OFC) gehören. Verglichen mit anderen Belohnungsstimuli gibt es wenig Forschung bzgl. der neuronalen Repräsentation subjektiver Belohnungswerte von visuellen sexuellen Stimuli (VSS) und ihrer Rolle bei der Entwicklung von problematischem Pornografiekonsum (Problematic Pornography Use; PPU). Wir untersuchen den Zusammenhang zwischen neuronaler Reaktivität auf VSS und individueller Bewertung mit Hilfe der funktionellen Magnetresonanztomographie (fMRT). 72 gesunde Männer sahen sich verschiedene VSS-Filmclips im MRT-Scanner an. Für die Filmclips wurden Ratings bezüglich Valenz und sexueller Erregung erhoben und als parametrische Modulatoren in der fMRT-Auswertung verwendet. Die Probanden füllten außerdem Fragebögen zu PPU aus. Die neuronale Aktivität während der VSS-Betrachtung im Nucleus Accumbens (ventrales Striatum), Nucleus Caudatus (dorsales Striatum) und OFC war positiv mit den individuellen Ratings der jeweiligen VSS assoziiert. Der Zusammenhang zwischen Aktivierung und Ratings der sexuellen Erregung war außerdem positiv mit den selbstberichteten Symptomen von PPU korreliert. Die Ergebnisse deuten auf eine präzise Repräsentierung der Belohnungswerte von VSS entsprechend den individuellen Präferenzen in den relevanten Belohnungsregionen hin. Eine engere Beziehung zwischen Ratings und Aktivierung bei Personen mit mehr PPU-Symptomen weist auf eine präzisere Ausrichtung der Präferenzen bei diesen Personen hin. Dieser Effekt könnte einen Risikofaktor darstellen, der suchtrelevante Informationen signalisiert und die Motivation erhöht, auf die präferierten Stimuli zu reagieren.

P2.121 - Inherently threatening contexts facilitate visuocortical engagement to conditioned threat

Y. Stegmann[1], **M. Andreatta**[1,2], **M. J. Wieser**[1,2]

[1] University of Würzburg, Germany
[2] Erasmus University Rotterdam, The Netherlands

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 situations of potential threat. In the current literature, fear and anxiety are usually considered mutually exclusive, with distinct neural underpinnings. However, there is accumulating evidence that is inconsistent with a distinction between fear and anxiety, and simultaneous activation of fear- and anxiety networks has been reported. Therefore, the current study experimentally tested potential interactions between fear and anxiety. Fifty-two healthy participants completed a differential fear conditioning paradigm followed by a test phase in which the conditioned stimuli were presented in front of threatening or neutral contextual images. To capture defense system activation, we recorded subjective (threat, US-expectancy), physiological (skin conductance, heart rate), and visuocortical (steady-state visual evoked potentials) responses 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 threatening compared to neutral contexts. 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 situations of potential threat.

P2.122 - Implicit Emotion Regulation: A Replication Study on the Counter Regulation of Emotions by Attentional Biases in Affective Processing

H. Heyer[1], **R. Rammensee**[1], **U. Basten**[1]

Universität Koblenz-Landau, Deutschland

Implicit emotion regulation is assumed to play an important role for resilience and mental health. This study replicates an experiment that investigated counter-regulation effects in the attentional processing of valence information that can be understood as a form of implicit emotion regulation (Rothermund, 2003. Emotion, 3.). The original study reported an attentional bias in favour of stimuli that were opposite in valence to a person's current affective-motivational state (incongruency effect) – but only if attention had to be shifted between stimuli of opposing valence (valence shift). In the current study, 79 healthy participants completed a word categorisation task in which the valence of a word had to be evaluated as positive or negative. Correct and fast responses led to success feedback (positive affective-motivational state), incorrect or slow responses to failure feedback (negative affective state). Consistent with the counter-regulation principle, response times were faster for incongruent combinations of target valence and feedback valence: After positive feedback participants were generally faster in evaluating negative words and vice versa. However, in contrast to the original finding, the incongruency effect did occur regardless of whether attention had to be shifted between two consecutive targets of opposing valence (i.e., independent of a valence shift). Our findings support the notion of counter-regulation in valence processing in an even broader sense than the original study. The incongruency effect may be due to biases in early attentional processes. We discuss options to study the neural mechanisms underlying the effect focusing on event-related potentials modulated by early attentional processes.

P2.123 - Distinct activation of the rACC and the vmPFC during different emotion regulation strategies

M. Burghart[1], **S. N. L. Schmidt**[1], **D. Mier**[1]

Universität Konstanz

Emotion regulation refers to our ability to modify emotional experiences with the goal of influencing our feelings and behaviour. Although it is a crucial component of daily life and essential to our well-being, not all strategies are necessarily adaptive. In this fMRI, study we sought to identify brain regions that show distinctive activity patterns for different emotion regulation strategies.
Thirty-one healthy female students completed an fMRI paradigm for emotion regulation. Participants were presented with images of negative scenes and were asked to use three strategies (reappraisal, distraction, and acceptance) to regulate their emotions. In the control condition, participants were instructed to simply observe either negative or neutral images. Data was acquired with a Siemens 3.0 Tesla MRI scanner.
Applying whole brain family wise error correction, all emotion regulation strategies in comparison to the neutral view control conditions activated inferior and medial frontal regions. Both reappraisal and acceptance were associated with higher activation in the ventromedial prefrontal cortex (vmPFC) and the rostral anterior cingulate cortex (rACC) compared to distraction. On a behavioural level, acceptance was most effective at reducing valence and arousal in comparison to the other two strategies. No differences were found between reappraisal and distraction.
The reduced activation of the rACC and the vmPFC indicates attenuated deliberate processing of emotional content. This may explain why distraction has been shown to be a maladaptive emotion regulation strategy with effective short-term, but poor long-term efficacy. This assumption is supported by our behavioural data showing no differences between reappraisal and distraction.

P2.124 - Hemodynamic correlates of emotion regulation in frontal lobe epilepsy patients and healthy participants

A. Benzait[1], V. Krenz[2], M. Wegrzyn[1], A. Doll[1], F. Woermann[3], K. Labudda[1], C. Bien[3], J. Kißler[1]

[1] Abteilung für Psychologie, Universität Bielefeld, Deutschland
[2] Fakultät für Psychologie, Universität Hamburg, Deutschland
[3] Universitätsklinik für Epileptologie, Universität Bielefeld, Deutschland

The ability to regulate emotion in the face of aversive events is indispensable for maintaining psychological health. It heavily relies on frontal lobe functions which are disrupted in frontal lobe epilepsy. We therefore investigated neural correlates of up- and downregulating emotions towards aversive pictures through reappraisal in 18 frontal lobe epilepsy patients and 17 healthy controls using functional magnetic resonance imaging. Patients tended to report more difficulties with impulse control than controls. On the neural level, they displayed no significant regulation related activity changes. Compared to controls, patients had diminished activity during upregulation in distributed left-sided regions, including ventrolateral and dorsomedial prefrontal cortex, angular gyrus and anterior temporal gyrus. Patients also showed less activity than controls in the left precuneus for up- compared to downregulation and in the left cerebellum for down- compared to up-regulation. Unlike controls, patients displayed no task-related activity changes in the left amygdala, whereas the right amygdala showed task-related modulations in both groups. Upregulation-related activity changes in the left inferior frontal gyrus, insula, orbitofrontal cortex, anterior and posterior cingulate cortex and precuneus were correlated with questionnaire data on habitual emotion regulation. Our results show that structural or functional impairments in the frontal lobes disrupt neural mechanisms underlying emotion regulation through reappraisal throughout the brain, including posterior regions involved in semantic control. Findings on the amygdala as a major target of emotion regulation are in line with the view that specifically the left amygdala is connected with semantic processing networks.

P2.125 - Fear lies in the eye of the beholder - freezing of gaze upon avoidable threat

A. Merscher[1], **M. Gamer**[1]

Universität Würzburg, Deutschland

Survival depends on the rapid detection and processing of relevant information in our environment. The human eyes are drawn to social or threatening stimuli as they may carry essential information on how to behave appropriately in a given context. Recent studies further showed a centralization of gaze that reminded of freezing behaviors in rodents. Probably constituting a component of an adaptive defense mode, centralized eye movements predicted the speed of motor actions. Here we conducted two experiments to examine if and how these presumably survival-relevant gaze patterns interact. Subjects viewed images including social, i.e., faces (Experiment 1, N=50) or threatening stimuli, i.e., snakes or spiders (Experiment 2, N=50) while awaiting an inevitable, no, or an avoidable shock they could escape from by a fast button press. The social and threatening cues within the scenes differed in their distance from the image center and we acquired eye-tracking and autonomic physiological data. Although we observed an initial orienting towards social and threatening stimulus aspects, this exploration pattern vanished towards the end of avoidable shock trials when a pronounced centralization of gaze emerged. Replicating previous findings, the amount of this center bias predicted the speed of motor reactions and we observed a concurrent activation of the sympathetic and parasympathetic nervous system. Taken together, exploration of potentially relevant cues seems to be part of a reflexive orienting response regardless of contextual valence. However, centralization of gaze may be a threat-specific action-preparatory response that occurs across a wide range of stimulus contexts.

P2.126 - Heart rate variability biofeedback reduces anxiety sensitivity in young healthy individuals

M. C. Hufenbach[1], **C. Ventura-Bort**[1], **A. O. Hamm**[2], **M. Weymar**[1], **J. Wendt**[1]

[1] Universität Potsdam, Deutschland
[2] Universität Greifswald, Deutschland

Anxiety sensitivity refers to the fear of the bodily symptoms of anxiety that are misinterpreted as dangerous. Increased anxiety sensitivity is considered a risk factor for the development of panic disorder. In contrast, 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 to maintain mental health.

P2.127 - Nahinfrarotspektroskopie crossmodaler Emotionseffekte im auditorischen und visuellen Kortex

T. Höfling[1], **A. Gerdes**[1], **G. Alpers**[1]

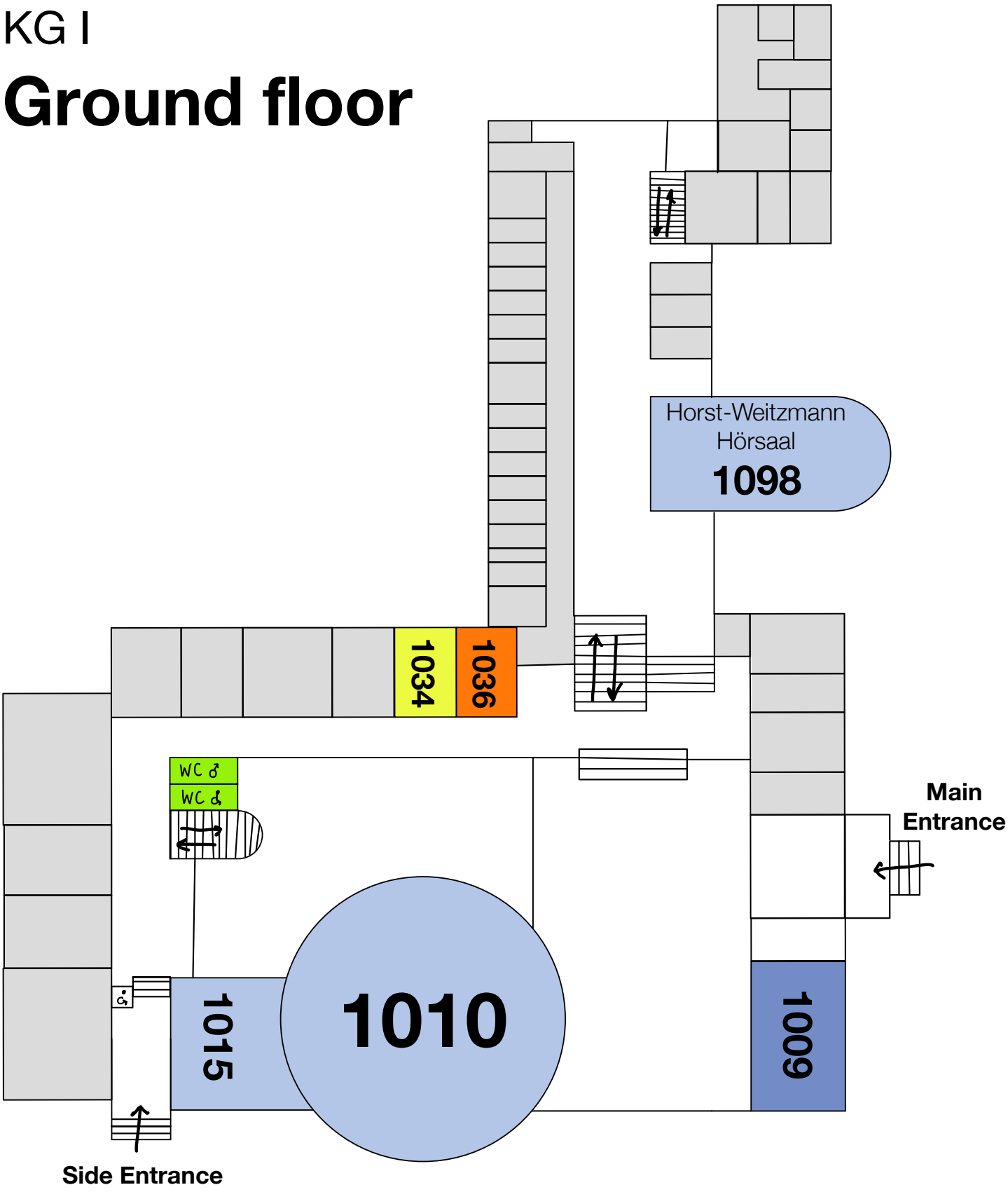
Universität Mannheim, Deutschland

Mehrere Studien konnten mit unterschiedlichen Methoden einen Effekt von Emotionen auf die neuronale Aktivität sensorischer Areale nachweisen. Unklar ist hingegen, ob bei auditiver und visueller Emotionsinduktion nur modalitätsabhängige sensorische Areale aktiviert werden oder ob eine modalitätsunabhängige Aktivierung verschiedener sensorischer Areale ausgelöst wird. Hierzu wurden in der vorliegenden Studie 36 Versuchspersonen angenehme, neutrale und unangenehme visuelle (IAPS) und auditorische (IADS) emotionale Reize präsentiert. Effekte auf die neuronale Aktivität des auditorischen und visuellen Kortex wurden simultan mittels Nahinfrarotspektroskopie gemessen. Relevante Areale im okzipitalen und temporalen Kortex wurden zunächst für jede Versuchsperson mit Hilfe von modalitätsspezifischen Lokalisationsaufgaben identifiziert (i.e., visueller und auditorischer Localizer). Die erwartete starke Aktivierung des visuellen Kortex durch Bilder und des auditorischen Kortex durch Geräusche konnten wir nachweisen. Unseren früheren NIRS-Befund einer stärkeren Aktivierung primärer auditorischer Areale durch angenehme und unangenehme im Vergleich zu neutralen Geräuschen konnte repliziert werden. Allerdings konnten wir keinen signifikanten Emotionseffekt im visuellen Kortex nachweisen. Da keine modalitätsübergreifende Aktivierung im jeweils anderen sensorischen Kortex beobachtbar war, deuten unsere Befunde auf eine modalitätsabhängige sensorische Verarbeitung auditorischer und visueller emotionaler Reize hin.

Maps of the conference venue

KG I

Ground floor



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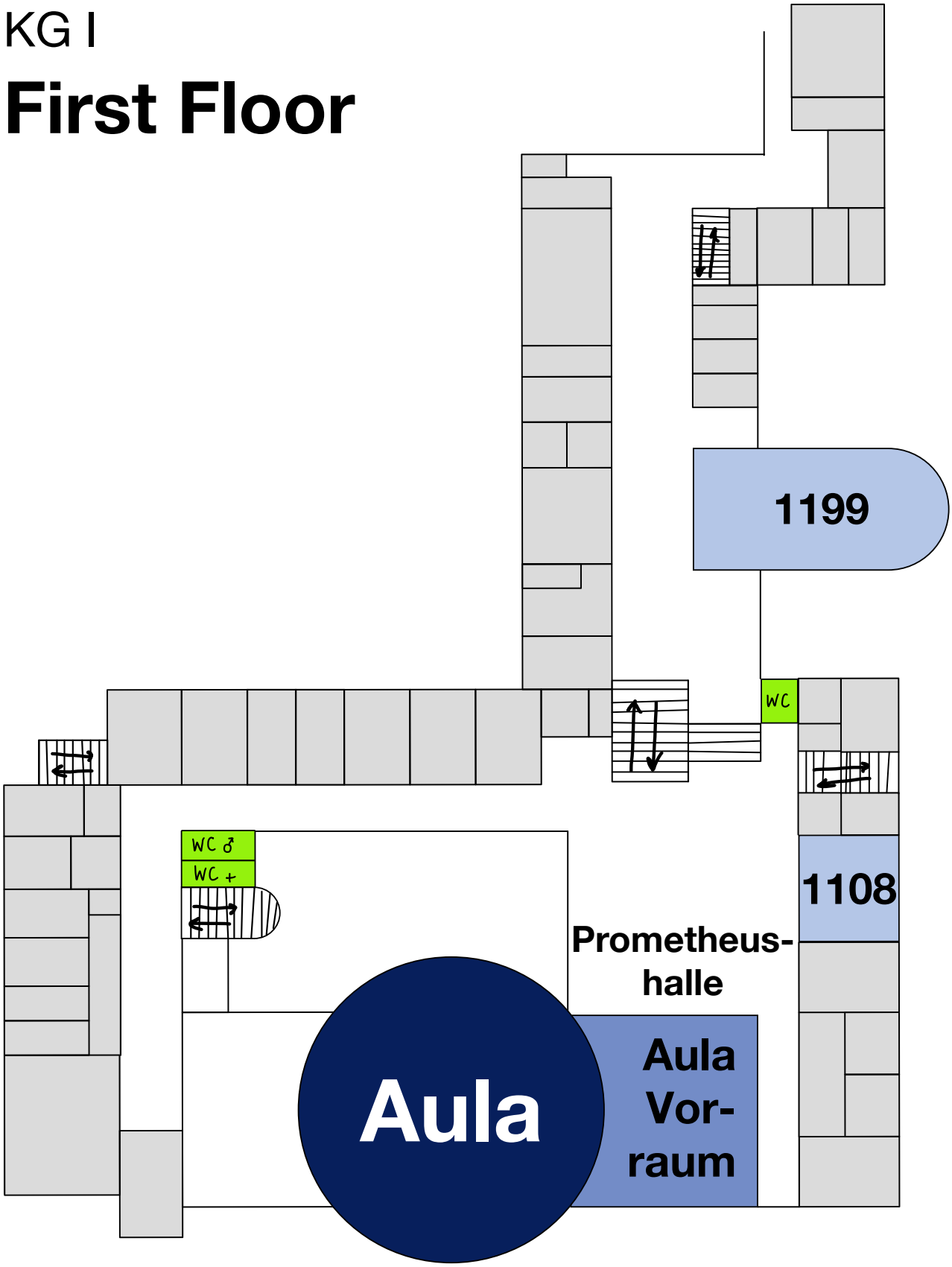
First Floor



KG I

Second floor