CMBB Day 2023

Aula, University Main Building, Justus Liebig University Gießen, Ludwigstr. 23, Giessen

9.15 **Welcome** (Carsten Culmsee, *Deputy Director of the CMBB*)

Chair: Carsten Culmsee

9.30 **Oscar Marín, FMedSci, FRS** (King's College London)
Balancing excitation and inhibition in the developing cerebral cortex

10.00 **Luciana Besedovsky** (Ludwig Maximilian University Munich)
Sleep and the immune system – a prime example of neuro-immune communication

10.30 **Marco Rust** (Philipps University Marburg)
Deciphering the molecular machinery that governs neuronal actin dynamics

11.00 – 11.30 Coffee break

Chair: Belkis Ezgi Arikan

11.30 **Ben de Haas** (Justus Liebig University Giessen)
I spy with my little eye - what can individual differences tell us about perception?

12.00 **Katharina Dobs** (Justus Liebig University Giessen)
Face perception in humans and machines

12.30 **Markus Wöhr** (KU Leuven and Philipps University Marburg)
Improving translational research models for human mental disorders: Deciphering socio-affective communication through ultrasonic vocalizations in rats

13.00 – 14.30 Lunch break

Chair: Emma Stewart

14.30 **Robin Hiesinger** (Free University of Berlin)
Self-Organization in Brain Wiring

15.00 **Brigitte Röder** (University of Hamburg)
The role of visual experience for the development of active vision and underlying neural representations

15.30 **Constantin Rothkopf** (Technical University of Darmstadt)
Understanding human navigation: strategies, errors, and variability result from dynamic interactions of uncertainty between perception, cognition, and action

16.00 **Award of the CMBB Science Communication Prize, with talks by the prize winners**
Verena Schuster (Philipps University Marburg)
Maximilian Broda (Justus Liebig University Giessen)

16.30 – 18.00 Coffee Break and **Poster Session**

18.00 – 19.15 Evening Buffet

19.15 **Grußwort, Prof. Dr. Katharina Lorenz**
Vizepresident für Lehre (Justus Liebig University Giessen)

Vorstellung zur Bürgervorlesung
Roland Fleming (*Geschäftsführender Direktor der CMBB*)

19.30 **Bürgervorlesung**, **Prof. Dr. Gerd Gigerenzer** (Harding-Zentrum für Risikokompetenz, Universität Potsdam)

Klick: wie wir in einer digitalen Welt die Kontrolle behalten

ABOUT THE SPEAKERS

Balancing excitation and inhibition in the developing cerebral cortex

Approximately one in six neurons in the adult mouse neocortex are inhibitory gamma-aminobutyric acid-containing (GABAergic) interneurons. This ratio is relatively stable across cortical regions and species regardless of total neuronal numbers. Although establishing the appropriate proportion of excitatory and inhibitory neurons is likely essential for cortical function, our understanding of this fundamental process is incomplete. In this talk, I will describe mechanisms regulating the final number of excitatory and inhibitory neurons in the mouse cerebral cortex. I will also describe how altering their normal ratio impacts neural circuit function and behaviour.

Oscar Marin, FMedSci, FRS
King's College London

Credit: MRC CNDD

Biography
Oscar Marín is a Professor of Neuroscience and Director of the MRC Centre for Neurodevelopmental Disorders and the Centre for Developmental Neurobiology at King's College London. He graduated in Biology and obtained a PhD in Neuroscience from Universidad Complutense in Madrid, followed by postdoctoral training at UCSF. He was a group leader at the Institute of Neuroscience in Alicante before joining King's in 2014. In 2005, he was selected as one of the founding members of the Scientific Council of the European Research Council, where he served until 2010. He is a Member of the European Molecular Biology Organization, a Fellow of the Academy of Medical Sciences, and a Fellow of the Royal Society. Oscar serves on several editorial and advisory boards and has received multiple prizes, including the Prix Roger de Spoelberch, the Cajal Medal from the Spanish Royal Academy of Sciences, the ECNP Neuropsychopharmacology Award, and the FENS-EJN Award.

Sleep and the immune system – a prime example of neuro-immune communication

For a long time, it was believed that the nervous system and the immune system were two separate entities that work independently of each other. Today, it is clear that the opposite is true: There is an intensive and complex bidirectional interaction between the two systems. Furthermore, the nervous and immune systems also share striking similarities, such as their ability to process information and form long-lasting memories. The interaction between sleep and the immune system is a prime example of how the nervous system and the immune system can potently affect each other. In this talk, I will provide an overview of how sleep and the immune system interact, with a specific focus on the effects of human sleep on peripheral immune functions and immunological memory. I will also outline why the effects of poor sleep on the immune system are considered relevant for a variety of different diseases, including neurodegenerative, psychiatric, and cardiovascular diseases.

Luciana Besedovsky
Ludwig Maximilian University of Munich

Credit: Luciana Besedovsky

Biography
Luciana Besedovsky studied psychology at the Universities of Göttingen and Düsseldorf, Germany, with a focus on biological psychology and pharmacology as subsidiary subject. She finished her PhD at the University of Tübingen, Germany, under the supervision of Prof. Dr. Jan Born. From 2017 – 2018, she was a postdoctoral research fellow at Harvard Medical School in Boston, USA (Host: Dr. Monika Haack), after which she returned to Tübingen to lead the group “Sleep and Immunology”. In 2021, she took up a professorship at the University of Munich, where she is continuing her work on the role of sleep for the immune system.

Deciphering the molecular machinery that governs neuronal actin dynamics

Research in my lab focusses on unraveling the molecular mechanisms that control neuronal actin dynamics and on elucidating the relevance of actin regulators for mammalian brain development and function. In previous studies, we identified actin- depolymerizing proteins of the ADF/cofilin family as key actin regulators in neurons that control the morphology and function of excitatory synapses, and their loss-of- function in mice impaired associative learning and caused behavioral deficits reminiscent of attention-deficit/hyperactivity disorder. In search of proteins that control ADF/cofilin activity in neurons, we identified cyclase-associated proteins (CAP) as crucial interaction partners. In my talk, I will present ongoing projects in which we study the cellular and physiological functions of CAP1 and CAP2 in neurons and beyond.

Marco Rust
Philipps University of Marburg

Credit: Rolf K. Wegst

Biography
Prof Marco Rust did his Diploma in Biology at the University of Bielefeld in 2000 and earned his PhD in the Center for Molecular Neurobiology (ZMNH) at the University of Hamburg in 2004, where he also performed a postdoc. After another postdoc in the Mouse Biology Unity at the European Molecular Biology Laboratory (EMBL) in Rome, Italy, he started as a Junior professor for Neurobiology at the University of Kaiserslautern in 2008. Since 2014 he has been a Professor for Molecular Neurobiology at the Institute of Physiological Chemistry at the University of Marburg.

I spy with my little eye - what can individual differences tell us about perception?

Perception is typically explored through the lens of 'general' psychology, which implies that individual differences are negligible or intractable. Here, I will present data from eye-tracking and neuroimaging experiments documenting clear and measurable differences between individuals observing the same scenes. I will argue that such data offer an objective window into subjective perception, which in turn enables novel tests of general biological mechanisms.

Benjamin de Haas
Justus Liebig University of Giessen

Credit: Lukas Volkwein, Westside Studios

Biography
Ben de Haas studied psychology at Justus-Liebig University Gießen (JLU) before moving to University College London (UCL). At UCL, Ben completed a PhD in neuroscience with Geraint Rees, as well as postdoctoral positions with Sam Schwarzkopf and Marty Sereno. He specialised in functional neuroimaging and developed a keen interest in individual perception. Returning to Gießen, Ben worked on individual eye movements with Karl Gegenfurtner, started an ERC funded research group and recently was appointed Professor for Experimental Psychology and Individual Perception.

Face perception in humans and machines

Why does the human face perception system work the way it does? This long-standing question has fascinated scientists from multiple disciplines. While answers are elusive when studying humans alone, machines can provide insightful perspectives. In this talk, I'll explore how convolutional neural networks (CNNs) can help us understand the distinct behavioral and neural 'signatures'—like the face-inversion effect and functionally specialized neural areas for face perception—that characterize human face perception.
Drawing upon our research, I'll show that only CNNs specifically trained for face recognition—unlike those trained on generic objects or merely for face detection—achieve human-level performance and exhibit similar behavioral signatures to humans. Critically, much like the human visual cortex, CNNs trained on both face and object recognition spontaneously segregate the two tasks into distinct subsystems. These findings suggest that 'human-like' face perception might be the result of computational optimization for face recognition.
In conclusion, I'll discuss how this integration of human behavior, neuroscience and artificial intelligence offers novel insights into why visual recognition operates the way it does, and how this approach can lead to novel and testable predictions of the human visual system.

Katharina Dobs
Justus Liebig University of Giessen


Credit: Kris Brewer

Biography
Dr. Katharina Dobs has been a research group leader in the Department of Psychology at Justus Liebig University Giessen (JLU) since 2020. Specializing in cognitive computational neuroscience, her research leverages recent advances in AI to investigate the functional organization of the human visual system. Her contributions to the field are highlighted by high-impact publications, research grants, and awards, including the recent award of an ERC Starting Grant. Before establishing her lab at JLU, Dr. Dobs was a postdoctoral researcher at the Center for Brains, Minds, and Machines at MIT, where she worked with Prof. Nancy Kanwisher. She was also a postdoctoral fellow with Dr. Leila Reddy at CerCo-CNRS in France. Dr. Dobs earned her PhD from the Max Planck Institute for Biological Cybernetics and holds dual diplomas in Computer Science and Psychology from Philipps-University Marburg.

Improving translational research models for human mental disorders: Deciphering socio-affective communication through ultrasonic vocalizations in rats

There is a need for improved animal models to advance brain sciences. This includes animal models of human mental disorders and their treatment. Because the diagnostic criteria for mental disorders are purely behaviorally defined, the validity of rodent models strongly relies on their behavioral phenotype. For this reason, deep and longitudinal behavioral phenotyping constitutes the principal component for current translational research, yet this strategy depends on sensitive behavioral assays with high relevance to each diagnostic symptom category. Rats display a rich social behavior repertoire. This includes socio-affective communication through the emission of calls above the human hearing threshold of ~20 kHz, so-called ultrasonic vocalizations (USV). Typically, three main types of USV are distinguished: (A) Isolation-induced 40-kHz USV in pups, as well as (B) aversive 22-kHz USV and (C) appetitive 50-kHz USV in juvenile and adult rats. Specifically, 22-kHz USV occur during and in anticipation of aversive events, e.g. predator exposure or fear learning, while 50-kHz USV occur during and in anticipation of appetitive events, e.g. social play or in response to psychostimulants, most notably amphetamine. In my talk, I will provide an overview on socio-affective communication in rats and show how studying 22-kHz and 50-kHz USV in sender and receiver can be used to assess behavioral alterations with relevance to affective and neurodevelopmental disorders.

Markus Wöhr
KU Leuven and Philipps University of Marburg

Credit: Fotostudio Laackmann

Biography

Markus Wöhr, Dr. rer. nat. (Ph.D.), is Professor for Biological Psychology and Behavioral Pharmacology at KU Leuven, Belgium. He is a member of the Leuven Brain Institute and the head of the Social and Affective Neuroscience Research Group at the Faculty of Psychology and Educational Sciences. At present, he is also holding a Young Investigator Group Leader position at the Department of Behavioral Neuroscience, Faculty of Psychology, Philipps-University of Marburg, Germany.

He has a broad background in animal behavior and pharmacological research in translational models for human mental disorders, with specific training and expertise in behavioral neuroscience of affective and neurodevelopmental disorders. His main research interests are social and affective neuroscience. Together with his teams, he combines genetic, pharmacological, and behavioral approaches and studies neurobiological mechanisms underlying social behavior, acoustic communication through ultrasonic vocalizations, and socio-affective information processing in mice and rats. His long-term goal is to decipher socio-affective communication through ultrasonic vocalizations in rodents with the aim to improve translational research models for affective and neurodevelopmental disorders, most notably autism.

Self-Organization in Brain Wiring

How is the brain ‘genetically encoded’? The genome contains information to grow a brain, not information that describes the brain. Navigation through the developing brain less resembles guidance through a city grid with fixed addresses than the navigation of a city under construction, where the final address may not exist at the beginning of the journey. This seminar will explore the question how developmental self-organization can ensure both specificity and robustness of brain wiring using the Drosophila visual system as a model

P. Robin Hiesinger
Free University Berlin

Credit: Bernd Wannenmacher

Biography
Robin Hiesinger received his PhD in 2000 and after a postdoc with Hugo Bellen until 2006 ran a lab until 2015 in the US and ever since in Berlin, Germany. The Hiesinger lab uses genetics, live imaging and computational modeling to study the unfolding of genomic information during brain wiring. With this focus, Robin leads a 13 lab research consortium (RobustCircuit.org), is a current recipient of an ERC Advanced Grant (SynPromiscuity.flygen.org), and author of the book The Self-Assembling Brain (SelfAssemblingBrain.com). More information on the lab is available at flygen.org.

The role of visual experience for the development of active vision and underlying neural representations

Prospective developmental studies have postulated that active vision is crucial for the acquisition of object representations. However, it has been unknown whether visual experience during early development is necessary for the emergence of typical visual exploration and underlying neural representations of the environment. We investigated individuals who had been born blind due to dense bilateral cataracts, which were removed later in life. Despite suffering from nystagmus, these individuals showed largely typical visual exploration patterns. We speculate that active vision drives the acquisition of object representation and that color might be helpful.

Brigitte Röder
University of Hamburg and *LV Prasad Eye Institute*

Credit: Sebastian Engels Fotographie

Biography
Brigitte Röder studied Psychology at and received her PhD from the Philipps University of Marburg (Germany). After her postdoc time at the University of Oregon (U.S.) she was awarded an Emmy Noether grant of the German Research Foundation (DFG). In 2003 she moved to the University of Hamburg, where she since then holds a full professorship for Biological Psychology and Neuropsychology with a second affiliation at the Medical Faculty of the University of Hamburg. Currently she is a Visiting Scholar of the LV Prasad Eye Institute in Hyderabad (India). Brigitte Röder's research interests comprise multisensory processes and age-dependent neuroplasticity in humans. Her main research methods include behavioral assessments, electrophysiological techniques and brainimaging. Current work focusses on the neural mechanisms of sensitive periods in brain development as revealed by sight recovery individuals.
Brigitte Röder is member of the German National Academy of Sciences Leopoldina, the Academy of Sciences in Hamburg and the Hector Fellow Academy. Her most important awards include the Gottfried Wilhelm Leibniz Award of the German Research Foundation, an Advanced Grant of the European Research Council (ERC), the Hector Science Award and the Wilhelm Wundt Medal.

Understanding human navigation: strategies, errors, and variability result from dynamic interactions of uncertainty between perception, cognition, and action

Goal-directed navigation is one of the most fundamental natural behaviors. It requires continuously integrating noisy sensations about self-motion and position relative to landmarks, representing them internally into a sense of location and heading direction, concurrently planning future paths, and executing motor actions sequentially. Extensive research on human navigation uses the triangle completion task, in which subjects navigate a triangular-shaped outbound path by picking up a sequence of three objects in a real or virtual environment with landmarks and then returning back to the location of the first object. Perhaps surprisingly, this task is sufficient to elicit a broad range of navigation strategies. However, understanding the origins of errors and variability in navigation strategies, or just the question whether uncertain information from landmarks and path integration are combined when estimating the position or homing direction in navigation are still unresolved with contradicting and puzzling results. Thus, it is still unknown why and under which circumstances these behaviors are adopted and how this might relate to the different sources of uncertainty.
Here we show that a broad range of experimental data from several laboratories, experiments, and conditions can be explained succinctly and quantitatively by a assuming that human carry out probabilistic control under uncertainty involving path planning with a limited time horizon. We show how to recover internal beliefs and navigational costs, explain the origin of navigational strategies, predict biases and variability in navigation and resolve the open question, whether humans weight the navigational uncertainties in navigation.

Constantin Rothkopf
TU Darmstadt

Credit: Daniel Enders TUDa

Biography
Constantin Rothkopf is W3 Professor at the Institute of Psychology and founding director of the Centre for Cognitive Science at the Technical University of Darmstadt. He is also a founding member of the Hessian Center for Artificial Intelligence (hessian.ai), a member of the ELLIS Unit Darmstadt, a member of the DAAD Konrad Zuse Schools of Excellence in Artificial Intelligence ELIZA, and co-spokesperson of the cluster project “The Adaptive Mind” and the LOEWE priority “Whitebox”. After receiving his PhD in Brain and Cognitive Sciences and Computer Science from the University of Rochester, NY, he was a postdoctoral fellow at the Frankfurt Institute for Advanced Studies (FIAS) in the theoretical neuroscience group from 2009. In 2009, he started teaching at Goethe University, Frankfurt and from 2010 to 2012 he was Principal Investigator of the research group "Beliefs, representations, and actions" at FIAS. After a year as a substitute professor at the Institute of Cognitive Science at the University of Osnabrück, he took up the W2 professorship "Psychology of Information Processing" at the TU Darmstadt in 2013. During the winter semester of 2017, he was a visiting professor in the Department of Cognitive Science at the Central European University, Budapest. In 2022, he received an ERC Consolidator Grant from the European Research Council for his project 'ACTOR'. In the summer semester of 2023, he was a Visiting Professor at the Zuckerman Institute, Columbia University, New York, USA.

DISTINGUISHED PUBLIC LECTURE • BURGERVORLESUNG

KLICK: Wie wir in einer digitalen Welt die Kontrolle behalten

Wie trifft man gute Entscheidungen? Oder sollte man diese lieber dem digitalen Assistenten überlassen? Was können komplexe Algorithmen, was nicht? In diesem Vortrag lade ich Sie ein zu einer Reise in die Forschung über den Menschen in der digitalen Welt. Die Herausforderung ist, digital kompetente Bürger zu werden statt schlafwandelnd in die Überwachung zu gehen – durch Tech-Firmen und Staaten. Wenn Häuser, Fabriken und Städte smart werden, warum dann nicht auch die Menschen?

Gerd Gigerenzer
Max-Planck-Institut für Bildungsforschung und *Harding-Zentrum für Risikokompetenz, Universität Potsdam*

Bildnachweis: Arne Sattler

Biographie
Prof. Dr. Gerd Gigerenzer, langjähriger Direktor am Max-Planck-Institut für Bildungsforschung, leitet das Harding-Zentrums für Risikokompetenz an der Universität Potsdam und ist designierter Vize-Präsident des European Research Council (ERC). Er war Professor an der University of Chicago und John M. Olin Distinguished Visiting Professor an der School of Law der Universität von Virginia. Er ist Ehrendoktor der Universität Basel und der Open University of the Netherlands. Er hat u.a. den Preis der American Association for the Advancement of Science (AAAS) für den besten Zeitschriftenartikel in den Verhaltenswissenschaften, den Deutschen Psychologie-Preis und den Communicator-Preis erhalten. Er trainiert Manager, Ärzte und amerikanische Bundesrichter im Umgang mit Risiken und Unsicherheiten. Seine mehrfach ausgezeichneten Sachbücher wie Bauchentscheidungen, Risiko und Klick wurden in mehr als 20 Sprachen übersetzt. Das Gottlieb Duttweiler Institut hat Gigerenzer als einen der 100 einflussreichsten Denker der Welt bezeichnet.

POSTER ABSTRACTS

Submissions with IDs starting with A will be presented in the downstairs lobby area, those starting with B will be presented on the first floor in the "Rektorenzimmer"

ID: A100

Keywords: Lung-brain axis, acute respiratory distress syndrome, lipopolysaccharde, omega 3 fatty acids, resolvin E1

Omega-3 polyunsaturated fatty acids modulate LPS-induced ARDS and the lung-brain axis of communication in wild type versus Fat-1 mice genetically modified for leukotriene B4 receptor 1 or chemerin receptor 23 knock-out

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Specialized pro-resolving mediators (SPMs) and especially resolvin(Rv)E1 can actively terminate inflammation and promote healing during lung diseases like acute respiratory distress syndrome (ARDS). Although ARDS primarily affects the lung, many ARDS patients show neurocognitive impairments as well. To investigate the connection between the lung and brain during ARDS and the therapeutic potential of SPMs and its derivatives, genetically omega-3 polyunsaturated fatty acid (PUFA)-enriched Fat-1 mice were crossbred with ChemR23 (CR) or LTB4 receptor 1 (LR) knockout mice and used in this study. ARDS was induced in these mice by intratracheal application of lipopolysaccharide (LPS, 10µg). Mice were sacrificed at 0h, 4h, 24h, 72h and 120h post inflammation and effects on lung, liver and brain were assessed by RT-PCR, multiplex, immunohistochemistry, western blot and LC-MS/MS. Humoral pathways to the brain did not seem to play a major role as assessed by low-grade systemic inflammation (liver) and modest genomic nuclear factor (NF)-interleukin (IL)6 brain activation. Interestingly, neutrophil trafficking may contribute to underlying mechanisms of lung-brain communication. We revealed that during LPS-induced ARDS, genetic omega-3 PUFAs enrichment and the absence of RvE1 or LR receptors altered mediators of inflammation in the lung, liver and hypothalamus such as IL-17, IL-10 or NFIL-6. Specifically, deficiency of the CR showed more significant effects than the LR on neutrophil markers in the lung and brain. Overall, we showed that the humoral pathway and immune cell trafficking to the brain contributed to immune-to-brain communication during ARDS. Deficiency in RvE1 receptors as well as genetically enriched omega-3 PUFA levels effected lung-brain interaction during ARDS by altering profiles of several inflammatory and lipid mediators. Our new insights into differences in lung and brain lipid mediators provide evidence for potential candidates such as 18-HEPE, RvE1/D2, protectins/marensin 1 to explain omega-3 PUFAs dependent alterations in lung-brain communication.

ID: A101

Keywords: navigation, desert locust, circuit model, neuronal dynamics, steering behaviour

Robust long-range migration with an alternative compass: A circuit model of the desert locust central complex

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The central complex (CX) is the insect brain's navigation hub. In fruit flies and desert locusts, it features a compass-like head direction coding. However, notable differences exist between the two species. In the fly, the protocerebral bridge (PB) features a 2×360° spatial encoding, but data suggest a 1×360° mapping in the locust. Further, the kidney-shaped central body in the locust contrasts with the toroidal ellipsoid body in the fly, rendering an anatomically motivated ring attractor compass unlikely in the locust.

To test whether a 1×360° compass in the PB is compatible with physiological and anatomical constraints of the locust brain, we constructed an integrated firing rate model of CX neurons encoding orientation and responding to rotation (CL1a and CL2, E-PG and P-EN in the fly). Connectivity was constrained by data indicating axon and dendrite positions. Synaptic weights were optimised to yield a robust compass bump shifting in tune with rotation information conveyed by TN neurons. To test whether this model can guide long-distance desert locust migration in a steady direction, we fed its output into the compass layer of a circuit model which produces steering signals to align current and desired headings.

The circuit maintains a stable 1×360° compass signal which is shifted via rotation-dependent asymmetrical synaptic modulation. This is contrary to previous models relying on asymmetric inhibition and excitation, but we have not found a viable solution without modulated synapses. The compass bump transitions between the lateral ends of the PB, indicating that anatomical ring closure is not necessary for effective ring-like network properties. During a simulation, the agent can maintain a steady goal direction and compensate for perturbations. To further test our model, we envision a robotic implementation performing migration-inspired tasks under varying conditions.

ID: A102

Reduced neural activation during preparation of self-induced hand movement in schizophrenia

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Abstract: Hallucinations and passivity-symptoms are core symptoms of schizophrenia. It has been suggested that these symptoms rely at least partly on impaired sensory-motor predictive mechanisms. However, the neural basis of this impairment, especially regarding the prediction and preparation for the processing of action feedback remains unclear. In an fMRI study, patients (n = 21) and healthy controls (n = 24) are asked to detect temporal delays between active and passive hand movements and the connected video feedback (Uhlmann et al., 2021). The video feedback was either their own or someone else's hand moving in accordance with their hand (Uhlmann et al., 2020). Here, we focused on fMRI contrasts between the preparation (before movement execution) of self-induced vs. externally-triggered movements. We observed largely comparable brain activities for both patients and controls within the visual cortex and the left primary motor area. However, patients also showed reduced activity in the left insular for preparing self-induced hand movements, especially in conditions with own hand feedback. Our results suggest that deficits in action outcome monitoring in schizophrenia are already observable on a neural level before an action is executed. Thus, impaired preparatory neural processes might reflect predictive mechanisms which could underline a reduces sense of agency and ego-disturbances in schizophrenia.

ID: B103

Keywords: Individual differences, eye movements, scene descriptions

Tell me your point of view: Individual differences in gaze behavior predict individual differences in scene descriptions

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Individuals show consistent differences in the way they fixate complex scenes (e.g., de Haas et al., 2019), but it remains unclear whether individual gaze results in individual perception. Previous studies show that fixations predict object memory on the group level, but disregard individual differences. To address this gap, we conducted a study with 30 participants who viewed everyday scenes, while we recorded their gaze. After each scene presentation, we asked participants to describe the most relevant aspects of what they just saw. To compare interindividual differences in gaze behavior and scene descriptions, we computed pairwise observer similarities in object fixations and noun occurrences. We found a positive Pearson correlation ($r = .45$, $p < .001$) between the interindividual similarity of observers' gaze and the similarity if their scene descriptions. Further analysis revealed a lower but positive correlation ($r = .22$, $p < .001$) when dwell time differences were collapsed across semantic categories such as faces, implied motion, text, food, or touched objects. Interestingly, we found no correlation when comparing observers' scanpath similarity to description similarity ($r = .004$, $p = .942$). The correlation between the number of fixated objects and the number of named nouns ($r = .07$, $p < .001$), as well as the length of scene descriptions ($r = .14$, $p < .001$), indicated a positive trend that explorative eye movements lead to more detailed descriptions. Together, our results suggest that participants with similar fixation tendencies describe scenes more similarly. Additionally, gaze tendencies for specific object categories appear to play a significant role, which we will explore further. Moreover, we will investigate other fixation properties such as temporal dynamics and object detection or inspection.

ID: B104

Keywords: executive control, mental effort, action control, motivation

When the brain casts doubt: Effects of losing control on executive effort readiness

J. Kolano, **L. Pantke**, **D. Kishore Menon**, **M. Peper**
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The concept of cognitive effort, despite its multifaceted influences on everyday life behavior, is not easily accessible. Assessment is time-consuming and costly and it remains unclear, what factors might influence the decision to invest or refrain from investing cognitive effort? The Expected Value of Control Theory (Shenhav et al., 2016) predicts that the ACC evaluates potential costs and benefits of a given action and selects responses that offer the highest net value, taking into account various factors, such as required cognitive resources, conflicting and emotional stimuli, and outcome probabilities. This study explored the factors underlying cognitive effort by inspecting behavioral indices and self-report measures associated with changes in effort readiness. We assumed that experiencing a loss of action control in a cognitive reasoning task that was due to non-contingent unpredictable feedback, may differentially attenuate the willingness to invest effort in a forced-choice effort discounting paradigm. Out manipulation targeted processing mechanisms in the ACC that were expected to induce distinct behavioral response and decision patterns. Our results indicate that reduced action control may increase negative affect and modify behavioral response and decision patterns. However, these modifications appeared to be differently associated with trait measures such as the disposition of increased behaviour inhibition. Thus, our findings illustrate that behavioral response and decision patterns in cognitive effort discounting paradigms may provide insights into the latent construct of mental effort. This might also lead the way for a future neuropsychological assessment of effort readiness in clinical populations.

ID: B105

Keywords: Emotional Body Language, Individual Differences, Movement Similarities

How Movement Similarities influence the Perception of Emotional Body Language

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When we observe affective body movements, information from the whole body (e.g. kinematic and postural features) is transformed into an understanding of the expressed emotion. It is assumed that the observer integrates the observed actions of others with the own motor repertoire in order to assign meaning. Thus, understanding someone else's emotional expressions might be achieved by performing a simulation based on one's own motor programs. Possible evidence for this is provided by studies that demonstrated that the perception of emotions is influenced by individual characteristics such as a person's tendency to express emotions or one's own movement kinematics such as walking speed.

However, up to now it is unclear how subjective understanding of other people's bodily actions and emotions is related to individual movement patterns. Our study aims to characterize participants' 'emotional expressions regarding predefined movement features in order to explain how those modulate the perception of emotional body language in others.

Therefore, participants (11 male, Ø Age 23,4 ± 4) completed two different experiments. In the first part they were instructed to perform prescripted emotional scenes (Happiness, Affection, Sadness, Anger) while their movements were recorded (3D Motion-Capturing). In the second phase, short videos of point light displays were presented and participants subsequently rated the emotional content and valence of the scene.

Our findings reveal that the similarity between an individual's own movements and the observed scenario exerts a more pronounced influence on the subjective aspect of emotion perception, specifically in terms of perceived emotional intensity, rather than mere categorical labeling of the observed emotion. This aligns with the research of Bellot and colleagues (2023), who emphasized that patients with Parkinson's disease undergo a more pronounced impact on intensity perception but not on emotion recognition due to impaired motor simulation.

ID: A106

Keywords: Escitalopram, Ultrasonic Vocalizations, Anxiety, Social Approach, Amphetamine

Acute administration of SSRI in the rat – Effects on anxiety-like behavior, social approach and amphetamine-induced 50-kHz ultrasonic vocalization

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Selective serotonin reuptake inhibitors (SSRIs) like escitalopram (ESC) are widely used to treat anxiety disorders in humans. Acutely, however, SSRIs can have anxiogenic effects both, in human subjects as well as in rodents. Here, we tested whether ESC has anxiogenic effects in the elevated plus-maze (EPM) and whether ESC affects the responsiveness to playback of appetitive ultrasonic vocalization (USV) or the emission of 50-kHz USV and psychomotor activation induced by d-amphetamine (AMPH). In the EPM, clear anxiogenic effects were found: Animals injected with 1 or 5 mg/kg ESC showed less exploration of and time spent in open arms, as compared to vehicle-treated controls. In a test for social behavior, the higher dose led to reduced locomotor activity, but neither 1 nor 5 mg/kg reduced social approach, as determined by time spent proximal to the social signal source. Finally, in an experiment on amphetamine-induced hyperlocomotion and 50-kHz call production, rats were treated with amphetamine (2.5 mg/kg) or NaCl directly before open field testing. Acute administration of ESC had no effects on amphetamine-induced hyperlocomotion and call production. Rats vocalized more after amphetamine administration and produced more frequency-modulated calls. Together, acute anxiogenic effects of ESC treatment do not lead to prominent alterations in social behavior or stimulant-induced behavioral changes.

ID: A107

Keywords: Neuroanatomy, Mechanosensation, chordotonal organ, insect

Functional morphology of a leg mechanoreceptor complex in stick insects

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Stick insects (Phasmatodea) provide important models for neurophysiology, including mechanosensation. While several mechanoreceptors in the proximal leg are studied in detail, an important mechanoreceptor complex in the tibia, the subgenual organ complex, is less studied for neuroanatomy and functional morphology.

Comparative neuroanatomy shows a consistent neuroanatomy of the subgenual organ complex in Neophasmatodea with two chordotonal organs, the subgenual organ and distal organ. The subgenual organ contains ca. 40 sensory neurons and spans the hemolymph channel with attachment at the inner leg cuticle, which suggests a sensitivity to vibrational stimuli transferred in the hemolymph. The distal organ is so far not characterised for its physiological properties. The ca. 20 sensilla in the distal organ are arranged in a linear, highly ordered array in the tibia. These are positioned in the hemolymph channel, with a connection to the leg cuticle by fine tissue strands, both consistent with an activation by substrate vibrations transferred over the leg.

Notably, the two organs are linked at the ventral side by a strand of connective tissue. This connection affects the morphology of the subgenual organ by pulling it in distal direction. This linkage of the two organs possibly affects the mechanical properties of the subgenual organ, possibly reducing its sensitivity. In addition, the response properties of the two organs may be rather similar, compared to a hypothetical situation of separate organs with distinct mechanical couplings. While both likely respond over a range of vibrational frequencies, the frequency distinction between subgenual organ and distal organ may be limited.

ID: A108

Keywords: Pain, Placebo analgesia, Classical conditioning

Pharmacological conditioning in a rat model of inflammatory pain to study mechanisms of placebo analgesia

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Introduction: While the phenomenon of placebo analgesia is well-documented in humans, the translation into a reliable animal model is still challenging. In this study, we aim to apply an established protocol of taste-associative learning to induce behaviorally conditioned analgesia.

Methods: We use a rat model of Complete Freund's Adjuvant (CFA)-evoked paw edema to induce symptoms of inflammatory pain. From day 2 after CFA-injection, rats are repeatedly treated with ibuprofen or morphine. Application of analgesic drugs (*unconditioned stimulus*, US) is paired with presentation of a novel sweet taste (*conditioned stimulus*, CS) three times (*acquisition*). In the following retrieval phase, rats are re-exposed to the taste to induce a conditioned response, mimicking the pharmacological effects. We assess spontaneous (Open-Field-Test) and evoked pain-related behaviors (Von-Frey-Test, Plantar-Heat-Test), and examine inflammation-associated changes in structures of the afferent nociceptive system (e.g., dorsal root ganglia, spinal dorsal horn).

Results: Intraplantar injection of CFA induces a robust paw edema for eight days, accompanied by a consistently enhanced mechanical and thermal sensitivity. Spontaneous activity is reduced for 24h but returns to baseline from day 2. Repeated intraperitoneal injection of ibuprofen and morphine on every other day results in a drug-induced analgesia. Taste-associative learning with ibuprofen as US results in conditioned analgesia, when rats are re-exposed to the taste with a placebo injection.

Discussion: With an established taste-associative learning paradigm, we will be able to analyze cellular and molecular mechanisms of learned analgesic effects in a rodent model of inflammatory pain, which might contribute to a better understanding of placebo analgesia in humans.

ID: B109

Keywords: eye movements, interception, action

Adaptive eye movements in gamified interception task (Pong)

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Eye movements are commonly explored through simple tasks with repeated trials under highly restricted conditions. To address the challenge of extending these findings to natural sequential behaviors while maintaining experimental precision, we used a gamified interception task. Participants engaged in an iPad-based Pong game while their eye movements were captured using a mobile eye tracker (Tobii Pro Glasses 3). Participants controlled a paddle on the bottom of the screen to intercept a moving dot (ball) whilst an automated opponent intercepted the ball at the top of the screen. They scored points whenever the ball passed the opponent's paddle exiting the screen. We manipulated paddle shape (rhombus or rectangle) and ball speed (normal or fast). Notably, interception performance declined for rhombus-shaped paddles and fast balls. Eye movements were adapted over time relative to the moment of interception. Participants closely tracked the ball (pursuit) immediately before and after their interception action. Interestingly, during the opponent's interception, participants rather shifted their focus from the ball to the opponent's paddle. Additionally, participants minimized saccades and blinks during both their own and the opponent's actions. Crucially, interception performance was related to preceding eye movements: When participants successfully hit the ball, there was a heightened likelihood of them tracking it right before acting, in contrast to instances where they missed. In essence, our findings underscore the dynamic adjustment of eye movements to task demands which seems to be beneficial for task performance.

ID: B110

Keywords: aging, prediction, uncertainty, eye hand coordination, smooth pursuit

Age-effects on Gaze and Hand Movements when Intercepting (Un)Predictable Moving Targets

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Preventing an uncontrolled rolling egg from falling off the kitchen table requires precise, synchronized eye and arm movements while anticipating the unpredictable path of the egg. When the egg's path is unpredictable, one will likely track the egg to sample information about its future position, and when a reliable prediction is formed, then one may bring gaze to the position where the egg is expected to fall off the table. Yet, tracking a moving object is subject to sensorimotor delays, as eye movement at a single instance is based on sensory information obtained in the past. These sensorimotor delays can get longer with aging, and therefore older adults may reduce sensory sampling, adapting their sensorimotor system accordingly. In two experiments, we examined how aging affects eye and hand movements when intercepting a moving target. Younger (23-37 years) and older (57-64 years) healthy adults had to intercept a moving target, while the interception location was of high or low spatial certainty. Further, target path was manipulated and either predictable or unpredictable. Preliminary results show, that older adults predict the interception location earlier than younger adults. While eye onset is similar across groups, older adults shift their gaze and hand movement on the interception location before younger adults. By predicting the future interception location older adults presumably compensate for their sensory decline and longer latencies. The longer sampling duration of the interception location provides richer sensory input to intercept the target temporal and spatial correctly. Indeed, older adults' hand duration over the correct interception location was longer than younger adults. With less certain interception locations the target was longer pursued in both age groups. In sum, the current data suggest that online visual sampling is not compromised by aging but gaze might be deployed differently with higher interception location certainty.

ID: B111

Keywords: face perception, scene perception, eye tracking, convolutional neural networks (CNNs)

Prior Scene Information Facilitates Face Detection

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Humans detect faces across various scene contexts with remarkable speed and accuracy. While scene information is known to affect object detection, its influence on the rapid detection of faces remains unclear. To investigate this, we presented participants (n=38) with 120 natural target scenes and recorded their eye movements during a face detection task. Each target scene, belonging to one of twelve indoor scene categories (e.g., bathroom, basement), contained a single face. For each target scene, we produced a corresponding face-less version by editing the image manually. Before each target scene, participants were shown either an initial preview of the face-less version or a gray screen (no preview) for 250 ms. The allocation of which half of the images were previewed was counterbalanced across participants. Participants' first saccade on the face occurred earlier with the face-less scene preview than in the no-preview condition (mean time to fixation: 207 vs. 216 ms; $p<0.001$). The category of the target scene also affected face detection latency ($p<0.001$). Using partial correlations, we found that basic face features (e.g., face size, face eccentricity) and features extracted from deep convolutional neural networks contributed distinctively to the variance in face detection latency. Our results reveal that prior scene information enhances human face detection in multi-faceted ways, challenging purely bottom-up accounts of face detection.

ID: B112

Keywords: Cross-cultural processing, prosody perception, linguistic prosody, emotional prosody

L2-categorization of linguistic and emotional prosody in German: an EEG-study

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The present study compared the perception of linguistic (*STATEMENT, QUESTION*) and emotional (*NEUTRAL*, *LIKE*, *DISGUST*) prosody between native German speakers (L1) and Chinese German learners (L2). Behaviorally, both groups were successful in categorizing linguistic prosodies, but the L1 speakers were more accurate in identifying the presented emotional prosodies. For linguistic prosody, ERP analyses revealed differences between the groups in an early time window (150-250 ms) but not in the later time windows, suggesting that L2 learners are more sensitive to pitch modulation at the level of acoustic analysis but decode linguistic prosody similarly to L1 speakers. In the task testing emotional prosody, both groups showed an early (250-400 ms) and late (400-750 ms) effect for the processing of *LIKE* compared to *DISGUST*, suggesting universal components of emotional prosody processing. An additional anterior negativity observed in the L2 learners may suggest language- and cultural-specific modification in emotional prosody processing.

ID: A113

Keywords: CYLD, cell death, ferroptosis

Metabolic effects of CYLD knockout mediating protective effects in models of ferroptosis

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The deubiquitination enzyme CYLD is associated with multiple cellular processes and diseases, such as cylindromatosis, a genetic disorder, which leads to skin tumours. In a CYLD knockout mouse model, we found protection against traumatic brain injury and acute neuronal damage *in vivo* (1). The molecular mechanisms underlying the observed resistance to neuronal cell death by CYLD-knockout form the essential part of our current research.

We compared two CRISPR/Cas9 CYLD-KO cell lines with HT22 wildtype cell lines, using biochemical methods like MTT assay, xCelligence, FACS Annexin/PI, Seahorse assay and Western blot to investigate oxidative cell-death mitochondrial parameters.

The depletion of CLYD mediated significant neuronal protection against oxidative stress and ferroptosis induced by the small molecules Erastin and RSL-3, and reduces oxidative cell damage. Further, CYLD deletion was associated with an upregulation of the transcription factor HIF-1-α and reduced mitochondrial respiration while the glycolytic activity remained comparable to the CYLD-positive wildtype control.

Based on our results, we suggest a metabolic re-programming in CYLD-KO cells, that mediates mitochondrial and cellular resistance against oxidative damage and ferroptosis.

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ID: B114

Keywords: individual differences; saccades; inferior temporal cortex; hyperalignment; movie

Does individual gaze lead to individual visual representations?

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Previous research has found evidence for a shared geometry of movie representations across brains. Hyperalignment is a machine-learning technique to compare such geometries across individual brain topographies and allows cross-brain decoding of movie snippets from inferior temporal cortex (IT) far above chance (Haxby et al., 2011, Haxby et al., 2020). However, decoding performance is also far from perfect. Here, we asked whether errors in hyperalignment are purely due to measurement noise or reflect genuine individuality of neural representations. We hypothesized that individual differences in eye movements (e.g. Bargary et al., 2017; de Haas et al., 2019; Constantino et al., 2017; Broda & de Haas, 2022) lead to systematic divergence of neural representations beyond topography. First, we found that individual saccadic rates and amplitudes towards a feature film ('Shaun the Sheep') varied up to factor 2 (n = 38) in an eyetracking experiment. Then, we used functional MRI in a subset of participants (n = 14) to test how predictive inferior temporal representations of one observer were for those of another, in two conditions. Participants watched movie segments either freely moving their eyes or fixating centrally. We then used a customized version of hyperalignment to test cross-decoding accuracy, separately for each pair of observers and condition. Results showed that the amplitude of BOLD responses dropped significantly for central fixation compared to free-viewing ($t = -4.63$, $p < .001$, across IT). Nevertheless, cross-decoding performance significantly *in*creased from 38% to 63% ($t = 11.27$, $p < .001$). We conclude that individual eye movements enhance the neural signal evoked by visual stimulation, but also lead to more individual representational geometries. Our next step will be to disentangle the contribution of different gaze parameters to the inter-individual divergence of neural representations.

ID: B115

Keywords: individual differences, internal models, scene perception, drawing

Individual Differences in Internal Models Determine Scene Perception

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How does our brain make sense of the complex inputs it receives during everyday vision? Widely applied predictive processing theories suggest that visual inputs are compared to internal models of the world. On this view, effective visual perception is thought to occur when these inputs align well with our internal models. However, the specific contents of these internal models in individual people are not yet well understood. To explore individual differences in internal models, we conducted a drawing study that enabled participants to provide unconstrained descriptions of their internal models for different natural scenes. Specifically, participants were asked to draw typical versions of scenes (e.g., a typical kitchen or living room). On the group level, the composition of these drawings was well described by the occurrence frequency of objects in a large set of natural scene photographs, as well as by the objects' conceptual distance to the scene category in a distributional semantics model. Notably, individual drawings varied substantially between people. Our key hypothesis was that these variations capture individual differences in internal models that are capable of predicting differences in perception. To test this hypothesis, we constructed controlled 3d-rendered scenes from the drawings and asked participants to categorize them under brief presentation times. Across two studies, we found that participants were more accurate at categorizing scenes that were similar to their own drawings, compared to other people's drawings, supporting the idea that individual differences in internal models can affect scene perception. Overall, our findings shed new light on why visual perception differs across participants. Our methods further provide a new impulse for the development of a truly personalized approach to visual perception.

ID: B116

Keywords: Face perception, Computational stduy, emotion identification

A Computational Study of Differential Importance of Facial Sub-Regions in Emotion Identification

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Several empirical studies, e.g. via masking or eye-tracking, have suggested that different parts of the face may be differentially important for humans in the identification of different emotional states. However, few studies have investigated the objective importance of facial features in various facial categorization tasks. We present a computational approach that allows the quantification of the “ideal” importance of facial features for the detection of expressions. We then present a visualization technique that allows the assessment of not only how much each pixel contributes to the identification of each facial emotion, but also how different parts of the face may contribute redundant information. Our results indicate that the detection of “happy” depends largely on information in the mouth region, but importantly, while there is also substantial useful information in the eye region, that information is highly correlated with that in the mouth region. For the identification of “fearful” or “angry”, not only is most of the useful information in the eye and eyebrow region, but the useful information in the mouth region does not correlate with that in the eye region. Our model predicts that human observers should fixate the eye region for identifying different possible expressions, while those who prefer the mouth region may be selectively impaired in "fearful" or "angry" identification but not "happy" identification. This is particularly evident in individuals with autism spectrum disorder (ASD), who prefer the mouth region over the eye region. The results show that human face processing is well-adapted to the statistical properties of faces in the natural environment, explaining why certain behavioral impairments may occur when attention is misallocated. The computational techniques presented in this work can be useful for studying other-race effects and developing novel diagnostic and treatment techniques in clinical populations with known deviations in fixation behavior and affect processing.

ID: B117

Cues for predictive eye movements in naturalistic scenes

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Eye movements are often investigated with simple and controlled stimuli, under the assumption that results can be generalized to the real world. We previously tested this by comparing tracking of the same trajectories, either as an isolated target or embedded in a naturalistic video, the movement of a puck in an ice hockey game. We observed that the oculomotor system was able to leverage the contextual cues available in the naturalistic scene to produce highly predictive eye movements. Here, we wanted to asses which factors are critical for achieving this predictive advantage by manipulating (1) expertise, (2) the amount of available peripheral information, and (3) contextual and kinematic cues. When peripheral information was manipulated by decreasing the visible area of the video, the predictions of all observers decreased. However, expert ice hockey fans were consistently more accurate and better in predicting than novices and also benefitted more by additional peripheral information. Artificial contextual cues about the position of the players did not lead to a predictive advantage, whereas impairing the causal structure of kinematic cues by playing the video in reverse led to a severe impairment. Watching the video upside down, potentially making the kinematic cues more difficult, did not significantly affect predictive behavior. Together, these results demonstrate that when contextual information is available in naturalistic scenes, the oculomotor system is successfully integrating them and is not only relying on low-level information about the target trajectory. Critical factors seem to be the amount of available information, expertise with the stimuli and especially for our ice hockey videos the availability of intact kinematic cues for player movements to predict what is going to happen next.

ID: B118

Keywords: Mental rotation, Motor skills, Visuo-spatial prediction, Shepard-Metzler block task

Relationship between Mental Rotation Ability and Motor Skills in 4- to 6-year-old children

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Mental rotation ability is crucial for object recognition and visuo-spatial prediction. Recent studies suggest a strong interplay between mental rotation and motor abilities during infancy (Schwarzer et al., 2022). While improvements in mental rotation performance have been observed in children between the ages of 3-to-5 (Frick et al., 2013), limited research has explored the relationship between this cognitive ability and motor skills within this age group. To address this research gap, our ongoing study with 4-to 6-year-old children aims to understand the development of the relation between motor skills and mental rotation ability beyond infancy. To assess mental rotation ability, we created a block task with a modified Shepard-Metzler object and its mirror object (Shepard & Metzler, 1971) and two 3D boxes with a cut-out of the corresponding objects. The task involves presenting the two objects in various orientation (along X axis and Y axis) and rotation angles (0 to 180 degrees) and one 3D box in which only one of the objects fits. Each child is asked (i) to point at the object that would fit into the box (perception) and (ii) to grasp and fit the object into the box (action). Motor skills are assessed using LoMo (Jascenoka & Petermann, 2018). Preliminary data analysis reveals that the 6-year-olds show more accurate responses in both parts of the mental rotation task compared to 4-year-olds. There is a positive correlation between motor skills and action part of the mental rotation task in older children, suggesting their interdependence beyond infancy.

ID: A119

Keywords: Selenocompounds, GPx4, RSL3, Ferroptosis

Novel Ebselen-derivatives for pharmacological interference of RSL3-mediated ferroptosis in neuronal HT22 cells

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Ferroptosis is a caspase-independent regulated cell death process characterized by iron-dependent accumulation of reactive oxygen species (ROS), primarily through lipid peroxidation and mitochondrial ROS formation. Decreased activity of glutathione peroxidase 4 (GPx4) and enhanced lipoxygenase (LOX) activation are considered pivotal triggers of ferroptosis [1]. The selenoperoxidase GPx4 serves as a critical regulator due to its unique ability to reduce complex hydroperoxides, disrupting the harmful lipid peroxidation chain reaction [2-4]. Ebselen, an organoselenium compound mimicking GPx4's antioxidant role [5], is limited in neurodegenerative disorder treatment. This study introduces three novel Ebselen derivatives, evaluated for ferroptosis therapy potential.

Using mouse hippocampal neurons (HT22 cells), nanomolar concentrations of the GPx4 inhibitor RSL3 induced oxidative cell death. The effects of Ebselen and the novel selenocompounds were studied using fluorescence-activated cell sorting (FACS) for lipid peroxidation, cell death, ROS generation, and mitochondrial parameters like ROS production, lipid peroxidation, and mitochondrial membrane potential. Furthermore, mitochondrial respiration was assessed using the Seahorse XF analyzer, while cell viability was detected via MTT- and ATP assays. Mitochondrial size, GSH concentration, and GSH/GSSG ratio were assessed using microscopic techniques and GSH/GSSG Glo assay.

Both Ebselen and the selenocompounds prevented RSL3-induced cell death. While Ebselen concentrations of 15 µM were required to protect HT22 cells against RSL3, the novel selenocompounds exhibited enhanced potency, and concentrations as low as 1 µM reduced lipid peroxidation, ROS production, mitochondrial impairment, and conferred complete protection against oxidative cell death. Notably, the selenocompounds exhibited a concentration-dependent protective trend even at high RSL3 concentrations. Moreover, the new Ebselen-derivatives maintained GSH content and mitochondrial length after ferroptosis induction.

In comparison to Ebselen, structurally modified selenocompounds showed robust protection at concentrations of 0.5 µM to 1 µM, tenfold lower than Ebselen. The distinctly enhanced protective outcomes of these novel selenocompounds underscores their potential as therapeutic candidates for attenuating ferroptosis.

ID: B120

Keywords: deep learning, artificial neural networks, color categorization, color perception

Deep Reconciliation of Categorical Colour perception

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We perceive colours categorically. Our perceptual system separates a continuous space into distinct categories. The most prominent example is the rainbow, there are no discontinuities in its colour spectrum, yet we see discrete bands. The underlying reason, particularly the role of language, has spawned a heated debate between universalists and relativists. We reconcile these two explanations by studying vision-language and pure-vision deep neural networks (DNN). The results of our odd-one-out experiments show that pure-vision models (e.g., ImageNet object recognition networks) explain 85% of human data. In turn, suggesting a large part of our categorical colour perception is purely driven by visual signals. The remaining 15% is explained with vision-language models (e.g., CLIP text-image matching networks) even when tested without their language module. In turn, suggesting colour categories is a free-from-language representation, yet linguistic colour terms have influenced its development. We investigated whether colour categories emerge in all pure-vision models by studying Taskonomy networks trained on 24 visual tasks. Human-like colour categories appear only in less than half of those models, namely, networks trained on semantic (e.g., image segmentation, object recognition, and scene classification) or 3D tasks (e.g., shade from shaping, surface normal prediction, and depth estimation). Our results show low-level tasks (e.g., autoencoding and denoising) never obtain human-like colour categories. It also matters whether a network is trained on 2- or 3-dimensional outputs for the same perceptual task. Networks trained on 3D tasks of edge and keypoint detection obtain human-like colour categories but not their corresponding 2D networks. Overall, our findings provide evidence for the utility of categorical colour representation in several visual tasks but also indicating a portion of categorical colour perception can only be explained by the language component, reconciling both universal and relative theories.

ID: B121

Humans use Newtonian physics in intuitive sensorimotor decisions under risk

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How do humans make decisions under risk? This question has classically been studied with choices between uncertain gambles involving explicit monetary rewards, which have long been known not to maximize expected utility. In contrast, sensorimotor actions, which have more recently been also been modeled as decisions under risk, are well described by statistical decision theory in many tasks. However, because many naturalistic scenarios of sensorimotor decisions are inescapably governed by the laws of physics, the question arises, how humans act under circumstances in which sensorimotor decision require intuitive physical knowledge. Here, we integrate intuitive physics with sensorimotor decision-making. In an experiment, participants slid pucks to target areas, providing gains and losses in a virtual environment so that the uncertainty inherent in motor control interacts with the physical relationships governing object motion. Using computational modeling with several generative models of participants' sliding actions, we find evidence that humans use Newtonian physics in their motor decisions for scenarios with prospective economic outcomes.

ID: B122

Keywords: Gesichterverarbeitung, hemisphärische Lateralisation, periphäre Stimulation, fMRT

Hemisphärische Lateralisation der neuralen Verarbeitung von Gesichtern: Eine fMRT-Studie

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Auf Hirnsystemebene erfolgt die Gesichterverarbeitung in einem spezialisierten bilateralen neuralen Netzwerk. Wichtige Regionen in beiden Hemisphären sind hierbei die sogenannte Occipital Face Area (OFA) und die Fusiform Face Area (FFA). Diese funktionelle Magnetresonanztomographie-Studie untersuchte Veränderungen im Aktivierungsmuster dieses Gesichtsnetzwerks bezüglich Aktivierungsstärke und Hemisphärenlateralisation, wenn Gesichter zentral oder peripher präsentiert werden.

Bei 20 gesunden rechtshändige Probanden wurden Gesichter und Objekte sowohl foveal als auch parafoveal bei 4° visueller Exzentrizität präsentiert, jeweils links und rechts. Die Analyse konzentrierte sich auf neuronale Aktivierungsmuster im primären visuellen Kortex (EVC) sowie den gesichtsverarbeitenden Regionen (OFA/FFA).

Die Resultate zeigten, dass foveale Präsentationen generell höhere Aktivierung aufwiesen als parafoveale. Es wurden keine signifikanten Unterschiede in der Aktivierung zwischen den Hemisphären des EVC und der OFA festgestellt. Allerdings wurde eine signifikane Mehraktivität in der rechten FFA bei fovealer Präsentation beobachtet.

Im Vergleich zur fovealen Stimulation wiesen parafoveale Präsentationen signifikante kontralaterale Aktivitätsunterschiede im EVC auf, sowohl zwischen den Hemisphären als auch innerhalb einer Hemisphäre zwischen Stimulusbedingungen. Ebenfalls zeigte sich, dass die kontralaterale Stimulation keine signifikant niedrigere Aktivität zeigte wie die foveale Stimulation in derselben Hemisphäre.

In OFA und FFA waren die Aktivierungswerte für beide Stimulusbedingungen in beiden Hemisphären signifikant niedriger als bei fovealer Präsentation. Es zeigte sich eine signifikante kontralaterale Präferenz nur in der rechten – jedoch nicht in der linken – Hemisphäre.

Die ermittelten Lateralitätsindizes bestätigten die kontralaterale Präferenz bei parafovealer Stimulation. Foveale Präsentation bevorzugte die rechte Hemisphäre. Für die rechte FFA konnte keine klare Hemisphärendominanz bei rechter Stimuluspräsentation festgestellt werden.

Generell wies die rechte Hemisphäre tendenziell höhere Aktivierung auf, besonders im EVC und FFA. Jedoch waren diese Unterschiede nicht statistisch signifikant über alle Regionen und Stimulusbedingungen.

Zusammenfassend führt foveale Präsentation zu höherer Aktivierung und einer Tendenz zur rechten Hemisphäre. Parafoveale Präsentationen induzieren kontralaterale Stimulationen in visuellen Arealen und betonen die Bedeutung der rechten FFA für die Gesichtsverarbeitung.

ID: B123

Keywords: gaze eye-tracking fMRI alexithymia Theory of Mind ToM

Seeing things differently: How gaze shapes neural signal during Theory of Mind according to alexithymia

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Studies about social cognition regularly use complex visual stimuli to asses neural processes associated with abilities like “Theory of Mind” (ToM). However, when looking at a complex visual stimulus, gaze patterns shape neural activation. Thus, if gaze patterns differ systematically between individuals, wrong conclusions about the origin of revealed activation differences may be drawn. These obstacles can be overcome by the combined analysis of neural activation and natural viewing behavior. We combined functional magnetic resonance imaging (fMRI) with eye-tracking to assess effects of unconstrained gaze on neural ToM processes in healthy individuals with different levels of alexithymia. First, participants with high alexithymia levels looked less at eyes in both ToM and task-free viewing contexts. Second, we found that neural ToM processes were not affected by individual differences in alexithymia per se. Instead, depending on alexithymia levels, gaze on critical stimulus features reversely shaped neural signal in medial prefrontal cortex (MPFC) and anterior temporo-parietal junction (TPJ). These results emphasize that natural selective attention affects fMRI patterns well beyond the visual system. Our study implies that, whenever using a task with multiple degrees of freedom in scanpaths, ignoring the latter might obscure important conclusions.

ID: B124

Keywords: OTS-words, reading, fMRI, visual categories

Both mOTS-words and pOTS-words prefer emoji stimuli over text stimuli during a reading task

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The visual word form area in the occipitotemporal sulcus, here referred to as OTS-words, plays a critical role in reading and has been shown to respond more strongly to words than other visual categories. As in most prior fMRI studies only the text stimuli were readable, we hypothesized, that this region's preference for text may be driven by a preference for reading tasks. To test this, we performed three fMRI experiments (N=15) to investigate mOTS-words and pOTS-words and systematically varied the participant's task and the visual stimulus. In experiment 1, we contrasted text stimuli with non-readable visual stimuli (faces, limbs, houses, and objects). In experiment 2, we used a fMRI adaptation paradigm, presenting the same or different compound words in text or emoji formats. In experiment 3, participants performed either a reading or a color task on compound words, presented in text or emoji format. Using experiment 1 data, we identified left mOTS-words and pOTS-words in the native brain space of each participant by contrasting text stimuli with non-readable stimuli. In experiment 2, pOTS-words, but not mOTS-words, showed fMRI adaptation for compound words in both text and emoji formats. In experiment 3, surprisingly, both mOTS-words and pOTS-words showed higher responses to compound words in emoji than text formats. Moreover, mOTS-words, but not pOTS-words, also showed higher responses during the reading than color task and more so for words in the emoji format. Multivariate analyses of experiment 3 data showed that distributed responses in pOTS-words encode the visual stimulus, whereas distributed responses in mOTS-words encode both the stimulus and the task. Together, our findings suggest that the function of the OTS-words subregions goes beyond the specific visual processing of text and that these regions might be flexibly recruited whenever semantic meaning needs to be assigned to visual input.

ID: A125

Keywords: newborns, myelin, white matter, grey matter, development

Cortical and white matter myelin contents are linked in newborns

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During infancy, the human brain rapidly builds myelin, a fatty sheet that is wrapped around axonal fibers, and plays a crucial role in facilitating efficient communication across the brain. The myelin content of both the white matter and the gray matter of the have each been linked to neural circuit efficiency and cognitive abilities in infants. In this study, we test whether myelination in the white and gray matter are linked in newborns using data from the Developing Human Connectome Project (dHCP). In total, we will analyze two data sets from 1197 individual newborns (ages at birth: 23-45 gestational week, ages at scan: full-term subjects scanned between 37-44 weeks, preterm-born subjects scanned soon after birth or at term-equivalent age). Here we report pilot data from 5 randomly chosen individuals (ages at birth: 29-42 weeks gestational age, ages at scan: 38-42 weeks gestational age). In each individual, we identified 20 (9 bilaterally) white matter bundles using automated software we developed (pyBabyAFQ) and mapped their termination in gray matter. We then correlated T1w/T2w, a myelin-sensitive imaging contrast, measured along the white matter bundles with T1w/T2w measured at the gray matter terminations of each bundle. Our findings showed a correlation between T1w/T2w measured within the bundle and T1w/T2w measured at the cortical termination of each bundle (R^2=0,63, p=2.50e-05). As T1w/T2w is linked to myelin content, these initial findings highlight the intricate interplay between white and gray matter myelination during early brain development. We propose that these observations may be explained by experience-dependent myelination, so that social interactions, sensory stimulation, and several forms of learning simultaneously impact myelination of grey and white matter.

ID: A126

Semantic Priming in Major Depressive Disorder: An Electrophysiological Investigation

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The present electrophysiological study aims to investigate rather understudied aspects of lexical processing in Major Depressive Disorder (MDD). Specifically, the aim was to investigate activation propagation at the lexico-semantic level in MDD, and thus to explore the underlying pathomechanism of speech alterations. Semantic abnormalities have already been observed in several electrophysiological studies using the indirect semantic priming paradigm in other cohorts of patients, such as in Schizophrenia (SZ) (Kuperberg et al., 2019). The present study was designed to investigate semantic priming in MDD (Georgieff et al., 1998; Iakimova et al., 2009) and to fully understand the relationship between semantic priming and MDD and its potential as a diagnostic or treatment outcome measure.

For this purpose, an electrophysiological investigation was performed using a semantic masked priming paradigm in two groups of participants (with MDD and healthy controls (HD)) consisting of directly (e.g., *tiger – stripes*) and indirectly (e.g., *lion – stripes*) related prime-target pairs and an unrelated condition (e.g., *knot – stripes*). It was hypothesized that in MDD a stronger automated indirect semantic priming effect compared to HC is present. While we found a priming effect around 300 to 500 ms from target onset in the HC group for the direct semantic priming condition, we observed priming effects in MDD for both directly and indirectly related prime-target pairs. Our findings thus provide neural evidence for abnormally broad automatic lexical-semantic activity in MDD, as has previously been reported for SZ. This provides evidence for diagnosis-shared abnormalities in semantic processing and common underlying neuronal mechanisms across psychiatric disorders. Our findings align with studies showing large (neuro)biological overlap across psychiatric disorders including symptoms, genetics, environmental risk factors, and cortical measures among others.

ID: B127

Keywords: Emotionswahrnehmung, Körperbewegungen, Kinematik, Point-Light Displays

Der Beitrag von Bewegungsmerkmalen für die Emotionserkennung aus Körperbewegungen bei 5-jährigen Kindern und Erwachsenen

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Bisherige Studien zur Emotionswahrnehmung bei Kindern nutzten hauptsächlich Gesichter und Sprache als emotionale Stimuli. Viel weniger ist über die Emotionswahrnehmung aus Körperbewegungen bei Kindern bekannt. Unsere Studie untersuchte, ob die Verarbeitungsvorteile, die in Studien zur Wahrnehmung von emotionalen Gesichtern und Wörtern für positive Emotionen bei Kindern und für negative Emotionen bei Erwachsenen gefunden wurden (Bahn et al., 2017; Vesker et al., 2018), auch bei der Wahrnehmung von emotionalen Körperbewegungen auftreten. Außerdem wollten wir herausfinden, welche spezifischen Bewegungsparameter zur Emotionswahrnehmung von interaktiven Dyaden im Vergleich zu nicht-interaktiven Monaden bei Kindern und Erwachsenen beitragen. In einer Kategorisierungsaufgabe bewerteten 5-jährige Kinder und Erwachsene wütende und fröhliche Point-Light Displays (PLDs), welche emotionale Szenen entweder von einer Person (Monade) oder von zwei interagierenden Personen (Dyade) zeigten. Mithilfe von repräsentativen Ähnlichkeitsanalysen haben wir intra- und interpersonelle Bewegungsparameter der PLDs bestimmt und sie mit den emotionalen Ratings der Probanden in Zusammenhang gebracht. Die Ergebnisse zeigten signifikant höhere Erkennungsraten fröhlicher PLDs bei 5-Jährigen und wütender PLDs bei Erwachsenen für Monaden, aber nicht für Dyaden. In beiden Altersgruppen hing die Emotionserkennung signifikant mit kinematischen und posturalen Bewegungsparametern zusammen, wie z.B. der vertikalen Bewegung und der Gliedmaßenkontraktion. In Dyaden waren außerdem interaktive Parameter, wie beispielsweise die interpersonelle Distanz, relevant für die Emotionserkennung. Somit scheint die Emotionswahrnehmung aus Körperbewegungen in Monaden eine ähnliche Entwicklungsverschiebung von einem Verarbeitungsvorteil positiver Emotionen zu einem Verarbeitungsvorteil negativer Emotionen zu erfahren, wie dies zuvor für emotionale Gesichter und Wörter festgestellt wurde. Interessant ist, dass Kinder und Erwachsene trotz dieser altersspezifischen Verarbeitungsvorteile bei der Emotionsverarbeitung ähnliche Bewegungsparameter verwenden.

ID: A128

Keywords: optogenetic; paradoxical kinesia; inferior colliculus; catalepsy; Parkinsonism

Optogenetic stimulation of the inferior colliculus activates neurons in the mesencephalic locomotor region and induces paradoxical kinesia

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Paradoxical kinesia refers to a sudden transient ability of akinetic Parkinsonian patients to perform motor tasks they are otherwise unable to perform. However, the neuronal mechanisms underlying paradoxical kinesia are still unknown. Previous studies pointed at the inferior colliculus (IC), as a potential structure involved in paradoxical kinesia. The present study used electrophysiological recordings and optogenetic stimulation to evaluate the hypothesis that IC neuronal projections to the mesencephalic locomotor region (MLR) are involved in paradoxical kinesia. In order to test this hypothesis, we investigated whether optogenetic activation of neurons in the IC could modulate neuronal activity in the MLR in anesthetized rats and induce paradoxical kinesia in cataleptic awake rats. Wistar male rats received a microinjection of adeno-associated-viruses (AAV-ChR2) for channelrhodopsin expression or an AAV-control in the IC. Then, an optical fiber was placed in the IC and the rats were submitted to two experiments: Experiment 1- electrophysiological recordings were performed in IC and MLR neurons during IC-optogenetic stimulation in anesthetized rats and experiment 2 – optical stimulation was applied in the IC and catalepsy period was assessed during a bar test in awake rats after having received haloperidol. Activity of 267 neurons were recorded in IC and MLR. Optogenetics stimulation resulted in a significant activity increase of 89.1% of IC-recorded and 52.9% of MLR-recorded neurons. These results demonstrate a functional modulation of MLR neuron activity by IC neuronal projection. Optogenetic stimulation of this IC-MLR projection in ChR2-AAV awake rats induced a decrease in the catalepsy state, i.e. led to paradoxical kinesia. In conclusion, the present study demonstrates that the IC-MLR projection could induce paradoxical kinesia and be an alternative target for improving motor impairments in Parkinsonian patients.

ID: B129

Keywords: Face perception, facial motion, facial identity

Between identity and motion: uncovering the features that make your face unique

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In the field of face perception, the question of whether facial identity and facial motion are processed in an independent or interactive manner remains a subject of ongoing debate. While early models posited separate yet parallel pathways for each, more recent research offers evidence for both independent and integrated processing mechanisms for facial identity and motion. For instance, individuals exhibit unique idiosyncrasies in facial motion. However, the specific features contributing to this uniqueness remain unclear. Our study aims to identify these distinctive characteristics by analyzing the non-rigid motions of facial landmarks across different actors and expressions, extracted from the MPI's large face database. Initial landmark analysis allowed for the extraction of various motion components, which were then evaluated for consistency within and between actors across multiple expressions. Our results offer promising insights into the idiosyncratic markers that contribute to facial identification. Detailed findings and their implications will be further discussed in the poster.

ID: A130

Keywords: Childhood Maltreatment, Childhood Sexual Abuse, MRI, GMV, cortical thickness

Specific effects of childhood sexual abuse on brain morphometry in gray matter volume and cortical thickness

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Background: Childhood sexual abuse (CSA) is linked to specific morphometric changes, including thinning of the somatosensory cortex and gray matter volume (GMV) loss in the visual cortex. Given that victims of CSA often additionally experience other forms of Childhood Maltreatment (CM), interpretation of respective findings is challenging, as generally higher trauma load might drive these morphometric changes. Addressing this concern, this is the first study to explore specific effects of CSA on GMV and cortical thickness while accounting for general trauma load.

Method: CM was assessed using the Childhood Trauma Questionnaire (CTQ). Brain structural data (3T magnetic resonance imaging) were analyzed using voxel-based (GMV) and surface-based (cortical thickness) morphometry (SPM, CAT12 toolbox), applying threshold-free cluster enhancement (TFCE). 195 sexually abused individuals (healthy subjects and depressed patients, aged 18-65) were matched 1:1 to individuals with CM other than CSA regarding age, sex, diagnostic group distribution and overall trauma load (CTQ sum score).

Results: We identified larger GMV in the right exterior cerebellum in individuals with CSA compared to non-sexually maltreated individuals. Furthermore, the CSA group exhibited wide-spread increases in cortical thickness across a heterogeneous set of fronto-parietal regions.

Conclusion: As of now, this is the largest study investigating the specific effects of CSA on GMV and cortical thickness while simultaneously accounting for general trauma load. Our results indicate a unique effect of childhood sexual abuse on brain morphometry, specifically larger cerebellar GMV and increased cortical thickness in fronto-parietal regions. Thus, CSA might constitute an unparalleled impact on child development, highlighting the importance of distinguishing specific types of traumata in future research.

ID: B131

Keywords: Dynamic Causal Modeling, Face recognition, FFA, OFA, Peripheral stimulation, Interhemispheric Integration

Interhemispheric integration in the neural face recognition network: does stimulus location matter?

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For many years, face-sensitive brain areas such as the occipital face area (OFA) and the fusiform face area (FFA) have been studied for their functional differences. However, little attention has been paid to the interplay between these regions across the two hemispheres. Here, we investigated the interhemispheric interaction between these face-sensitive regions for central and peripheral face presentations. Depending on the stimulus presentation, we believe that different amounts of resources need to be shared between the hemispheres. Therefore, we predict an increase in interhemispheric integration for peripheral compared to central stimulation. We use Dynamic Causal Modelling (DCM) to calculate the effective connectivity, i.e. the directed stimulation, between both OFAs and FFAs for different conditions. Our hierarchical model includes fixed forward connections from primary visual cortex (V1) to OFA and FFA regions as well as lateral bidirectional connections between OFA and FFA. For simplicity, we model only the modulatory effects between interhemispheric connections.

Averaging over all models (n=17), the first results show that central stimulation increases right lateralised effective connectivity (FFA Ep=0.73; OFA Ep=0.61) and decreases input from left OFA to right OFA (Ep=-0.18). When the stimulus is presented in the right visual field, a similar pattern is seen, but with greater inhibitory input from left to right (FFA Ep=-0.13; OFA Ep=-0.28). Looking at the left stimulation, there is a positive input from left to right FFA (Ep=0.06) and negative input from left to right OFA (Ep=-0.02). For both peripheral stimuli, the effective connectivity remains similar from the left to right hemisphere (FFA Ep=0.67; OFA Ep=0.34 (left faces); FFA Ep=0.66; OFA Ep=0.26 (right faces)).

Overall, the data suggest that stimulus presentation alters interhemispheric connectivity in the face recognition network. Furthermore, there appears to be a difference between OFA and FFA interhemispheric integration for central or peripheral presentations.

ID: A132

Keywords: ITG, numerosity, mathematical processing, fMRI, neuroimaging

Developing a standardized and efficient fMRI paradigm for localizing ITG-numbers

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Recent research has identified an area in the inferior temporal gyrus (ITG) that shows greater activation for symbolical numbers (Arabic-numerals) than other visual stimuli, and accordingly receiving the name “number form area” (NFA) or “ITG-numbers”. However, a major challenge in understanding the role of ITG-numbers in cognition is its localization, as many studies failed to identify the region successfully. Thus, a short and efficient fMRI experimental paradigm is needed that successfully identifies this region, ideally even in developmental populations. To close this significant methodological gap, here we developed a novel paradigm for the identification of ITG-numbers. In our paradigm participants are presented with images of Arabic-numerals and sets of UFOs, which depict amounts from one to five. Participants are asked to perform a one-back task and are instructed to either attend to the presented amount or to the color of the images. A cue in the beginning of each trial indicates to which feature of the stimuli participants should pay attention to and is followed by a short block of four images of a single stimulus category. Using a 3 Tesla MRI scanner, we collected 4 runs (5 minutes each) of this novel paradigm from 7 adults. In this data, we could identify ITG-numbers in 6 out of 7 participants in the left and right hemispheres (math task vs color task, $t \geq 3$). Hence with our new paradigm only 20 minutes of data collection is needed to identify ITG-numbers, making our paradigm particularly useful for developmental populations that generally require short sessions. In our future work,, we will employ this novel paradigm to evaluate the development of ITG-numbers in children prior to and during formal schooling.

ID: A133

Ionic selectivity of the permeation pathways in TRPM3 channels

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TRPM3 channels are involved in diverse cellular processes, such as insulin secretion and detection of painful heat. They can be activated by chemical agonists such pregnenolone sulfate. In addition to the central ion conduction pathway, the presence of a non-canonical permeation pathway was reported, that can be opened by co-application of clotrimazole and pregnenolone sulfate (1) or by pathogenic gain-of-function mutations (2).

Here, we aimed to investigate the selectivity property of the permeation pathways of TRPM3 channels, by recording reversal potentials in whole-cell patch-clamp recordings of HEK293T cells overexpressing wild-type or mutant TRPM3 proteins.

Our results confirm that the co-application of clotrimazole strongly potentiates inward currents through TRPM3 channels. Surprisingly however, our data indicate that the clotrimazole-enhanced inward current can also be carried by divalent cations. Furthermore, our data demonstrate that the reversal potential of TRPM3 currents is not significantly altered by the addition of clotrimazole, indicating that the ion selectivity of TRPM3 channels was not altered by this substance. The same result was found under a large variety of ionic conditions. Importantly, replacing a glutamate in the central pore by cysteine or glutamine strongly reduced the divalent permeability of this central pore, but also of the clotrimazole-enhanced currents. Finally, we show that the inward current through the pathogenic mutant V992M is also carried by divalent cations to a significant extend and has a similar ionic selectivity profile as wild-type TRPM3 channels.

Together, our results do not support the notion that TRPM3 channels exhibit two distinct ion-conducting pathways with different ionic selectivities. This conclusion has important implications for the pathophysiology of TRPM3-related disorders, such as juvenile epilepsy and mental retardation associated with gain-of-function mutations in TRPM3 channels.

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ID: B134

Investigating face pareidolia using DeepGaze: Bridging human and artificial perception

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Pareidolia, the tendency of humans to perceive familiar patterns, such as faces, in random stimuli, is a captivating aspect of visual perception. In this study, we investigate the phenomenon of face pareidolia using DeepGaze, a state-of-the-art computational model trained to predict human gaze behavior. Although trained intensively on natural visual stimuli, DeepGaze has not been explicitly tailored for face pareidolia. Here, we ask to which extent DeepGaze can generalize and recognize face-like patterns by probing it with diverse visual stimuli exhibiting varying degrees of such patterns. Remarkably, DeepGaze outperforms standard face detection models in discerning and localizing these patterns ($p<0.01$, bootstrap-test). This suggests that its gaze prediction mechanisms capture subtle facial features effectively. We further directly compare the gaze-based heatmaps generated by DeepGaze with human gaze data on face pareidolia stimuli. Our dataset includes human gaze heat maps (n=38) for images featuring face pareidolia (101), regular scenes with objects (86), and scenes with a single human face (100). The model shows a high correlation in gaze distribution and intensity when compared to human data, even for face-like stimuli (pixelwise correlation: $r = 0.80$). Nevertheless, the model performs better in scenes with objects and faces than in face pareidolia scenes ($p<0.01$, t-test), indicating that some nuances of human gaze behavior in face pareidolia remain uncaptured. In summary, DeepGaze emerges as a promising tool for investigating complex cognitive phenomena like face pareidolia, narrowing the gap between artificial and human perception.

ID: B135

Keywords: meta-analysis, feedback, eeg, motor learning

Feedback Processing in Motor and Cognitive Tasks - The Feedback-Related Negativity

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Feedback plays an important role in motor and cognitive learning processes. However, feedback processing in motor learning is often more complex and ambiguous compared to cognitive tasks, as errors can occur at different time points and on different task elements. The feedback-related negativity (FRN; also known as reward positivity) is an event-related potential of reinforcement learning, which reflects a postdictive error processing. The FRN has been frequently used in studies with cognitive tasks, but the number of studies involving motor paradigms is still increasing. This meta-analysis distinguishes between motor and cognitive tasks used in FRN studies and compares the FRN amplitude and the FRN latency between both domains. Therefore, a literature search for FRN studies using motor tasks was conducted. After reviewing, a dataset of 25 studies with motor tasks was analyzed and compared to a dataset of 47 studies, published in a previous meta-analysis by Sambrook & Goslin (2015). The FRN amplitude was higher in the motor domain (M=-3.59 µV, SD=1.81 µV) than in the cognitive domain (M=-2.69 µV, SD=1.61 µV), t_{81}=2.31; p=.001; d=0.54, which could be driven by a higher task complexity and feedback ambiguity in motor tasks. In addition, the FRN latency was shorter in the motor domain (M=257.18 ms, SD=42.66 ms) than in the cognitive domain (M=276.48 ms, SD=26.73 ms). Since sensory information can be used to predict action outcomes, processing time may have been reduced. Overall, the meta-analysis motivates future research to adapt the analysis procedures depending on the tasks used in EEG studies, while focusing on differences in error- and feedback processing between both domains.

Reference

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ID: B136

Keywords: replication, task-based fMRI, computational modelling, face-identity learning, face

Modeling Face Recognition in the Predictive Coding Framework: A Combined Computational Modeling and Functional Imaging Replication Study

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The learning of new facial identities and the recognition of familiar faces are crucial processes for social interactions. Recently, a combined computational modeling and functional magnetic resonance imaging (fMRI) study used predictive coding as a biologically plausible framework to model face identity learning and to relate specific model parameters with brain activity. The original authors demonstrated that behavioral responses on a two-option face recognition task can be predicted by the estimated level of contextual and facial familiarity extracted from a computational model based on predictive coding principles. Furthermore, BOLD activity in the superior temporal sulcus (STS) varied with contextual familiarity of face stimuli. In contrast, activity in the fusiform face area (FFA) covaried with the prediction error parameter that updated facial familiarity.

However, literature combining task-based fMRI with computational modeling in humans still needs to be expanded, and prior results are largely not replicated. The goal of the present study was to replicate the initial findings in an independent sample of subjects. Our results support the original findings in two critical aspects. First, on a group level, the behavioral responses were modeled best by the same computational model reported by the original authors. Second, we showed that estimates of these model parameters covary with brain activity in specific, face-sensitive brain regions. Our results thus provide further evidence that the functional properties of the face perception network follow central principles of predictive coding. However, our study yielded diverging findings on specific computational model parameters purportedly reflected in brain activity. For once, we did not find evidence of the STS's computational involvement in face recognition processes. Additionally, our results demonstrated that activity in the right FFA was associated with multiple computational model parameters.

ID: A137

An assessment of bacterial induction of mouse Neutrophil extracellular traps in vitro using LPS or Group B Streptococcus.

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Neutrophil extracellular traps (NETs) are formed by activated neutrophil granulocytes (NG) and serve an important role in pathogen clearance. However, previous studies have found that NET overexpression can induce pro-inflammatory cytokine profiles that contribute to the pathogenesis of certain disease states as well as observed neurotoxic properties of the proteases and decondensated DNA released from NGs. Group B *Streptococcus* (GBS) is a leading cause of neonatal sepsis and meningitis worldwide and can have severe outcomes including neurodevelopmental impairments and even death. We aimed to investigate the inflammatory response of NGs to gram-negative (LPS) and gram-positive (GBS) bacterial mimetics to induce NETs *in vitro* and assess their potential to contribute to neuronal damage. Bone marrow derived NGs were isolated from the femur and tibia of aged mice (19-22 weeks). To induce NETosis NGs were then incubated for 3h with CXCL1 (50ng/ml) in combination with LPS (1, 10, or 20mg/ml) or GBS (MOI 100). After 3h the cells were fixed and analyzed by immunofluorescence for the NET markers myeloperoxidase and DNA/Histone1. Supernatants were collected and analyzed by bioassays for TNFa and IL-6. Preliminary results indicate that treatment with GBS alone but not LPS may significantly increase NET formation. Treatments performed in combination with CXCL1 did not increase NET formation in either GBS or LPS groups. Levels of TNFa and IL-6 appeared unaffected by treatment with GBS or LPS but further analysis is required. Together, our ongoing experiments suggest a possible role for NETs in contributing to the inflammatory response during GBS infection.

ID: A138

Keywords: Borna disease virus 1, neuroinflammation, mitochondria, peroxisomes, TNF, TNFR1, TNFR2

Tumor Necrosis Factor Receptor 1 Mediates Changes in Mitochondrial and Peroxisomal Dynamics in Neurons – a Mechanism Contributing to Borna Disease Virus Persistence in the Brain

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Borna disease virus 1 (BoDV-1) causes a persistent, non-cytolytic infection in the mammalian brain accompanied by glial activation and T-cell-mediated neuroinflammation in susceptible end hosts. Peroxisomes and mitochondria play essential roles in cellular antiviral immune response but the effect of BoDV-1 infection on peroxisomal and mitochondrial dynamics and their respective antioxidant capacities is still not clear. Using different mouse lines [tumor necrosis factor-α transgenic (TNFTg; to mimic chronic inflammation), TNF receptor-1 knockout (TNFR1ko), and TNFR2ko mice in comparison to wild-type (Wt) mice], we analyzed the abundances of both organelles and their main antioxidant enzymes, catalase and superoxide dismutase 2 (SOD2), in neurons of the hippocampus, cerebral and cerebellar cortices. In non-infected TNFTg mice, we detected a strong increase in mitochondrial (6.9-fold) and SOD2 (12.1-fold) abundances; peroxisomal abundance increased slightly (1.5-fold), but that of catalase decreased (2.9-fold). Unlike in TNFR1ko where no changes occurred, the abundances of both organelles, but not of their antioxidant enzymes, increased in TNFR2Ko mice. After BoDV-1 infection, a strong decrease in mitochondrial (2.1-6.5-fold), SOD2 (2.7-9.1-fold), and catalase (2.7-10.3-fold) abundances, but a slight increase in peroxisomes (1.3-1.6-fold) were detected in Wt and TNFR2ko mice, whereas no changes occurred in TNFR1ko mice. Chronic TNF overexpression prevented changes in peroxisome and catalase abundances, but not that of mitochondria and SOD2. Our data suggest that the TNF system is involved in the biogenesis of both subcellular organelles. Moreover, TNFR1 signaling mediated the BoDV-1-induced alterations of both organelles and the availability of their main antioxidant enzymes, highlighting new mechanisms by which BoDV-1 could achieve immune evasion and viral persistence.

ID: B139

Probing the other-race effect in deep neural networks

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Humans excel at recognizing faces, yet often struggle disproportionally with faces of unfamiliar races – a phenomenon known as the other-race effect. Despite decades of study, the computational underpinnings remain unclear. In this study, we employ deep convolutional neural networks (CNNs) as models of the human visual system to explore the computational mechanisms underlying the other-race effect. We trained three distinct CNNs for face recognition: one solely on white faces, another network on Asian faces, and a third on both Asian and white faces. The single-race trained CNNs showed a drop in performance when probed on the opposite race, mimicking human behavior. Intriguingly, the dual-race trained network performed similarly well on both races, matching the performance of the single-trained networks. This finding suggests that multi-racial exposure during training can mitigate the other-race effect in networks – a phenomenon paralleled in human development. To further understand how dual-race training affects facial representations, we analyzed the networks' feature spaces. Compared to the single-trained networks, the dual-trained network showed greater separation between Asian and white face representations. Moreover, multidimensional scaling revealed an increased intra-category variability for Asian faces in the dual-trained network. Our results provide a stepping stone towards a computational explanation of the other-race effect and yield testable predictions regarding the role of visual experience in human face perception.

ID: A140

Identification of residues in TRPM3 channels important for the agonist action of pregnenolone sulfate

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TRPM3 channels, which are best known for their role in detecting noxious heat, are tetrameric complexes with unusual pharmacological properties. They are activated by the endogenous steroid pregnenolone sulfate (PregS) and also by the chemically unrelated dihydropyridine nifedipine (Nif) [1]. So far, the binding sites for these agonists are not known, but it is believed that these two substances act on different binding sites, because they do not compete with each other [2].

Using molecular docking on the recently published CryoEM structure of TRPM3 [3], we observed an intersubunit cleft capable of accommodating PregS and identified several amino acid residues interacting with PregS from both subunits forming the cleft. We mutated the 10 amino acids that displayed the strongest interaction with PregS in the docked pose and analyzed the resulting mutant ion channels after overexpression in HEK293 cells with whole-cell patch-clamping. We measured dose-response curves for the agonists PregS and Nif, but also tested other steroidal substances with weaker agonist properties, such as pregnenolone, pregnenolone hemisuccinate and DHEAS [2].

All tested mutant proteins produced functional ion channels responsive to PregS and Nif. Quantitative analysis showed that some mutated residues tested severely affected the pharmacological properties of the channel. Several mutations strongly reduced the agonistic effect of PregS compared to Nif. Most of the mutants showed abnormalities compared to wild-type channels when tested with steroidal analogues of PregS. The mutations with the strongest effects on steroid activation were located on transmembrane helices 1 and 4.

These data indicate that an intersubunit cleft formed by transmembrane helices 1 and 4 and accessible from the membrane lipids might be involved in binding PregS.

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ID: B141

Keywords: face detection, functional magnetic resonance imaging, dynamic causal modeling, illusion

“I spy with my little eye…”: Connectivity analyses of the illusory face detection network

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The most basic aspect of face perception is simply detecting the presence of a face, which requires the extraction of features that it has in common with other faces. Putatively, it is caused by matching high-dimensional sensory input with internal face templates, achieved through a top-down mediated coupling between prefrontal regions and brain areas in the occipito-temporal cortex (“core system of face perception”). Illusory face detection tasks can be used to study these top-down influences. In the present functional magnetic resonance imaging study, we showed that illusory face perception activated the core system just as real faces, albeit with atypical left-lateralization of the occipital face area. The core system was coupled with two distinct brain regions in the lateral prefrontal (inferior frontal gyrus, IFG) and orbitofrontal cortex (OFC). A dynamic causal modeling (DCM) analysis revealed that activity in the core system during illusory face detection was upregulated by a modulatory face-specific influence of the IFG, not as previously assumed by the OFC. Based on these findings, we were able to develop the most comprehensive neuroanatomical framework of illusory face detection until now.

ID: A143

Keywords: Alzheimer's disease, SPMs, adipokines, excitotoxicity, hippocampal slice cultures

Deciphering neuroprotective effects of n-3 polyunsaturated fatty acids and related impacts of adipokines using organotypic hippocampal slice and primary neuroglial cell cultures

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Alzheimer's disease (AD) is characterised by amyloid-beta (Aβ) and tau neuropathology and progressive, debilitating cognitive decline. Early life stress leads to brain inflammation, changes in lipid mediators in AD and exacerbates amyloid pathology. Recent studies have shown that specialized pro-resolving lipid mediators (SPMs, derivatives of omega-3 polyunsaturated fatty acids, n-3) and metabolic sensors such as adipokines affect AD disease states.

The aim of the present study is to decipher neuroprotective properties of n-3 and their metabolites (SPMs) and how this effect is modulated by adipokines like C1q/TNF-Related Protein 3 (CTRP3). For this purpose, we use organotypic hippocampal slice cultures (slices) from male and female neonatal mice exposed to early life stress and incubate them with Aβ oligomer-enriched stocks. Here, we present the project methodology of our established slice cultures and first results after excitotoxic or inflammatory stimulation with either NMDA and glutamate or bacterial lipopolysaccharide (LPS). Moreover, we show that LPS increases SPMs release and CTRP3 inhibited LPS-induced IL-6 secretion in primary neuroglial cell cultures. We are further testing if stimulation of the slices in the way described above leads to changes in neuronal survival using propidium iodide, detection of inflammatory signalling (RT-PCR) and measures of cytokines/PUFAs/SPMs. To reveal the functional role of resolvin E1 (RevE1), we will also derive slices from Fat1-mice that lack resolvin receptors (ChemR23-deficiency), to model n-3 enrichment with and without functional RevE1-signalling. As a positive pharmacological control, slices from wild-type mice will be treated with either 18-HEPE, the direct precursor for RevE1, or RevE1 directly.

ID: A144

Keywords: Cimicifuga extract, oxidative stress, mitochondria, TCA-cycle metabolism

Cimicfuga racemosa extract mediates resilience against oxidative cell death in neuronal cells by targeting mitochondrial TCA-cycle metabolism

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Cimicifuga racemosa extract is a well-established herbal medication widely prescribed to treat menopausal symptoms that has gained interest as a metabolic regulator. Recent work suggests that *Cimicifuga racemosa* extract Ze 450 directly regulates mitochondrial energy turnover through its actions on complex I of the mitochondrial electron transport chain (ETC). However, the mechanisms by which *Cimicifuga* extract Ze 450 affect mitochondrial energy metabolites, representing a key role for the ETC activity, remain poorly defined.

To gain a comprehensive insight into the signaling effects of the extract on the mitochondrial proteome and metabolome, neuronal HT22 cells were treated with Ze 450 and analyzed by mass spectrometry. Real-time measurements of mitochondrial and glycolytic respiration were performed to detect acute effects of the Cimicifuga extract on the mitochondrial energy release. MitoPlates® were used to understand how substrate utilization and metabolic activity can be reprogrammed upon treatment.

Here we demonstrate that Ze 450 inhibits glucose and glutamine utilization in mitochondria leading to a suppressed mitochondrial-dependent biosynthetic activity. Rather, *Cimicifuga racemosa* extract Ze 450 decreases the flow of glucose- and glutamine-derived metabolic intermediates into the Tricarboxylic Acid (TCA) cycle, leading to reduced citrate production and de novo lipid biosynthesis. In models of oxidative stress, it was also shown that reprogramming of mitochondrial metabolism by Ze 450 is largely dependent on glutamine depletion, as inhibition of glutaminolysis – but not the depletion of glucose entry into the TCA cycle, resulted in protection against ferroptosis.

Our data indicate that the metabolic effects of *Cimicifuga racemosa* extract Ze 450 are due to restriction of important anaplerotic substrates required for TCA cycle-dependent biosynthesis. These observations provide both new insight into the mechanism of Ze 450 action on metabolic adaptations but also highlight its role for the resilience against age-related processes engaged by impaired mitochondria and the loss of antioxidative capacities.

ID: B145

The Development of Lexical Representation During the Third Year of Life: A Longitudinal EEG Study

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During early language acquisition, lexical representations become increasingly differentiated depending on language experience and vocabulary growth. However, little is known about the precision of word form representation in early childhood. The present longitudinal EEG study investigates aspects of lexical specification in 24-, 30- and 36-month-old children. 15 monolingual, German-speaking children participated in a picture-word-matching task, 18 monolingual, German-speaking adults served as controls. Prototypical pictures were followed by auditory stimuli in one of four conditions: Phonological violation, wherein target word onsets were altered to create pseudowords; Prosodical violation, wherein target word stress was altered; Semantic violation, wherein close co-hyponyms of the target were presented; Control, which were the expected word forms. EEG was recorded from 32 channels, and ERP effects were investigated with linear mixed-effects models and bonferroni-corrected post-hoc tests. Adults show a negativity in response to the phonological violation 400 ms post-stimulus onset, and a negativity from 300 to 400 ms in the semantic condition. Children at 24 months show early negativities in the phonological condition, and a late negativity in response to the prosodic manipulation. At 30 months, prolonged negativities are present 400 ms post-stimulus onset in the phonological and the semantic condition. At 36 months, the negativity in the semantic condition recurs, but the phonological condition now evokes an early positive effect, followed by a later negativity. Effects at 24 months indicate the detection of phonological differences, but adult-like patterns of lexical access are absent before 30 months. Prosodic violations appear insubstantial to lexical access. 24-month-olds seem to treat close co-hyponyms as viable word candidates, but recognize the semantic distinctions with increasing age. The small negative component in adults indicates that their mental lexicon appropriately represents semantic differences. Our results hint at a shift in lexico-semantic processing between 24 and 30 months.

ID: A146

Keywords: Microglial cells, cell activation, a-synuclein, sGC, Riociguat

a-Synuclein and LPS alter cytokine secretion, phagocytosis, cell migration and metabolic activity in BV2 microglial cells

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a-Synuclein (a-syn) aggregation is associated with progressive neurodegeneration in Parkinson's Disease (PD). Although microglia are capable of phagocyting a-syn [1], its high loads shifts towards an inflammatory phenotype and may accelerate neurotoxicity [2]. The soluble guanylyl cyclase (sGC) has been suggested for the treatment of PD [3], by modulating immune response. Here, we analyzed the effects of a-syn oligomers on inflammation markers, phagocytosis, wound healing, and metabolic activity and the effects of sGC activator Riociguat in a-syn-treated BV2 microglial cell line.

BV2 cells were exposed to lipopolysaccharide (LPS), a-syn, and combinations with LPS (250 ng/mL) and Riociguat (100 µM). Inflammation was analyzed through Griess and LegendPLEX assays. Phagocyting activity was examined using fluorescent pHRodo particles, cell migration was monitored by scratch assay and mitochondrial activity was evaluated by Seahorse XF96 fluxmeter.

The results showed that co-treatment of a-syn with LPS, but not a-Syn alone resulted in significant increases in NO production. Cytokines were detectable when the cells were treated with 2.5 µM a-syn and in co-treatment with LPS. Riociguat reduced NO production to control levels whereas inflammatory cytokines were only partially reduced. In Phagocytosis Assay, only the population of highly phagocytic cells increased when treated with a-syn and in co-treatment with LPS and Riociguat. Furthermore, a-syn reduced microglia migration and co-treatment with Riociguat was not able to rescue cell migration to control levels. LPS, on the other hand, increased cell mobility. Lastly, higher metabolic activity of a-syn-treated cells was detected for both OCR and ECAR without signs of mitochondrial dysfunction.

These results demonstrate that inflammation was induced at higher a-syn concentrations or in co-activation by LPS. However, pro-inflammatory activation neither altered phagocytosis activity nor induced mitochondrial dysfunction. Furthermore, pharmacological intervention with Riociguat was able to mitigate NO production, however the sGC activator did not fully reduce the pro-inflammatory cytokine production.

ID: A147

Borna Disease Virus-1 infection kinetics in organotypic hippocampal slice cultures of Lewis rats

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Borna Disease Virus 1 (BoDV-1) is the causative agent of a fatal neurological disease in numerous mammals including humans called Borna disease. In order to better understand the spread of Borna Disease Virus-1 in the brain, the kinetics of viral spread and infection in hippocampal organotypic slice cultures (OHCs) of Lewis rats was investigated. Viral spread was analyzed at 3, 7, 10, 14, 21, 28 and 42 days post infection (p.i.), respectively. Virus infection was visualized by immunofluorescence applying an BoDV-1- specific antibody recognizing the vial nucleoprotein an vial RNA was amplified by real time RT-qPCR. Virus infection was successful and was confirmed first day p.i. and was present until the last time point of infection indicating viral persistence in the rat OHCs.

The time points with the most remarkable morphological alterations and/or changes in viral load will then be selected for further transcriptome investigations.

This poster shows additionally that the manufacturing of organotypic hippocampal slice cultures is a promising technique to replace life animal testing, respecting the 3R concept.

ID: A148

Automatic multimodal segmentation of the hippocampus - Influence of different MRI modalities

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Background: Automatic segmentation of the hippocampus is used for preoperative planning and intraoperative visualization during selective amygdalohippocampectomy in epilepsy patients. Multimodal automatic segmentation includes information of different MRI submodalities in contrast to most existing automatic segmentation approaches. However, its effect on the segmentation accuracy of the hippocampus has not yet been investigated.

Methods: MRI data of five healthy subjects was prospectively obtained at a 3T MRI including a T1-weighted (T1w), T2-weighted (T2w), susceptibility-weighted (SWI), fluid-attenuated inversion recovery (FLAIR) data set. To examine the effect of different combinations of modalities, for each subject seven subsets were generated including only the T1w image set, or combined with one, two or all three other data sets. Rigid image fusion with the T1w image set and manual segmentation of the hippocampus was performed. Afterwards, automatic segmentation of the hippocampus was investigated (Anatomical Mapping, Brainlab, Munich, Germany). Object volumes and pairwise spatial overlaps (Dice Coefficient, DC) between automatic and manual segmentation (ground truth) were evaluated. Statistical analysis was performed using non-parametric tests.

Results: The mean size of the hippocampus ranged from 3.17 to 3.82cm³ (standard deviation, SD, 0.12 to 0.32cm³) showing significant differences ($p<0.001$). The mean DCs ranged from 0.67 to 0.88 with (SD ranging from 0.02 to 0.18), showing significantly highest DCs for subsets T1w+T2w and T1w+T2w+SWI, with overall significantly differing DCs across the subsets ($p<0.001$). Post hoc analysis revealed significant differences between subsets T1w and T1w+T2w, T1w+T2w and T1w+FLAIR, T1w+FLAIR and T1w+T2w+SWI ($p<0.001$).

Conclusion: The combination of different MRI submodalities results in significant differences in automatic segmentation results of the hippocampus with respect to volume and segmentation accuracy. In this sample, T1w+T2w(+SWI) MRI-images delivered the best results and might therefore be considered for routine imaging in preoperative planning. However, further examination of the effect on MRI data of epilepsy patients is required.

ID: A149

Impact of different MRI modalities on automatic multimodal segmentation of the subthalamic nucleus

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Background: Navigation systems play a crucial role in supporting interventions related to deep brain stimulation, such as those involving the subthalamic nucleus (STN). Due to the time-intensive nature of manual segmentation, automated techniques have been developed aiming to optimize segmentation quality and enhancing it's efficiency. In contrast to other approaches, multimodal automatic segmentation integrates data from different submodalities of magnetic resonance imaging (MRI). However, their accuracy on the segmentation outcomes has not been investigated thus far.

Methods: MRI data of 20 healthy controls (HC) and five Parkinson's Disease (PD) patients were prospectively acquired using a 3T MRI system. The acquired data included a T1-weighted (T1w), T2-weighted (T2w), fluid-attenuated inversion recovery (FLAIR), and susceptibility-weighted (SWI) data set. To assess the impact of different modalities, seven subsets were created for each volunteer, whereby these subsets included the T1w image data set alone, or combined with one, two, or all three additional data sets. For all subsets, rigid image fusion was performed using the T1w image set as basis. Afterwards, the STN was automatically segmented using the Anatomical Mapping Element (Brainlab, Munich, Germany). Object volume, the object's center of gravity (CoG) and Euclidean distances between those were determined and compared across the subsets.

Results: There was no statistically significant difference in the STN volumes observed across the different multimodal image subsets ranging from 0.08 to 0.13cm³ in HC and patients. Visual inspection revealed shifts of STN segmentations across the different subset; Euclidean distances between the CoGs ranged from 0.76 to 1.80mm in HC and from 1.07 to 3.47mm in patients.

Conclusion: The outlines of automatically derived STN segmentations changed based on the employed multimodal imaging data sets. Thereby, automatic multimodal segmentation potentially influences the preoperative planning strategy for precise DBS electrode positioning, intraoperative visualization linked to electrophysiological measurements, and postoperative image-guided programming.