CIN Werner Reichardt Centre for Integrativ Neuroscience

Graduate Training Centre of Neuroscience University of Tübingen

Hertie Institute for Clinical Brain Research

EBERHARD KARLS UNIVERSITÄT TÜBINGEN

NeNa

Conference

2021

Neurowissenschaftliche Nachwuchskonferenz

(Conference of Junior Neuroscientists)

October 7, 2021

Tübingen

From the NeNa-Team

Dear participants,

We are thrilled that you are joining us at the 22nd annual NeNa conference! We are doing our best to successfully steer NeNa through the Covid-crisis, and after a purely online event last year, we are proud to present a hybrid NeNa in 2021.

We hope that whether you are joining us from your laptop at home, or personally meeting us in the beautiful old train station in Unterjesingen, you will find this an intimate and inspiring environment where you will be able to meet new people, share your work, and pick up new ideas.

Sincerely yours,

The NeNa Organizing Committee 2021

Julia Fechner

Avani Koparkar

Anastasia Lado

Emilio Pardo González

Isabel Gomes Teixeira Torres Raposo

Lilian de Sardenberg Schmid

Ramona Siebert

Giulia Soto

Schedule NeNa 2021

Thursday, 7th October, 2021

9:00	Welcome	
9:15 – 10:15	**Keynote Emily Cross** "Towards a cognitive science of human—machine interactions"	
10:15 – 10:30	**Break**	
10:30 – 11:30	**1st Student talks:**	
	Session 1: Junya Inoue, Anna Denninger, Matthias Baumann and Sophie Müller	***Session 2:*** Lena Erlebach, Hang Lyu, Felix Knab, and Natalia Savytska
11:30 – 11:45	**Break**	
11:45 – 12:45	**Keynote Nelson Totah:** "How the brain learns in a complex world"	
12:45 – 13:45	**Lunch break**	
13:45 – 14:30	**Workshops**: *Toolbox for Light Microscopy* (Olga Oleksiuk) / *Science Communication* (Polina Krivykh)	
14:30 – 15:15	**2nd Student talks**	
	Session 1: Tong Zhang, Natalia Zhozhikashvili and Tatiana Malevich	***Session 2*** Yue Zhang, Lion Schulz and Weiyi Xiao
15:15 – 15:45	**Break**	
15:45 – 16:30	**3rd Student talks**	
	Session 1: Qi Wang, Vincent Plikat and Jiauhi An	***Session 2:*** Darya Momotenko and Elizaveta Ivanova
16:30 – 17:30	**Keynote Yevgenia Kozorovitskiy:** "Dopamine system dynamics and plasticity in aversive learning"	
18:00 – 22:00	**Get-Together**	

1st Student talks (10:30 – 11:30)

Junya Inoue
- Cerebellar complex spikes multiplex complementary behavioral information

Anna Denninger
- Sensory tuning in neural movement commands

Matthias Baumann
- Perisaccadic perceptual mislocalization depends on the visual features of the saccade target

Sophie Müller
- Keeping your balance: Vagus nerve stimulation boosts stomach-brain coupling via a vagal afferent pathway

Lena Erlebach
- A human(ized) system to study microglial biology ex vivo

Hang Lyu
- Functional characterization of SCN8A mutations associated with episodic ataxia

Felix Knab
- Identification of LRRK2 associated biomarkers in PD using extracellular vesicles

Natalia Savytska
- Transposable elements transcription in human dopaminergic neurons: a pilot study of impact of causal Parkinson`s mutations on retrotransposome

2nd Student talks (14:30-15:15)

Tong Zhang
- A causal role for microsaccades in peripheral visual sensitivity

Natalia Zhozhikashvili
- Parietal alpha oscillations associated with working memory may reflect cognitive effort modulations

Tatiana Malevich
- The microsaccadic rate signature in "blindsight" monkeys

Yue Zhang
- Optic flow processing in larval zebrafish: a case study for Marr's three levels

Lion Schulz
- Towards a computational cognitive perspective of misinformation

Weiyi Xiao
- Topological Analysis of Human Gaze on Natural Image Space

3rd Student talks (15:45 – 16:30)

Qi Wang
- Synthetic 9T-like structural MRI using a Generative Neural Network

Vincent Plikat
- Turning magic into research

Jiauhi An
- Neural correlates of working memory function in children with focal lesional epilepsy

Darya Momotenko
- Working memory during typing: EEG study

Elizaveta Ivanova
- Is there any difference between source or item monitoring?

Speakers

Emily Cross (University of Glasgow / Macquarie University Sydney)

"Towards a cognitive science of human—machine interactions"

Emily Cross' core interest is how we perceive and behave in social interactions. This is however not limited to social interactions among humans, she is also exploring interactions between humans and robots! She wants to understand how the human brain processes and responds to interactive robots, so humanity can be optimally prepared for an area that will without doubt become highly relevant in the future. Her broad range of research interests also includes dance as a way to explore complex action cognition, learning by observation and the neural foundations of art appreciation/neuroaesthetics.

Yevgenia Kozorovitskiy (Northwestern University)

"Dopamine system dynamics and plasticity in aversive learning"

Yevgenia (Genia) Kozorovitskyi wants to expand the understanding of neuromodulation and plasticity in the brain. Her interests range from the influence of neurohypophyseal peptides, over neuromodulation of adult synaptogenesis, to reconfiguration of the neural proteome. She hopes her research will facilitate the development of new therapeutic applications, exploiting the power of neuromodulators to functionally reconfigure, and even rewire, neural circuits.

Nelson Totah (Helsinki Institute of Life Science)

"How the brain learns in a complex world"

Nelson Totah's laboratory records and manipulates neural circuits involved in organisms' ability to adapt to an unpredictable environment. In this talk, he will present data collected from a head-fixed rat-on-a-treadmill apparatus, which enables high resolution monitoring of behavioral responses (treadmill running) and complex cognitive tasks (e.g., auditory-visual attentional set-shifting). he will first show individual-specific strategies employed by rats while they learn to respond to compound auditory-visual stimuli by focusing attention onto a single sensory modality. Using pupillometry and 'brain-wide' (32-electrode) EEG recordings, he will show data supporting neuromodulation-triggered cortical network resetting in relation to changing learning strategies. He will also briefly detail his efforts to characterize ensemble activity in the brainstem noradrenergic nucleus, locus coeruleus, and how such activity relates to the control of brain states. In the second part of the talk, he will demonstrate a novel 'near-mistake' behavioral paradigm in rats. We all know what it feels like to stop ourselves just before we commit a mistake. What happens in the brain during this cognitive process? To investigate this in rats, Totah's lab trained them to run when they see a 'Go' stimulus and remain immobile when they see a different 'NoGo' stimulus. A near-mistakes occurs when the rat initiates an incorrect running response to the NoGo stimulus, but quickly realizes their mistake and stops ongoing movement before crossing a response threshold (treadmill running distance). They demonstrate that anterior cingulate cortex firing rate and dimensionality-reduced population activity signal the magnitude of 'conflict' between competing Go and Stop actions by scaling firing rate with near-mistake movement size. He will place this result in the context of how the brain detects mistakes, monitors self-performance, and uses that signal to learn, adapt, and improve future behavior. Finally, he will touch upon a new direction of work studying how subjective perception of visual illusions modulates pupil size in rats.

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TALKS

T1- Cerebellar complex spikes multiplex complementary behavioral information

Akshay Markanday[a,b], Junya Inoue*[,b,c] , Peter Dicke[a] **,** Peter Thier[a,c]

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Purkinje cell (PC) discharge, the only output of cerebellar cortex, involves 2 types of action potentials, high-frequency simple spikes (SSs) and low-frequency complex spikes (CSs). While there is consensus that SSs convey information needed to optimize movement kinematics, the function of CSs, determined by the PC's climbing fiber input, remains controversial. While initially thought to be specialized in reporting information on motor error for the subsequent amendment of behavior, CSs seem to contribute to other aspects of motor behavior as well. When faced with the bewildering diversity of findings and views unraveled by highly specific tasks, one may wonder if there is just one true function with all the other attributions wrong? Or is the diversity of findings a reflection of distinct pools of PCs, each processing specific streams of information conveyed by climbing fibers? With these questions in mind, we recorded CSs from the monkey oculomotor vermis deploying a repetitive saccade task that entailed sizable motor errors as well as small amplitude saccades, correcting them. We demonstrate that, in addition to carrying error-related information, CSs carry information on the metrics of both primary and small corrective saccades in a time-specific manner, with changes in CS firing probability coupled with changes in CS duration. Furthermore, we also found CS activity that seemed to predict the upcoming events. Hence PCs receive a multiplexed climbing fiber input that merges complementary streams of information on the behavior, separable by the recipient PC because they are staggered in time.

T2 - A human(ized) system to study microglial biology ex vivo

Lena Erlebach*[a,b,c], Marc Welzer[a,b,c], Marta Vilademunt-Alcaide[a,b,c], Anika Bühler[a,c], Mathias Jucker[a,c], Deborah Kronenberg-Versteeg[a,c]

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Converging evidence suggests an involvement of microglia and (neuro-)inflammation in the onset of many neurodegenerative diseases like Alzheimer's disease. However, most of our knowledge on microglial biology derives from rodents or primary cell cultures and remain to be translated to human, highlighting the need for a human(ized) model system. Inaccessibility of living human tissue has limited the number of studies investigating neurons and glia and their respective roles in homeostasis and disease. Analyses of postmortem tissue can by default only provide a snapshot of glial phenotypes, thereby neglecting early cellular responses to pathological alterations and glial modulations of disease progression. We developed an ex vivo mouse brain slice culture system in combination with human induced pluripotent stem cells (iPSC)-derived microglia as a novel cellularly complex tool to dissect the dynamics and molecular mechanisms of genetic risk factors of neurodegeneration. We found that iPSC-derived microglial precursor cells integrate and differentiate well in the brain slice cultures, with very similar morphology, network characteristics and functional responses reminiscent of human microglia. This system is a novel cellularly complex tool that allows the study of human microglia dynamics in an in vivo-like environment. It furthermore offers the opportunity to dissect the molecular effects of genetic risk factors of neurodegeneration (like APOE or TREM2) in unprecedented detail while offering increased accessibility for (pharmacological) manipulation.

T3 - Sensory tuning in neuronal movement commands

Anna Denninger*[,a], Amarender Bogadhi[b], Matthias P. Baumann[c], Ziad M. Hafed[d]

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Successful interaction with our environment requires constant sampling of new sensory information by our brain. In vision, sampling is achieved by means of orienting eye movements, which entail both receiving visual input as well as generating movement commands. Indeed, oculomotor structures like the midbrain superior colliculus (SC) contribute to both processes. Conventionally, however, SC visuo-motor integration is believed to occur in a sequential manner: “vision” first takes place, and “action” follows. Thus, if the same saccade is made towards two different image features, the SC motor bursts should be completely the same; it should not matter, from a motor perspective, whether the saccade target is a car or a face. Here, by recording from SC neurons while monkeys generated saccades towards peripheral stimuli of varying visual features, we found intriguing evidence to the contrary. SC movement commands exhibit robust sensory tuning that is not explained by systematic changes in saccade properties; for a given saccade, the SC motor burst could be strong or weak simply as a function of the image features at the saccade target location. This sensory tuning of SC neural movement commands can afford higher brain areas with information about the upcoming foveated visual stimulus, which can aid in establishing perceptual stability in the face of saccade-induced retinal image shifts. To explore this possibility, we measured human peri-saccadic perceptual thresholds when saccades were made to different image features. As expected, participants exhibited elevated thresholds around saccades. Critically, however, the thresholds varied significantly with the saccade targets’ image features. These results provide a novel insight on the functional role of SC motor bursts, and they suggest that corollary discharge of SC neural movement commands can extend beyond simple spatial location updating to relaying information about the visual properties of saccade targets.

T4 - Identification of LRRK2 associated biomarkers in PD using extracellular vesicles

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Parkinson's Disease (PD) is a movement disorder characterized by predominant loss of dopaminergic neurons. Mutations in the Leucine-rich repeat kinase 2 (LRRK2) gene, such as the G2019S mutation, represent the most common genetic cause of familial PD. A decisive step towards optimizing therapy could be the identification of biomarker linked directly to PD pathogenesis. This could allow to start medication in the presymptomatic stages of PD or monitor drug efficacy in clinical trials. In recent years extracellular vesicles (EVs) have emerged as promising targets for biomarker studies.
We here present an ongoing study that follows an omics based approach towards the identification of LRRK2 associated biomarkers.
We isolated extracellular vesicles from the supernatant of iPSC-derived dopaminergic neurons in culture carrying the G2019S mutation and a gene corrected control line. After isolation of RNA from these EVs, qPCR of miRNAs 9, 16 and 103 confirmed the presence of exosomal miRNA and qualitative proteomic analyses showed overrepresentation of exosomal proteins. Next, we generated a small RNA library using the exosomal RNA and performed differential expression analysis. We identified 25 miRNAs that showed differential expression levels in G2019S derived EV's compared to EV's from the healthy control line and using qPCR, we confirmed overexpression of three miRNAs (miR-1234, miR-153, miR-135). Functional analysis showed involvement of these miRNA in LRRK2 associated pathways.
We are currently running quantitative proteomics of the isolated EV's to identify potentially interesting protein targets for a biomarker study. Preliminary results indicate that protein cargo of G2019S derived EV's substantially differs from EV's isolated from the gene corrected line.

T5 - Keeping your balance: vagus nerve stimulation boosts stomach-brain coupling via a vagal afferent pathway

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Maintaining energy homeostasis is vital and supported by vagal signaling between organs and the brain. Whereas previous research has established a gastric network in the brain that is phase synchronized with the rhythm of the stomach, tools to perturb its function were lacking. Here, we investigated the acute effect of right-sided transcutaneous auricular vagus nerve stimulation (taVNS) versus sham stimulation (randomized crossover-design) on the coupling between brain activity (as indexed by resting-state fMRI) and gastric frequency (as indexed by electrogastrography, EGG) in 31 healthy participants (20 female). To identify brain regions coupled to the intrinsic gastric rhythm, we computed phase coupling of fMRI and EGG time series at rest before and after the onset of the stimulation (taVNS vs. sham; ~10 min each). At baseline, we replicated key nodes of the gastric network, located primarily in unimodal regions, such as the somatosensory cortex. In line with vagal afferent modulation, taVNS increased stomach-brain coupling in the nucleus of the solitary tract (NTS) and the dopaminergic midbrain. Moreover, taVNS boosted stomach-brain coupling in regions that were phase synchronized at baseline. Crucially, taVNS-induced changes in coupling were mirrored in changes of subjective ratings of metabolic state and occurred mostly in transmodal regions. In line with preclinical research, our results suggest that acute taVNS modulates stomach-brain coupling via an NTS-midbrain pathway that signals gut-induced reward. We conclude that altered vagal signaling enhances the integration of unimodal metabolic signals into transmodal regions, providing promising evidence for the impact of the gastric network on food-seeking behavior and the maintenance of energy homeostasis. Also, taVNS could be a promising tool to alter neuro-gastric coupling, including potential treatments of somatic symptoms in disorders, such as Parkinson's disease or depression.

T6 - Transposable elements transcription in human dopaminergic neurons: a pilot study of impact of causal Parkinson`s mutations on retrotransposome

Natalia Savytska*[,a,b,c], Anastasia Illarionova [a,b,c], Elisangela Bressan[a], Noemia Fernandes[a], Erik Alsop[d], Kendall Keuren-Jensen[d]

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Increasing evidence of Transposable Elements (TEs) misregulation in neurodegenerative diseases suggests that TEs could serve as potential disease hallmarks of or even contribute to the pathogenesis of conditions like Amyotrophic Lateral Sclerosis, Alzheimer's Disease, Multiple Sclerosis. As such, TEs may become promising targets for future diagnostics or therapy development. These discoveries prompt further investigation into the activity of TEs in specific neuronal cell types susceptible to neurodegeneration, such as midbrain dopaminergic (mDA) neurons in Parkinson's Disease (PD). However, characterizing active TEs remains a challenging and non-trivial task with short-read sequencing data due to their repetitiveness and structural complexity (both within and between TEs subfamilies). Long-read sequencing provides an opportunity to characterize full-length transcripts (including splice variants) and helps discern actual TE transcripts from lnc- and mRNAs, which exapted integrated TEs for regulatory purposes.
In this study, we aimed to: 1) characterize active TEs in human iPSC-derived mDA neurons, and 2) expand the catalogue of confirmed active TEs transcripts in human somatic cells (currently limited to the TE catalogue for DUX4-induced muscle cells). To achieve these goals, we used Oxford Nanopore Technologies (PromethION) cDNA sequencing on 10 iPSC lines differentiated into mDA neurons from healthy controls, idiopathic PD patients, and individuals carrying known disease-linked mutations. The result of this study will contribute to our understanding of the TEs transcriptional activity and its functional role in mDA neurons under normal conditions and, therefore, will help decipher their contribution to the pathogenesis of PD. Furthermore, we will relate the presence and expression levels of the discovered TEs transcripts to short- read Illumina RNA sequencing data to test the specificity of the most commonly used short-read TEs quantification strategy.

T7 - A causal role for microsaccades in peripheral visual sensitivity

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Visual processing is frequently interspersed with saccades, which are associated with strong peri-movement changes in neural and perceptual sensitivity. With fixed gaze, for controlled experiments on processes like covert attention, microsaccades still occur. During the past two decades, it became clear that microsaccades are not random (Hafed and Clark, 2002; Engbert and Kliegl, 2003), but instead exhibit predictable correlations with enhanced or decreased peripheral visual sensitivity (in multiple brain areas) and perception. These time-locked changes appear at eccentricities 1-2 orders of magnitude larger than the eye movement endpoints themselves. However, it remains unclear whether it is microsaccades, perhaps through their motor preparatory activity, that causally influence visual sensitivity, or whether visual sensitivity is itself modulated independently of microsaccades, maybe through oscillatory brain-state fluctuations; in this case, it is such modulations that “leak” into the motor system and trigger microsaccades. Here, motivated by (Hafed and Clark, 2002), in which no attentional effects were present in the absence of microsaccades, we tested the former hypothesis. We used real-time retinal image stabilization to introduce tiny foveal motor errors at fixation (0.03-0.18 deg) and causally drive microsaccades in an experimentally-controlled direction. We then presented peripheral (>5 deg) visual stimuli congruent or incongruent with microsaccade direction and recorded monkey superior colliculus activity. In both monkeys and humans, we also probed behavioral performance (reaction time in monkeys; perceptual contrast sensitivity in humans). We found enhanced visual sensitivity and perceptual performance for microsaccade-congruent stimuli as a result of causally-generated microsaccades. Thus, foveal motor activity is sufficient to influence peripheral visual sensitivity. We also tested the modulation of visual performance when we placed stimuli farther away from large saccade landing positions. We found a similar effect to microsaccades. Therefore, saccades can indeed influence visual sensitivity at locations more eccentric than their endpoints, as is the case with microsaccades.

T8 - Optic flow processing in larval zebrafish: a case study for Marr's three levels

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When you sit down and turn to this computer screen, the image of the screen together with every other object in the visual field is shifted on your retina. This phenomenon is known as optic flow. Humans and a wide range of animals can determine and adjust their self-motion states based on optic flow. To understand how this is accomplished in vertebrate animals, we analysed the atomic functional units of visual motion processing, the receptive fields (RFs) of motion sensitive neurons in larval zebrafish. We recorded thousands of motion RFs and uncovered a matched-filter algorithm implemented in a diencephalic neuron cluster for determining translational self-motion state from optic flow. In behavioral experiments, we applied complex optic flow and observed optokinetic and optomotor responses matching the revealed neural mechanisms. Here, we would like to use these physiological and behavioral results as a case study for Marr's three-level framework to discuss which levels of understanding do we gain, what kind of conclusion can we draw, and what questions can we answer.

T9 - Parietal alpha oscillations associated with working memory may reflect cognitive effort modulations

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Task difficulty reflects the mental demand of the task, whereas mental toughness (MT) is a measure of resilience and confidence of an individual to complete a task. Task difficulty and MT are intricately related; however, little is known about brain correlates of this relation. We investigate the relation between task difficulty and MT and its impact on parietal alpha oscillations using electroencephalography. Specifically, we hypothesized that parietal alpha effects enhance with task difficulty and low MT (MTQ48) leads to their decrease for levels of higher difficulty. Eighty participants completed the Sternberg task with 4 difficulty levels (3, 4, 5, 6 digits). The Sternberg task includes the following phases that leads to the following corresponding alpha power modulations: stimulus encoding (alpha power event-related desynchronization, aERD), retention (alpha synchronization, aERS) and decoding (aERD). Data were analyzed using mixed effects regression models.

Results show that aERD, aERS and aERD increase with task difficulty. However, their dependency seems to reverse in the most subjectively difficult conditions in some subjects. Specifically, during the encoding period, parietal aERD was observed increased with task difficulty but was not affected by MT. This dependency may reflect cognitive load. During the retention period, parietal aERS first increased with task difficulty, however it decreased for the most difficult condition. This dependency may reflect the described phenomenon of the cognitive effort drop, although it was not affected by MT. During preparing and response, parietal aERD increased with accuracy decrease. However, low MT neutralized this dependency. This may reflect cognitive effort increasing in situations of uncertainty. Overall parietal alpha oscillations and cognitive performance are modulated by task difficulty and MT. Further research is needed to verify these effects with higher levels of difficulty.

T10 - Towards a computational cognitive perspective of misinformation

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Misinformation presents a challenge to societies worldwide but the cognitive computations underlying its detection and use are only coarsely understood. In this talk, I will introduce a behavioural task and accompanying Bayesian models that allow us to study key aspects of the phenomenon and frame it as a learning problem about the trustworthiness of information providers. Alongside, I will present pilot data, highlighting participants' successes and failures.

T11 - The microsaccadic rate signature in "blindsight" monkeys

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Microsaccades are rapid miniature eye movements that occur at a steady rate during gaze fixation and exhibit the properties of larger foveating saccades. Just as with larger saccades, microsaccade rate is modulated by abrupt visual onsets, which result in a decreased microsaccade frequency shortly after visual change, followed by a rebound to a higher rate. Although the dynamics and functional implications of this biphasic inhibition-rebound pattern, known as the microsaccadic rate signature, have been thoroughly investigated, its underlying neural circuits are still debatable, with both cortical and subcortical structures being considered as candidates. Thus far, reversible inactivation of the superior colliculus (SC) affected microsaccade directions but not microsaccade rate (Hafed, Lovejoy, & Krauzlis, 2013), whereas frontal eye field (FEF) inactivation influenced the late rebound phase of microsaccade rate but did not change the early inhibition (Peel et al., 2016). Here, we investigated the causal role of the primary visual cortex (V1) in the microsaccadic rate signature. We presented peripheral stimuli to Japanese macaques having a large, unilateral V1 lesion. Before the lesion, the microsaccadic rate signature and microsaccade direction modulations were consistent with the literature. After the lesion, baseline fixation was associated with a general bias of microsaccade directions away from the affected visual hemifield (for which the monkeys exhibited cortical blindness). More importantly, peripheral stimuli presented within the intact visual hemifield resulted in reflexive microsaccades in their direction followed by later microsaccades towards the affected hemifield; and stimuli presented within the affected hemifield resulted in microsaccadic inhibition followed by a large bias of microsaccades towards the intact hemifield. Thus, the V1 lesion did not eliminate the typical microsaccadic rate signature, despite altering its parameters. Our results support a subcortical, lower brainstem origin of the early microsaccadic inhibition effect, in particular, as has been recently suggested (Hafed et al. 2021).

T12 - Topological Analysis of Human Gaze on Natural Image Space

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In this study we develop a topological description for free-viewing gaze patterns on natural images, where the sequence of saccades and fixations can be understood as a matching between a subset of image patches in the periphery space to their corresponding subset in the fixation space. An image patch appears in the periphery before it gets fixated, so there is a bijective map between patches in these two signal spaces. Image patches in the fixation space could be taken as pixel signals from the screen and image patches in the peripheral space could be modeled as filtered signals. From each of the signal spaces, a distance matrix could be computed, describing the pairwise relationship between image patches in the space. We have shown that for each pair of real-valued symmetric matrices obtained from the two signal spaces, there exists an unique decomposition of the matrix into order preserving blocks of submatrices, such that in a matched pair of blocks, their corresponding order complexes are homeomorphic.

T13 - Sythetic 9T-like structural MRI using Generative Neural Network

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Aiming to tackle data deficiency in 9-Tesla Magnetic Resonance Image(MRI) anatomic images of human brain, which fits an adequate amount for deep neural network training, we applied generative neural networks to produce super-resolution 3D images based on extensive amount of 3T data. Such synthetic data own two main attributes to provide training model with essential features included in 9-Tesla images, ultra-high spatial resolution and the distinguishable contrast, thus a supervised neural network would gain better prediction accuracy benefiting from such realistic data augmentation. Additionally, such augmentation scheme avoids offending privacy from real patients as well as expensive scanning, especially when it comes to such data-driven neural network jobs. Moreover, high quality MR images better resolved contours of tissues and are helpful for follow-up data analysis, e.g. image registration, segmentation, etc., which employed advantage of the prevailing convolutional neural networks.

T14 - Working memory during typing: EEG study

Darya Momotenko*[,a]

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Executive functions (EF) support the ability to retain information in working memory (WM) while suppressing unconscious reactions to external stimulation (Baggetta&Alexander, 2016). Typing is a hierarchical process in which EF are involved. The leading theory describing the processes of typing posits a model of two feedback loops that have specific properties associated with text processing (Logan & Crump, 2011). This model is based on the hierarchical control of cognitive processes during typing (Scaltritti et al., 2017). According to the model, the external loop is responsible for formulating sentences, and the internal one is responsible for the typing of these sentences. This phenomenon reflects the process of storing and processing information, which is implemented in WM. Therefore, by showing the respondent a sentence to be remembered and typed, the processes of neuronal activation and inhibition during the typing process may be traced. We aim to study the neurophysiological processes and WM during typing. We plan to obtain neuromarkers of WM during typing, which can be a prognostic and diagnostic tool for determining EF. We plan to recruit 60 skilled typists 17-19 y.o. (30 male). The BRIEF self-questionnaire (Gioia et al., 2000) and UNIT (Bracken&McCallum, 2016) will be administered. EEG will be recorded from 128 Ag/AgCI electrodes while participants memorize the maximum number of words in the sentence during the presentation (5 seconds), after which the participant was required to type the maximum number of memorized words. We used 13 sentences that included all letters of the alphabet. The sentences consisted of 7 to 14 words of varying degrees of lexical complexity. We pland to study the time-frequency EEG and spectral ERP and their relationship to WM. The statistical analysis will be implemented using ICA and Multiply Regression methods. We assume that there will be an inverse and proportional relationship between WM and the amplitude of the LRP and inhibition of the ipsilateral, and activation of the contralateral motor cortex in alpha and beta rhythms during typing. Funding: Russian Foundation for Basic Research grant № 20-313-90046\20 (PI: Grigorenko E.L.).

T15 - Turning magic into research

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Magic is a helpful tool for scientists to investigate human behavior and cognitive processes, such as attention, awareness and surprise. However, while there is a growing interest for magic in psychology, it has not been in the focus of neuroscientists yet. In this project, we attempt to shed light on the neural correlates of high-level prediction errors by means of functional magnetic resonance imaging (fMRI) using magic tricks. We created and validated a set of videos showing either magic tricks, similar control actions or surprising events. The magic videos contained one out of three magic effects and were shown to subjects either with or without prior knowledge about the underlying method of the magic tricks. By means of univariate analyses we could replicate previous results and show that high-level as well as low-level areas were activated during the perception of magic tricks in an effect-dependent manner. Moreover, we found areas differentially active in the perception of magic, when comparing neural responses before and after the revelation of the magic trick, suggesting that these areas are involved in higher level prediction. Multivariate analyses showed that information about the perceived magic effect can be read out of low-level visual areas, rising evidence for feedback prediction signals about high-level visual features.

T16 - Is there any difference between source or item monitoring?

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Metamemory involves the individual's knowledge and regulation of one's own memory. Judgement of Learning (JOL) is a widely used and investigated task to assess confidence in future remembering. Judgement of Source (JOS) - a twin task of JOL, is typically used for source metamemory monitoring. The main aim of this study was to disentangle whether these two tasks rely on the same or different monitoring mechanisms. To do so, congruence and type of information (source or item) were also manipulated: participants were presented with congruent and incongruent source-item pairs, and were requested to make both JOL and JOS judgements separately. In the memory test, participants were given old and new items and asked to indicate whether these items were presented at the encoding. If the answer was positive, participants had to name the source. Analysis on memory showed effects in relation to congruence: higher accuracy for congruent than incongruent pairs of information. No differences were found depending on the JOL or JOSs task. Analysis on relative metamemory accuracy, however, showed that participants did not discriminate between congruent and incongruent pairs when assessing their confidence. No significant differences were found between confidence ratings in JOS and JOL. These results support the hypothesis of a common mechanism of source and item monitoring in metamemory. The results, however, did not support the previous research, according to which incongruent pairs tend to be remembered more accurately, than congruent. Overall, it seems that the factor of congruence plays a much bigger role in determining the memory accuracy and confidence than the choice between JOS and JOL judgements.

T17 - Neural correlates of working memory function in children with focal lesional epilepsy

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Epilepsy is one of the most common brain disorders. In addition to seizures, children with epilepsy face with a high risk of cognitive impairments, including malfunctioning in executive functions such as working memory. The bilaterally represented executive functions are likely to depend on the integrity of interhemispheric white matter tracts like Corpus Callosum (CC). Using Diffusion Tensor Imaging (DTI) we can investigate white mater integrity measured by Fractional anisotropy (FA) of epilepsy patients. In this study, we analyze the DTI data from 17 patients with childhood epilepsy and 24 controls, to investigate the cognitive sequelae of focal epilepsy. Previous studies proved that microstructural changes in CC may indicate functional reorganization in adults. However, it is not yet confirmed for children. Therefore, we aim to characterize the link between structural and microstructural changes in the CC for children with epilepsy. Specifically, we extracted FA scores from three subregions (Genu, Body, Splenium) of CC and correlated them with scores in a working memory task. Our univariate analysis of variance results controlled for age show that patients' FA scores decrease significantly with age as covariate at subregion Genu; Moreover, the working memory scores are positively correlated with FA scores at Body among patients. This information may serve as quantitative biomarkers in future treatment studies.

Workshops

W1 - Toolbox for Light Microscopy

Olga Oleksiuk

Light Microscopy Instrumental Manager at Universitätsklinikum Tübingen

Light microscopy is the most widely used approach for life science research. This workshop will provide the participants with a short overview of different light microscopy techniques and elements of imaging analysis as a toolbox to get the best results. The available microscopes within the joint HIH-CIN Imaging Cluster in the Tübingen University Hospital will be introduced.

W2 - Science Communication: Why bother?

Polina Krivykh

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Science communication is becoming more and more trendy nowadays. It is really cool and wonderful to see that scientists share their research with the general audience. During the workshop, we will discuss why even bother and spend time on science communication, and what are possible ways, platforms and options to share scientific knowledge. Finally, we will touch the topic of how to start doing all that if you feel inspired!

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