ABSTRACTS
MIND AND MATTER

Conversations Across Disciplines

6–8 June 2023, Helsinki, Finland

UNIVERSITY OF HELSINKI

ACADEMY OF FINLAND

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MIND AND MATTER Conversations Across Disciplines

6–8 June 2023, Helsinki, Finland

Programme and Abstracts

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PROGRAMME

Tuesday, 6 June 2023

17:30–18:00 Registration (Banquet Rooms, Unioninkatu 33)

18:00–19:30 University of Helsinki Reception

Wednesday, 7 June 2023

09:30–10:15 Registration (Metsätalo, Unioninkatu 40)

10:15–10:30 **Welcome**
Professor Kimmo Alho, University of Helsinki

10:30–12:30 **Session 1: Minds with Language**
Chair: Riikka Möttönen, University of Helsinki

Ruth de Diego Balaguer, ICREA and University of Barcelona
In the right place at the right time: temporal expectations modulate language learning

Eleonore Smalle, Ghent University and Tilburg University
Cognitive development as an important piece of the language learning puzzle

Jeremy Skipper, University College London
A voice without a mouth no more: The neurobiology of language and its relationship to consciousness, mental health, and wellbeing

12:30–13:30 Lunch break

13:30–15:30 **Session 2: Perception**
Chair: Alexander Carruth, University of Helsinki

Robert Kentridge, Durham University
What use is colour experience?

Ziad M. Hafed, University of Tübingen
A vision for orienting in oculomotor control circuitry

Susanna Schellenberg, Rutgers
Self-representation and subjective perspectives

15:30–15:45 Break and transition to Unioninkatu 33

15:45–18:00 **Poster session (Unioninkatu 33)**
Poster presenters will be available for questions in two shifts:
16:00–16:50 Posters 1, 3, 5, etc.
16:50–17:40 Posters 2, 4, 6, etc.

See the end of this document for a numbered index of posters.
The winners of the poster competition will be announced at 17:45.

Thursday, 8 June 2023

10:00–12:00 — Session 3: Motivation and Cognitive Control

Chair: Benjamin Cowley, University of Helsinki

Markus Ullsperger, Otto von Guericke University Magdeburg
Multiplexed performance monitoring signals in the EEG in health and mental disorders

Gerit Pfuhl, NTNU and The Arctic University of Norway
Is it effortful to be rational?

Jonathan Shock, University of Cape Town
Attention, reward and preference: Ideas of the mind applied to AI

12:00–13:00 — Lunch break

13:00–15:00 — Session 4: Crossdisciplinary Influences in the Study of Mind

Chair: Valtteri Arstila, University of Turku

Anne Giersch, INSERM - French National Institute for Health and Medical Research
Phenomenology and experimental approaches in psychiatry: is there any sense there?

John Bickle, Mississippi State University and University of Mississippi Medical Center
Crossdisciplinary neuroscience: Philosophers' contributions as metascientists

Ophelia Deroy, Ludwig Maximilian University of Munich
Making sense of active sensing

15:00–15:30 — Coffee break

15:30–17:30 — Session 5: Dreaming and Consciousness

Chair: Liisa Kuula, University of Helsinki

Martin Dresler, Donders Institute for Brain, Cognition and Behaviour, Radboud University
The cognitive neuroscience of lucid dreaming

Robert Stickgold, Harvard University
Sleep, Memory and Dreams: The Need for Consciousness in Dreaming

Anu-Katriina Pesonen, University of Helsinki
The role of REM sleep in emotional processing

KEYNOTES

Ruth de Diego Balaguer

ICREA and University of Barcelona

IN THE RIGHT PLACE AT THE RIGHT TIME: TEMPORAL EXPECTATIONS MODULATE LANGUAGE LEARNING

Temporal expectations are essential for our motor control, they improve our perception and guide most of our behaviors. Language is predominantly conveyed through speech which is inherently a temporal stimulation. However, and despite the ubiquitous relevance of correctly orienting attention in time, we know little about how this ability influences language function. In this talk, I will review developmental data and neuroimaging evidence in adults indicating how the ability to know what to expect at the correct time is a core component of language learning. In particular, I will illustrate how different aspects of temporal orienting have a determinant role on word segmentation and rule learning. The left frontoparietal system involved in temporal orienting has a clear anatomical overlap with the language network. Is this a pure coincidence? I will argue that it is not, and the intimate relation with temporal orienting abilities is essential to understand language learning.

After a Degree in Psychology, during her PhD at the University of Barcelona (UB) Ruth de Diego Balagauer specialised in Psycholinguistics and Cognitive Neuroscience. She spent three years as a post-doc at the INSERM in Paris (Université Paris Est, Créteil, UPEC) where she studied the involvement of the striatum in the learning of new rules in language. She was a Research-Lecturer at the Ecole Normale Supérieure in Paris before she created her lab at the UB, back in Barcelona as an ICREA Junior Researcher. After that, she became an ICREA Research Professor and consolidated her group at the UB with an ERC Starting Grant. Her research is mainly focused on the cognitive functions and neural circuits engaged in the extraction of grammatical rules while learning a new language.

De Diego Balaguer's research combines information from brain-damaged patients, developmental populations and brain-imaging in healthy individuals to understand whether words and rules of language require different neural and cognitive mechanisms to be acquired since the earliest stages of contact with a new language. She is particularly interested in i) the role of the attentional systems in the acquisition of different aspects of language; ii) the role of the striatum as a brain structure that could make the interface between language and other cognitive functions necessary in the learning process; and iii) how is the acquired information consolidated and modified when we learn new additional information.

Eleonore Smalle

Ghent University and Tilburg University

COGNITIVE DEVELOPMENT AS AN IMPORTANT PIECE OF THE LANGUAGE LEARNING PUZZLE

Why do children learn language more easily than adults do? This puzzle has fascinated language scientists for decades. In the poster presentation, we will approach the language learning puzzle from a cognitive perspective that is inspired by evidence from the perceptual and motor learning literature. Recent neuroscientific studies show that two memory systems in the brain are involved in human learning, an early implicit procedural memory system and a late-developing cognitive or declarative memory system. We argue that cognitive development comes at a cost for implicit statistical learning processes that are essential in the early stages of novel language acquisition. This is supported by experimental evidence from our lab showing that acquisition of implicit linguistic knowledge is enhanced under cognitive depletion in adults. More research is needed to test the cognitive cost hypothesis, as it could partly solve the language learning puzzle.

Dr Eleonore Smalle is a post-doctoral research fellow of The Research Foundation – Flanders (FWO) at Ghent University (Belgium) and an Assistant Professor at Tilburg University (Netherlands). She combines methods from experimental psychology (e.g., brain stimulation and behavioral tasks) for studying cognitive correlates to language learning. In 2022, she was laureate for the EOS Pipet Science Award for her work on language learning.

Jeremy Skipper

University College London

A VOICE WITHOUT A MOUTH NO MORE: THE NEUROBIOLOGY OF LANGUAGE AND ITS RELATIONSHIP TO CONSCIOUSNESS, MENTAL HEALTH, AND WELLBEING

Most research on the neurobiology of language overlooks its relationship to consciousness, mental health, and wellbeing (and vice versa). I introduce a 'HOLISTIC' model, which proposes that distributed brain networks involved in language processing and inner speech generate and sustain self-awareness or higher-order consciousness. Over time, these collectively maintain the 'narrative self' and include regions like the superior temporal gyrus, ventral pre- and primary motor cortex, and aspects of the 'default mode network'. Entrenchment in these networks could lead to impaired mental health or wellbeing. Consequently, neuroplasticity targeting them should improve these by altering conscious experience and allowing for more flexible or adaptive narratives. I present preliminary evidence from our group supporting this model. Specifically, individual differences in brain networks and regions associated with language processing, inner speech, and the 'narrative self' 1) predict variations in wellbeing; 2) are disrupted by propofol, a drug causing loss of consciousness; and 3) are a primary target of both acute and long-term use of psychedelics, drugs profoundly impacting consciousness and self-related processing. Collectively, our work suggests that any mechanistic understanding of the 'neural correlates of consciousness' and the neurobiology of mental health and wellbeing must take into account the neurobiology of language.

After living nomadically in a car and some vans for a few years, Jeremy Skipper got a PhD and became an Associate Professor at University College London. After another bout of living nomadically on a narrowboat, his current research uses neuroimaging and psychedelics to examine the relationship between the neurobiology of language, inner speech, and consciousness.

Robert Kentridge

Durham University

WHAT USE IS COLOUR EXPERIENCE?

Colour is a confusing topic for many reasons. One is that we use the term both to describe an aspect of our visual experience and to describe a property of the surface of objects in the world which is related to the way in which they reflect light of different wavelengths. These usages are often in conflict. We may judge that two objects are covered in the same colour of paint but, if one is in sunlight and the other in shadow, the colour experiences they elicit will differ. As the function of vision is most obviously to inform us about the properties of objects in the world (such as the nature of their surface material) so that we can act in a manner that maximises our chances of survival, we might ask what the function of that other version of 'colour', colour experience, could be? Our colour experience neither matches the proximal colour stimulus (the light reaching our eyes) nor the distal stimulus (the spectral reflectance of an object's surface). By analysing how and when colour experience is likely generated, and in addition considering the timing of experience in general, I suggest a role for colour experience (and phenomenal experience more broadly) in episodic memory.

Bob Kentridge is a Professor of Psychology at the University of Durham in the North-East of England. He has spent many years investigating the effects of brain damage on consciousness in people with the conditions 'blindsight' and cerebral achromatopsia – colour blindness cause by damage to ventro-medial occipital cortex. The results of this work have implications for philosophical positions on the nature of consciousness, the role of attention in consciousness, and colour. Kentridge regularly speaks at meetings that attract a mix of philosophers and psychologists and has had many fruitful discussions with philosophers which have prompted him test some of their hypotheses empirically. In the last five years he has also been collaborating with archaeologists in Durham and Germany on developing tests of hypotheses about the role of psychological and visual factors in the production and use of the earliest art in the upper Palaeolithic (the 'ice age') – Visual Paleopsychology. He supervises graduate students in Psychology, Philosophy, and Archaeology. He is currently a Fellow of the Canadian Institute for Advanced Research's programme in Brain, Mind and Consciousness.

Ziad M. Hafed

Eberhard Karls Universität Tübingen

A VISION FOR ORIENTING IN OCULOMOTOR CONTROL CIRCUITRY

Movement control is critical for successful interaction with our environment. However, movement does not occur in complete isolation of sensation, and this is particularly true of eye movements. Here, the superior colliculus (SC) plays a fundamental role, issuing saccade motor commands in the form of strong peri-movement bursts that are widely believed to specify both saccade metrics (direction and amplitude) and kinematics (speed). The lower brainstem, in turn, transforms these commands into appropriate extra-ocular muscle drives. In this talk, I will describe how the existence of visual sensory responses in the SC and brainstem oculomotor control networks is critical for supporting visual behavior, as well as for coordinating rapid orient-versus-interrupt decisions that we are constantly faced with in a dynamic environment. The series of investigations that I will describe will culminate in the intriguing observation that classic SC saccade-related peri-movement bursts are clearly dissociated from movement kinematics; rather, they are sensory-tuned and contain information about the visual features of the saccade targets. The visual signals that we observe are also often the strongest for images of real-life objects, rather than simplified patterns. These results recast classic models of brainstem oculomotor control, as well as hierarchical cortico-centric views of visual image processing for perception.

Ziad was trained as an Electrical Engineer at McGill University, and he graduated with great distinction on top of his class. He then obtained his Master's degree in Electrical Engineering, again receiving highest honors, before completing a Ph.D, both his Master's and Ph.D. degrees were completed at McGill University, after which Ziad moved to the Salk Institute for Biological Studies as an NSERC (Canada) and Sloan-Swartz (USA) Fellow.

Ziad's interest in vision started at the end of his undergraduate studies, during which he worked on computer vision and developed a novel face recognition algorithm for computers. At the time, computer vision was faced with significant challenges to achieving robust performance, and the field as a whole sometimes looked for insights from biological vision. Ziad was thus intrigued by understanding human vision, because it works so successfully and so effortlessly despite the major theoretical challenges discovered by computer scientists and engineers. As a result, he embarked on developing biomimetic neural network models of brain circuits in his Master's research, exploring human visual performance in behavioral experiments during his Ph.D., and investigating neurophysiological mechanisms in awake, behaving primates at the Salk Institute for Biological Studies.

Ziad moved to Tübingen in 2010, and he continues to approach the problem of visual perception using a multitude of techniques. He is particularly interested in the role that eye movements play in supporting visual perception, and he is infinitely grateful for the amazing team of students and scientists working with him.

Susanna Schellenberg

Rutgers

SELF-REPRESENTATION AND SUBJECTIVE PERSPECTIVES

When an individual navigates her environment as a philosophy professor, her perspective is different than when she does so as a parent or a mountaineer. Her preferences are different, what evidence she pays attention to shifts, and which of her many beliefs are relevant changes. This paper explores the role of self-representation in our perspectives. I argue that how an individual represents herself is a critical part of her perspective. I argue moreover that how she represents herself can shift from moment to moment thus entailing shifts in her perspective. If this is right, then contra orthodoxy, a perspective is not a fixed point in intellectual space that changes only slowly over time.

Susanna Schellenberg is Professor of Philosophy and Cognitive Science at Rutgers University. Her main research interests are in philosophy of mind, AI, neuroscience, and epistemology. The topics she has tackled include perception, consciousness, evidence, mental capacities, representational content, and imagination.

In a series of papers culminating in her book The Unity of Perception: Content, Consciousness, Evidence (Oxford University Press, 2018), she has developed an integrated theory of perception that is sensitive to evidence from neuroscience, cognitive psychology, and psychophysics. Perceptual content, consciousness, and evidence—three key features of perception—are each analyzed in terms of one fundamental property: the employment of perceptual capacities. In grounding consciousness, evidence, and content in the physical world, Schellenberg shows that these features of the mind are no less amenable to scientific investigation than any other features of the world. This physicalist view explains how perception is our key to the world while situating perception within that world in all its beauty and complexity.

Her current research is focused on issues at the intersection of AI, neuroscience, and philosophy funded by a Mellon New Directions Fellowship. She is working on a project on subjective perspectives in humans, AI, and animals.

Markus Ullsperger

Otto von Guericke University Magdeburg

MULTIPLEXED PERFORMANCE MONITORING SIGNALS IN THE EEG IN HEALTH AND MENTAL DISORDERS

Performance monitoring is essential for successful goal-directed behavior. An important aspect is the utilization of feedback on action outcomes in uncertain environments to make inferences on action-outcome contingencies and to learn and update action values. After a brief introduction of the neuroimaging and EEG correlates of performance monitoring in humans I will focus on feedback-related EEG dynamics. I will present data on the representation of reward prediction errors, learning rate, surprise and other variables guiding future decisions in the feedback-locked EEG. In a series of probabilistic learning experiments we found that variables influencing the update of stimulus and action values are represented in a latency range between 200 and 700 ms in a multiplexed fashion. Multivariate pattern analysis and regression approaches show that feedback-locked EEG activity can be used to predict subsequent behavioral adjustments and future decisions. In the last part of my presentation I will present data from patients with schizophrenia and major depressive disorder, respectively. Both patient groups show deficits in probabilistic learning. A transdiagnostic finding is that both groups show a reduced dynamics (i.e., decay) of the learning rate with learning progress rendering them more susceptible to misleading probabilistic feedback. These behavioral deficits are accompanied by specific changes in the feedback-locked EEG dynamics.

Professor Markus Ullsperger heads the Department of Neuropsychology at the Otto von Guericke University Magdeburg. His research focuses on developing and testing neurobiologically plausible models of performance monitoring and adaptive goal-directed behavior in humans. To this end he pursues a convergent-methods approach combining neuroimaging and EEG with computational modeling and pharmacological challenges. In addition to studies in healthy participants, his research extends to clinical populations with neurological, neuropsychological, and psychiatric disorders. His current work focuses on the interactions of the anterior midcingulate cortex with other brain regions to signal the necessity and implement adaptations, ranging from motor slowing via shifts in selective attention to learning and belief updating.

Trained as a physician, Markus Ullsperger obtained his doctoral degree at the Max Planck Institute of Cognitive Neuroscience in Leipzig, Germany, in 2000. Thereafter he worked as a scientific staff member at the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig at the Department of Cognitive Neurology. After his habilitation, he moved to Cologne, where he headed the Max Planck Research Group 'Cognitive Neurology' at the Max Planck Institute for Neurological Research. In 2009, he was appointed as full professor of Biological Psychology at the Radboud University Nijmegen, Netherlands, and principal investigator at the Donders Institute for Brain, Cognition, and Behaviour. Since 2012, he has been full professor of Neuropsychology at the Otto von Guericke University Magdeburg, Germany. In 2021/22 he served as President of the Society for Psychophysiological Research.

Gerit Pfuhl

NTNU and The Arctic University of Norway

IS IT EFFORTFUL TO BE RATIONAL?

Dual process theories of reasoning propose that normative and rational judgements are more effortful than intuitive judgements. This is inferred from response times, e.g., “thinking fast, and thinking slow”. A hallmark of expertise is that former effortful processes become intuitive and fast. This implies that response times are not helpful to know whether processing was effortful or not. To investigate whether a judgement requires cognitive effort we therefore used pupillometry. Effortful processing yields larger phasic responding or larger pupil dilation. In the first task, teleological reasoning (seeing causes when there are none), normative responding was not associated with longer response times or more effort. In contrast, overthinking was. In the second task, we provided participants with congruent, incongruent or uninformative base rate information in addition to stereotype information. We found two groups of respondents. Base-rate respondents required more time and effort to answer given uninformative base rate information whereas stereotype respondents required more time to answer normatively when given incongruent base-rate information. This illustrates that being rational is not necessarily effortful. I will discuss the implication for dual and single process theories of reasoning.

Gerit Pfuhl is Professor in Cognitive Neuroscience at the Norwegian University of Science and Technology. Her PhD was on Bayesian brains and abstract reasoning of corvids. With computational and physiological methods her research group studies human reasoning and decision-making and particularly the factors contributing to being rational.

Jonathan Shock

University of Cape Town

ATTENTION, REWARD AND PREFERENCE: IDEAS OF THE MIND APPLIED TO AI

In this talk I will discuss the balance and tension between using intuitive ideas from cognitive science to guide the development of Reinforcement Learning and Active Inference agents. I will talk about the benefits of attention bottlenecks, and the place of rewards and preferences within exploratory AI systems.

Jonathan Shock is an associate professor in the Department of Maths and Applied Maths at the University of Cape Town and an adjunct professor at the INRS Montreal. Originally from Oxford, England, he completed his PhD at the University of Southampton in 2005, in applications of string theory to understanding quantum chromodynamics. He then had postdoctoral research positions in Beijing, Santiago de Compostela and Munich before becoming a lecturer at the University of Cape Town in the Department of Mathematics and Applied Mathematics in 2013. He has a wide array of research interests and spends a lot of his time supervising students. His research interests cover machine learning (in particular reinforcement learning), theoretical physics, and neuroscience.

Anne Giersch

INSERM, Université de Strasbourg

PHENOMENOLOGY AND EXPERIMENTAL APPROACHES IN PSYCHIATRY: IS THERE ANY SENSE THERE?

Understanding schizophrenia can mean trying to capture the experience of patients, and disentangling the role of cognitive and neurobiological disorders. Integrating these approaches is always a challenge, but even more so in pathologies whose definition is still a matter of discussion. I will focus on only one part of the patients' sometimes strange experiences, i.e. disorders of the sense of bodily self. We usually imagine our bodily self as one, unique, and at least to some extent permanent, continuous in time. I will try to illustrate how phenomenology and experimental psychology may (cautiously) cross-talk. I will depart from phenomenological descriptions and show an example of how we tried to understand what leads to the disorders of the sense of self and time continuity. I will show how we can reason from the results and imagine the experiential consequences for the patients, i.e. in a crowded environment when they move, and from there create new experimental approaches.

Anne Giersch is Research Director at INSERM, at the University of Strasbourg. Her work focuses on the cognitive processes underlying perception and how they are impacted by mental disorders such as schizophrenia. The methods her group uses include psychophysics, EEG, fMRI, and tracking of ocular movement. Much of her work relates to temporality and selfhood (often in relation to schizophrenia), central themes in phenomenology.

John Bickle

Mississippi State University and University of Mississippi Medical Center

CROSSDISCIPLINARY NEUROSCIENCE: PHILOSOPHERS' CONTRIBUTIONS AS METASCIENTISTS

Pursuing crossdisciplinary neuroscience is different for philosophers and neuroscientists. Room for methodological innovation is greater in philosophy of science than in neuroscience. A recent case in point is the rise of the science-in-practice movement. Historically, philosophers have been most interested in the products of science, and mostly in its more theory-connected products (explanations, models, simulations, and theories themselves). The science-in-practice movement has shifted philosophical focus onto science's practices. Metascience is a variety of science-in-practice research. It seeks to explicate concepts pertaining to science by way of accurate descriptions of the practices that generate them; to make explicit various factors that implicitly drive scientists to do what they do in their day-to-day work, rather than what philosophers wish or hope or normatively recommend they do. In my presentation I'll focus on what philosophers pursuing metascience have contributed to crossdisciplinary neuroscience, with a focus on molecular and cellular cognition (MCC) research on learning and memory.

John Bickle is a Professor of Philosophy at Mississippi State University and Scientist-Educator at the University of Mississippi Medical Center. He has been interested in interactions between philosophes and neuroscientists since his graduate training in both disciplines in the 1980s and edited The Oxford Handbook of Philosophy and Neuroscience (OUP 2009). More recently, he has been at the forefront of a new focus on research tool development in neuroscience, resulting in a co-edited volume (with Carl F. Craver and Ann-Sophie Barwich), The Tools of Neuroscience Experiment: Philosophical and Scientific Perspectives (Routledge 2022).

Ophelia Deroy

Ludwig Maximilian University of Munich

MAKING SENSE OF ACTIVE SENSING

Most cases of perception in humans and in other animals involve some sort of movement – either of the sensory apparatus (hands, eyes, whiskers) or of the head or body. Studying perception during movement however raises big experimental challenges, especially when neural methods are concerned. In this talk, I will reflect on my work with cognitive neuroscientists and neurobiologists on what "active perception" means, especially across species and senses, and how it bears on what is being studied in the lab.

Ophelia Deroy is a Professor and Chair of the Philosophy of Mind and Neuroscience at Ludwig-Maximilians-Universität München. She is a member of the Faculty of Philosophy and the Munich Centre for Neuroscience. Her research has focused on the philosophical and cognitive aspects of perception, and multisensory integration in particular. More recently, as a director of Cognition Values Behaviour Research Group, which is an Interdisciplinary Research Lab at LMU, her work increasingly focuses also on how social interactions shape perception and decisions.

Martin Dresler

Donders Institute for Brain, Cognition and Behaviour, Radboud University

THE COGNITIVE NEUROSCIENCE OF LUCID DREAMING

During dreaming, we typically do not realize that we are not awake, despite an often bizarre dream environment. The exception of this rule is the phenomenon of lucid dreaming, where dreamers become aware of their current state of mind during ongoing sleep. Despite having been physiologically validated for decades, lucid dreaming is still poorly understood. In this talk I will give an overview on the cognitive neuroscience of lucid dreaming, including its neural correlates and induction strategies.

Martin Dresler received master degrees in biopsychology, philosophy and mathematics from Ruhr University, Bochum; received his PhD from Philipps University, Marburg; and performed postdoctoral research at the Max Planck Institute of Psychiatry, Oxford University and Stanford University. He is an associate professor for cognitive neuroscience at Radboud University Medical Center, where he leads the Donders Institute Sleep & Memory Lab.

Robert Stickgold

Harvard University

SLEEP, MEMORY AND DREAMS: THE NEED FOR CONSCIOUSNESS IN DREAMING

Dreaming represents one of several modes of memory processing that occur during sleep. The organization and function of dreams is explained by the NEXTUP model of dreaming. NEXTUP stands for Networks Exploration To Understand Possibilities. NEXTUP argues (1) that dreaming is a mechanism for exploring the usefulness of remote memories often only weakly associated with a current concern, (2) that the brain uses the dream narrative to explore this usefulness by observing the emotions generated while the narrative plays out, (3) that if the emotions generated are strong enough, the brain strengthens the neural pathways between the memory and the current concern, and (4) that this process can only be carried out by the brain in a conscious state.

Robert Stickgold is a professor of psychiatry at Beth Israel Deaconess Medical Center and Harvard Medical School. He received his B.A. from Harvard University and his Ph.D. from the University of Wisconsin, Madison, both in biochemistry. He had post-doctoral fellowships at Stanford Medical School in neurochemistry (with Eric Shooter) and at Harvard Medical School in neurophysiology (with Stephen Kuffler). He has published two science fiction novels, and over 100 scientific publications, including papers in *Science*, *Nature*, and *Nature Neuroscience*. His work has been written up in *Time*, *Newsweek*, *The New York Times*, *The Boston Globe Magazine*, and *Seed Magazine*, and he has given invited talks around the world, including Brazil, Sweden, Switzerland, Japan, and The Netherlands. He has been a guest on *The Newshour with Jim Leher* and NPR's *Science Friday* with Ira Flato several times, extolling the importance of sleep. He has spoken at the Boston Museum of Science, the American Museum of Natural History in New York, and NEMO, the Amsterdam museum of science. His current work looks at the nature and function of sleep and dreams from a cognitive neuroscience perspective, with an emphasis on the role of sleep and dreams in memory consolidation and integration. He has been a pioneer in establishing the importance of sleep in offline memory processing, and has identified a range of memory types enhanced by sleep. In addition to studying the normal functioning of sleep, he is currently investigating alterations in sleep-dependent memory consolidation in patients with schizophrenia, autism spectrum disorder, and PTSD. His work is currently funded by NIMH. He is coauthor, with Antonio Zadra, of the new book *When Brains Dream.*

Anu-Katriina Pesonen

University of Helsinki

THE ROLE OF REM SLEEP IN EMOTIONAL PROCESSING

There are several key questions remaining unanswered in relation to the affective brain function during sleep. Of sleep stages, the rapid-eye-movement sleep (REMS) is the most compelling candidate for sleep related affective processing, continuously investigated for that purpose since early 1960s. Its strong position in affective processing relies on its wake-like physiology; REMS is the most aroused sleep state, showing a desynchronized electroencephalogram (EEG) with theta and alpha waves, fast oscillations in the 20-50 Hz range of beta and gamma activity typical for wakefulness, muscle atonia, vivid dreaming, and varied and mental event-bound autonomic nervous system (ANS) activity. This talk concentrates on the state-of-the-art understanding of the role REM in emotional processing mental well-being. It gives insight into experimental methods that can be used for the investigation of REM sleep and gives overview of the state-of-the-art in REM-sleep research.

Anu-Katriina Pesonen is professor in experimental mind and brain research at the Faculty of Medicine, University of Helsinki. Her scientific background is in developmental psychology and sleep research, and she leads an interdisciplinary Sleep & Mind Research Group, combining methods and designs from psychology, medicine, and brain research. The team studies sleep structures, and develops experimental interventions to explore how sleep affects cognition, emotions and well-being, specifically in youth.

POSTERS

Giuseppe Flavio Artese

University of Kassel, DE

THE EXPERIENCE OF AFFORDANCES IN AN INTERSUBJECTIVE WORLD

The term affordance is a term in radical embodied cognitive science used to characterize the action possibilities offered by the environment. Notably, affordances are increasingly understood by philosophers and psychologists in relational terms that cut across dualities of knower and known, subject and object, or animal and environment. In recent years, relational theorists have begun to mark out two explanatory roles for the affordance concept. In one role, affordances are cast as belonging to a shared, publicly available environment that has an existence independent of the experience of any perceiving and acting animal. In a second role, affordances are described in phenomenological terms, in relation to an experiencing animal that has its own peculiar needs, interests and personal history. In this poster presentation, I argue for a single phenomenological and experiential understanding of the affordance concept able to reconcile the two different meanings that have attributed to the term by relational theorists. I do so first of all based on William James' concept of pure experience developed in his later, radical empiricist writings, suggesting that the Jamesian notion of pure experience serves as a model for how to understand affordances in phenomenological terms. I will argue however that James' notion of pure experience did not emphasize enough the social and intersubjective character of experience. James thought of pure experience as having a field structure that is organized by the selective interest and needs of the perceiver. Drawing on Gurwitsch I suggest that factors like individual needs and attention must be thought of as already confronted with a social reality. On the phenomenological reading of affordances here developed, affordances are understood as belonging to an intersubjective world structured by human social and cultural life.

Enrico Brugnami

Universidad de La Laguna, ES

UNDERSTANDING ATTENTIONAL MODULATION IN PREDICTIVE ERRORS THROUGH CONCEPTUAL SPACE MODELS

When we perceive reality, we hold certain hypothesis of expected data, but sometimes our hypothesis fails and our perceptions mismatch our expectations. In Predictive Processing this understood as prediction error (PE). In cases like this, our attention fluctuates to the features that are expected to generate more PE, so we can have a better response when PE occurs.

The aim of this poster is to understand this modulation of attention in PE cases with the diagrammatical apparatus of Conceptual Space Theory (CST) (Gärdenfors, 2000; Hautamäki, 2016). In CST we build conceptual spaces based on different features/dimensions of things perceived. When ordering hierarchically the dimensions attending to their salience, we construct multidimensional perspectives. My thesis is that multidimensional perspectives models can represent intuitively our cognitive performances of changing attention when PE occurs. This is going to be represented with diagrams in the poster along with explanations.

Tommi Buder-Gröndahl

University of Helsinki, FI

THE AMBIGUITY OF SEARCHING FOR LINGUISTIC REPRESENTATIONS IN DEEP NEURAL NETWORKS

The recently emerged field of BERTology (Rogers et al. 2020) aims to locate linguistic representations in state-of-the-art deep neural networks (DNNs) like BERT. This would demonstrate the representational potential of data-driven algorithms that lack innate language-specific constraints. However, interpreting experimental results is hindered by an ambiguity in how the term "linguistic representation" has been used in prior literature. Two readings can be distinguished, called the "content-reading" and the "vehicle-reading" here. Both treat linguistic representations as computational vehicles in a cognitive system. Their disagreement concerns how the linguistic status of such vehicles is established.

The content-reading takes linguistic representations to be vehicles that have linguistic properties as intentional contents (Rey 2020), determined by some referential theory of content such as informational semantics or teleosemantics (e.g. Dretske 1981, Millikan 1989). In contrast, the vehicle-reading denies that linguistic properties are found anywhere outside the cognitive system itself, and assimilates linguistic representations to high-level characteristics of the system's intrinsic structure (Collins 2014, Adger 2022). The readings give radically inconsistent criteria for how a DNN (or indeed any cognitive system) could contain linguistic representations in the first place.

Furthermore, both readings face significant theoretical challenges. Since DNN inputs are linear concatenations of tokens, the content-reading is in tension with the influential claim that syntactic structures are irreducible to linear strings of words (Chomsky 1957, 1975). The vehicle reading, in turn, resembles structural mapping accounts of computational realization, which suffer from well-known triviality problems (Sprevak 2018). The current predicament thus invites three possible ways forward: (1) accepting the content-reading and rejecting the irreducibility of syntax; (2) accepting the vehicle-reading and establishing a non-trivial mapping from DNN-states to linguistic descriptions; or (3) seeking non-representationalist alternatives for interpreting DNNs.

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ARISTOTLE AND PHENOMENOLOGY

This work analyses the influence of the Aristotelian theory on the origins of phenomenology, specifically in the investigation of Franz Brentano and Maurice Merleau-Ponty. We will address the work in which Brentano claims to be an Aristotelian and compare it with his attempts to highlight psychology as a science along with the foundations of phenomenology. For that, we will also develop the paramount notion of intentionality to phenomenology. We will investigate the similarities and differences between this notion in Aristotle, Brentano and Merleau-Ponty. Furthermore, it will be presented a significant similarity in the language of Merleau-Ponty and Aristotle. Finally, we argue that Brentano is not as Aristotelian as he claims.

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A TRANSIENT BETA OSCILLATION OCCURS WITH HIGH TEMPORAL REGULARITY PRIOR TO STOPPING AN ONGOING MOVEMENT

Beta oscillations (~15-30 Hz) undergo pronounced modulations during volitional movements. They are control signals for brain-machine interfaces that aim to restore movement in paralysis and are also therapeutic targets for closed-loop DBS in Parkinson's disease. However, usefulness of the beta oscillation has been limited by lack of understanding whether they cause immobility or maintain it. Moreover, there are conflicting reports on the role of randomly timed beta bursts in action stopping. These discrepancies may be due to the predominant use of the stop signal task, which estimates when subjects plan to stop instead of aligning brain activity to an observable stopping time. We used a new paradigm in which head-fixed rats on a treadmill began running and then chose to return to immobility. Peak velocity of these movements provided an unambiguous stop initiation time. We recorded 32-electrode EEG bilaterally from anterior frontal to posterior visual cortex (55,833 trials, 306 sessions, 14 rats). Beta power increased 50 msec prior to stop initiation. Larger movements (and thus a greater need for stopping) were associated with increased beta power. Responses were localized to motor cortex but was unexpectedly lateralized. Surprisingly, beta power also increased bilaterally in visual cortex. Starting 600 ms prior to stop initiation, beta burst count gradually increased and across-trial Fano Factor decreased. We assessed causality by calculating transfer entropy between the ongoing beta power envelope and treadmill velocity. During planning and execution of stopping, beta power was informative about velocity 200 msec in the future, but uninformative when considering epochs of sustained running or only the execution and maintenance of stopping. These data demonstrate conclusively that beta oscillations predict stopping and that the neural correlate of stopping is neither sustained beta power, nor randomly timed beta bursts, but beta bursts of consistent timing before stopping.

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DO ENERGY DRINKS BOOST YOUR COGNITION?

Cognitive effort depends on cognitive ability and motivation. We spend more effort for something we want, and we need less effort if we have high ability. Energy drinks are consumed to enhance motivation and performance, which implies that they increase cognitive effort. However, whether these drinks, (or, more precisely, their active ingredients) lead to an increase in spent cognitive effort has not been studied. We designed a double-blind placebo-controlled within-subjects experiment using artificial energy drinks. The manipulated active ingredients are sugar and caffeine, and participants are given either none, one or both of them in the three test sessions. Taste testing showed no ability to detect the active ingredients. Cognitive effort is gauged with the Cognitive Effort Discounting Paradigm (COG-ED; Westbrook et al. 2013, PLoS ONE) where effort is relative to a participant's cognitive ability, i.e., performance in the n-back task. Intrinsic motivation for challenging cognitive tasks is assessed with the Need for Cognition scale (Cacioppo & Petty, 1984, Journal of Personality Assessment). We also ask participants how much they believe energy drinks will increase motivation and performance. We predict that caffeine and sugar will lead to more cognitive effort spent on the COG-ED, and that this effect will be mediated by the participants' belief in energy drinks. Results are expected by Easter 2023.

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THE INFLUENCE OF FEATURE-BASED ATTENTION AND RESPONSE REQUIREMENTS ON ERP CORRELATES OF AUDITORY AWARENESS

In search for the neural correlates of consciousness (NCCs), it is important to isolate the true NCCs from their prerequisites, consequences, and co-occurring processes. To date, little is known about how attention affects the event-related potential (ERP) correlates of auditory awareness and there is contradictory evidence on whether one of them, the late positivity (LP), is affected by response requirements. By implementing a GO-NOGO design we controlled for feature-based attention and response requirements in the same experiment. The results show a prolonged auditory awareness negativity (AAN) for aware trials, which was influenced neither by attention, nor by response requirement. The LP was affected by both attention and response requirement. Consistent with the levels of processing hypothesis, the LP was related to consciousness as a correlate of the processing of higher-level stimulus features, likely requiring access to a "global workspace". Our findings further suggest that AAN is an ERP correlate of auditory consciousness proper and thus a true NCC in the auditory modality.

Heidi Haanila

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DIMENSIONS OF SELF - ELUCIDATED IN AN ANALYSIS OF DREAM EXPERIENCES

Selfhood is central in everyday experience and an important theme in the philosophy of mind. However, the concept of self is notoriously ambiguous. In this poster, I approach selfhood by examining dreaming and ask, how the study of dreaming can contribute to the definition of self. Dreaming is an altered state of consciousness that typically involves extensive alterations in self-consciousness and thus, the study of dreaming can function as a methodological tool for bringing out the subtleties of self.

The most general conceptual distinction within the self is drawn between minimal and reflective self. The first mentioned refers to self as a pre-reflective subject or subjectivity of experience, whereas the latter refers to self as an object of reflection. In more detail, minimal self involves (at least) experiential, embodied, and affective aspects of self, whereas the reflective self involves psychological-cognitive and narrative aspects of self.

I analyze the characteristics of self-experience in dreams and how it differs from the waking self-consciousness in terms of the aspects in both minimal and reflective self. This analysis elucidates different aspects of self and brings out the connections between them and the necessary features of self. Since the dream self typically lack many features of waking self-consciousness, my focus is on defining the most fundamental aspect of the minimal self that prevails even during dreaming. However, also the opportunities to study the reflective self through dreaming are briefly considered.

Risto Halonen, Sanni Luokkala and Anu-Katriina Pesonen

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RIGHT-LATERALIZED SLEEP SPINDLES ASSOCIATE WITH ENHANCED RECOGNITION ACCURACY FOR NEUTRAL MATERIAL: AN OVERNIGHT STUDY

Sleep is especially important for emotional memories, although the mechanisms for prioritizing emotional contents are not well known. As in waking conditions, emotional processing during sleep may be hemispherically asymmetric: right-lateralized REM theta (~4–7 Hz) has been found to associate with the retention of emotional memories. No research exists on lateralized non-REM sleep oscillations. However, sleep spindles, especially when coupled with slow oscillations (SOs), are known to facilitate off-line memory consolidation.

Our primary goal was to examine how the lateralization (right-to-left contrast) of certain sleep oscillations, i.e. REM theta, sleep spindles and SO-spindle coupling, associated with overnight recognition accuracy in a task consisting of neutral and emotionally aversive pictures. 32 healthy adult participants encoded 150 pictures before an overnight sleep. Recognition was tested three times: immediately, 12h and 24h later.

Recognition accuracy was similar between neutral and aversive pictures in immediate and 12-h retrievals, but after 24h, emotional pictures were less accurately recognized ($p<.001$). This difference was associated with the right-to-left contrast in frontal fast spindle density ($p<.001$). The lateralization of SO-spindle coupling was associated with higher neutral vs. emotional difference across all retrievals ($p=0.004$).

Our findings contribute to a largely unstudied area in sleep-related memory consolidation. Hemispheric asymmetry in non-REM sleep oscillations may be involved in neutral vs. emotional memory processing, although it remains uncertain whether the phenomenon is underlain by mechanistic off-line memory consolidation or if oscillatory lateralization reflects a trait-like bias in cognitive and/or affective processing. Methodological choices and participants' affective traits may be involved.

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THE EFFECTS OF STRESS EXPERIENCE INDUCED PRE-SLEEP AROUSAL ON SLEEP THE SUBSEQUENT NIGHT

Disturbed sleep often stems from pre-sleep arousal subsequent to stress experiences, in some cases involving emotions such as shame and social rejection. Our aim was to elucidate the impact of stress induced pre-sleep arousal on sleep processes during early night non-rapid eye movement sleep. In examining the physiological response to a social stress experience, we studied whether simulating a public speaking scenario using a virtual reality headset was sufficient in producing changes in heart rate variability (HRV) parameters. We compared two groups of healthy young adults (N=34), which differed in the experimental task. The stress group held a public speech in front of a virtual audience while the control group listened to a neutral presentation in the same but empty virtual seminar room. Physiological stress responses were measured with a portable HRV monitor and sleep processes with EEG. Group comparisons revealed significant changes in HRV and sleep parameters indicative of a successful stress induction. The stress group exhibited heart rate elevation and a shift in the HRV power spectrum around the virtual reality task as well as altered sleep the subsequent night. Early night slow wave sleep increased but wake-like beta activity adversely interfered with its slow wave activity, the effect augmenting in later sleep. We proposed a homeostatic viewpoint, where the presence of wake-like beta activity at sleep onset and early sleep in the stress group might explain the increase in early slow wave sleep.

Minna Huotilainen

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MUSIC FROM UTERUS TO DEMENTIA - HOW TO INTERPRET THE FINDINGS OF NEUROSCIENCE OF MUSIC ACROSS THE LIFE SPAN

Recently, neuroscience of music has provided a plethora of research findings on the role and effects of music across the life span. The most seminal ones include fetal musical memories (Partanen et al., 2013), infant auditory capabilities (Teinonen et al., 2009), accelerated language development with musical play in toddlers (Linnavalli et al., 2018) and especially in cochlear-implant users (Torppa et al., 2019), cognitive enhancement due to instrument playing in school-aged children (Putkinen et al., 2015, Saarikivi et al., 2019), neural effects of music therapy on adolescents (Erkkilä et al., 2011), and neural changes due to music rehabilitation in elderly stroke and Alzheimer's patients (Särkämö et al., 2018), among several others.

It is typical that in their studies, researchers have used narrow age groups, carefully defined patient groups, age-appropriate tasks, and situational cognitive or social goals in their studies, making it challenging to generalize across the age span and across the role of music. My work aims at holistic bridge building and recognizing research gaps in the field of neuroscience of music. Rather than attempting to build a uniforming theory on the role of music in the life of humans, I present a likely more successful matrix model of effects of music. This model aims at highlighting both the present important findings and the urgent need of research in specific, so far unattended areas.

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ASSOCIATION OF EARLY LIFE STRESS AND EMOTION REGULATION RELATED BRAIN ACTIVITY DURING BEHAVIORAL EMOTION REGULATION TASK

Early life stress (ELS) poses a significant risk for emotional well-being and the development of emotion regulation (ER). Robust research evidence indicates that ELS associates with alterations in spontaneous and task-based brain function (Kraaijenvanger et al., 2020). Such alterations have been suggested as the neurodevelopmental basis for ER related difficulties. However, neurodevelopmental ELS research utilizing behavioral ER related tasks is much scarcer, making it difficult to decipher how relevant the alterations are for behavioral ER (Ross et al., 2021). In the current functional magnetic resonance imaging (fMRI) study we utilized an emotional Go/No-go task (stimuli comprise images of neutral, happy, and angry faces) alongside prospective and retrospective measures of ELS. To consider the potential impact of ELS on motivational processes (Novick et al., 2018), the Go/No-go -task was extended with reward conditions (points were given for correct answers, subtracted for wrong answers, or no feedback was given). We expect increased ELS to associate with altered regulatory performance (i.e., response time and response errors) and task related brain activity. Functional alterations are expected in corticolimbic areas relevant for both ELS (e.g., SFG, amygdala, precuneus) and ER (e.g., PFC, ACC, superior temporal sulcus, hippocampus). The participants comprise a subsample (n = 90; 48 females) of now adult children of the Finnish families followed from pregnancy into their children's early adulthood. ELS was assessed both prospectively (parental reports of family relationship problems and mental health problems during pregnancy and infancy) and retrospectively (self-reported adverse childhood experiences in late adolescence). Participants completed the MRI scanning session in early adulthood (18–21 years old). Both behavioral and imaging data are analyzed using repeated measures and drift diffusion models. Preliminary results suggest that ELS has negligible influence on task performance and the underlying brain activity. Analyses are ongoing.

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OVERT CUES FOR COVERT LESSONS: LEARNING NONADJACENT REGULARITIES FROM CONTINUOUS SPEECH REQUIRES PERCEPTUAL CUES

The ability to extract regularities from the environment ("statistical learning") is crucial for learning without explicit instructions. One such context is language acquisition, where learners have to segment salient units from a continuous stream of speech. In natural language, salient units may be adjacent (e.g., in word-level segmentation) or nonadjacent (e.g., in syntax, the present continuous tense is _ing forms a nonadjacent regularity). Previous research suggests that unit co-occurrences are tracked at both adjacent and nonadjacent levels. Perceptual cues, such as pauses, prosodic cues or phonological similarities, facilitate learning; with nonadjacencies, they may be a prerequisite (Isbilen & Christiansen, 2022).

We investigated how natural prosodic cues in speech streams affect statistical learning of adjacent and nonadjacent regularities. In two online experiments, 30+30 participants passively listened to structured speech streams containing syllable triplets with both adjacent ("ABC") and nonadjacent ("AxC") regularities.

The experiments differed in triplet pitch structure. The neutral structure was possible to learn based on transitional probabilities between syllables, whereas the prosody structure also included pitch cues. A two-alternative forced-choice (2AFC) task probed learning of adjacent and nonadjacent regularities. To tease apart the learning of adjacent and nonadjacent regularities, nonadjacent regularities were presented in a triplet containing a novel middle syllable ("AyC") in the 2AFC task. They were pitted against foils with two familiar syllables and one novel syllable.

With perceptual cues, i.e., prosody, participants learned both adjacent and non-adjacent regularities. Without any perceptual cues, participants learned the adjacent regularities only. Overall, performance was better with perceptual cues. Thus, our results suggest that perceptual cues facilitate word segmentation but are necessary for tracking nonadjacent regularities in speech. Our future studies aim to determine how higher-level cognitive mechanisms interact with statistical learning of adjacent and nonadjacent regularities.

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NEURAL OSCILLATIONS REVEAL IMPLICIT PREJUDICE UNDETECTED BY BEHAVIOURAL MEASURES

Categorizing other people helps cognitive function but leads to inaccurate and harmful stereotypes (Fiske, 1998). While explicit measures show worldwide progress in lessened prejudice, implicit prejudice as measured by the Implicit Association Test (IAT) has not followed, partly explaining why groups remain unequal (Charlesworth & Banaji, 2019). Most studies on neural prejudice have focused on detecting biological processes that would explain the implicit and explicit measures of social behaviour, not the behaviour itself. Recently, it has been proposed to capture neural prejudice separately from behavioural measures using induced neural oscillations and magnetoencephalography (MEG) (Hautala et al., 2022; Levy et al., 2021, 2022). These studies have revealed neural mechanisms accounting for prejudice that is not captured by traditional implicit or explicit measures, reflected by oscillatory neural activity typically in the posterior cortex. In the current study, we ask whether neural measures can detect prejudice in a society where opposing discrimination is normative. We show that while explicit and implicit measures do not show intergroup prejudice against Muslim immigrants in a sample of 43 young adult Finns, neural oscillations show a reaction in the fusiform gyrus and amygdala, often associated with intergroup face perception bias. This research shows how adding neuroscience can help unravel social processes.

Jesse Kuokkanen

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ABSTRACTION AND COMPUTATIONAL PROPERTIES: THE VERTICAL-HORIZONTAL DISTINCTION IN THE MECHANISTIC FRAMEWORK OF COGNITIVE SCIENCE

In philosophy of cognitive science, accounts of physical computation study the question of what makes something a physical computing system. From the start, the working hypothesis in cognitive sciences has been that the brain or mind is a computer, so the question is highly relevant for sciences of the mind. One of the most popular and discussed theories of physical computation is the mechanistic account (Piccinini, 2015; Piccinini, 2020). I pinpoint an important theoretical blind spot in the mechanistic account and present a theoretical distinction between vertical and horizontal descriptive abstraction that, I argue, should be incorporated into the mechanistic account of physical computation.

The mechanistic account of physical computation (MAC) relies heavily on the notion of abstraction. In MAC, abstraction means omission of information from the description of a phenomenon, which is why I call it descriptive abstraction. For example, the laptop I am using to write this text can be described at different levels of abstraction: molecules, transistors, larger electronic components, or simply describing it as a laptop. 'Laptop' can be said to be the most abstract of these, as it omits the most information. According to MAC, mathematical descriptions of physical systems are abstract in this sense. Furthermore, it says that computational descriptions of physical systems are mathematical descriptions and thus, abstract in the same sense.

However, I argue that MAC conflates the direction of descriptive abstraction. In the case of a laptop and its components, one is dealing with vertical abstraction where one travels between levels of mechanisms. However, this cannot be the case with computational properties and their implementing physical structures, as they are not in a mechanistic part-whole relationship with one another. Instead, I suggest that computational properties are arrived at through horizontal descriptive abstraction, which omits information while staying within one mechanistic level.

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STATISTICAL LANGUAGE LEARNING WITH AND WITHOUT AWARENESS

How do we learn languages? Babies, children and adults use statistical learning (SL), i.e., automatic tracking of transitional probabilities, in detecting boundaries between repeating nonsense words (Saffran et al., 1996; Isbilen & Christiansen, 2022). Natural speech has a melody, i.e., prosody, which can also affect SL. It is exaggerated in infant-directed speech compared to adult-directed speech (Ma et al., 2020). It remains unresolved whether prosody affects SL by attracting attention to speech signals or by providing cues about its structure.

We tested, in two online experiments in 30 Finnish-speaking adults, the effect of pitch (fundamental frequency, F0) changes on SL of trisyllabic word-forms (e.g. lu-vi-ra). In Experiment 1, with natural prosody, the first syllable was the highest and the last one the lowest in F0. In Experiment 2 with random prosody, F0 varied randomly in each triplet. Both experiments included also neutral speech streams with constant F0. After exposure to the 4-minute syllable streams, learning was tested using a two-alternative forced choice (2AFC) task. Awareness of newly learned word-forms was assessed with confidence ratings (from “I guessed” to “I remembered”; see Batterink et al., 2015).

In experiment 1, 2AFC accuracy was higher in the natural prosody than the neutral condition. In Experiment 2, random prosodic cues did not increase accuracy relative to the neutral condition. Evidence for purely implicit learning without explicit awareness of word-forms was observed only in the natural prosody condition. In contrast, explicit awareness of learned word-forms was observed in all three conditions (neutral, prosody and random).

Our results suggest that naturalistic prosody improves adult SL, and it especially enhances extraction of linguistic patterns from continuous speech without awareness. Furthermore, results do not support the idea that attention plays a role in SL. Our on-going experiments focus on neural mechanisms underlying SL with and without prosody.

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LEARNING AND REACTION TIME VARIABILITY DURING CONTINUOUS PERFORMANCE TEST IN ADULTS WITH ADHD

Attention-deficit hyperactivity disorder (ADHD) in adults is associated with neuropsychological deficits in inhibition of interference, ability to focus and in sustained attention (Sergeant, et al, 2002). Although less than one fifth of ADHD cases have comorbid learning disorder (McCann & Roy-Byrne, 2000), executive functions mentioned above are essentials components in the process of learning. We have thus constructed a protocol to probe the interplay between these cognitive processes. In the current research we aim to answer the question of how the patterns of learning differ between patients with ADHD and neurotypical controls during the visual attention task.

The data was collected from 53 adults with ADHD (25 male, 28 female, aged 18-60) and 18 matched healthy controls measured with high-resolution electroencephalography. Participants performed a novel Primed Subjective Illusory Contour Attention Task (PSICAT), which presents gestalt-stimuli targets with distractor primes to induce interference inhibition during ecologically-valid sustained attention task. Growth curve modelling approach was used to analyse participant-wise reaction time (RT) and RT variability change over the time of the experiment.

The results demonstrate that for both groups learning takes place during the first fifth of the experiment. Regarding timing and patterns of learning our analysis revealed significant similarities between ADHD and Control groups. However, ADHD group showed greater variability of RT than Control group throughout the whole experiment, especially at the end of each experimental block. The insights from the current research can encourage educational professionals to study participants' individual learning trajectories and implement new techniques in order to enhance learning opportunities in ADHD patients.

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INTERACTION-BASED PHENOTYPING FOR OBSERVER-INDEPENDENT MEASURES OF SOCIAL IMPAIRMENTS IN PSYCHIATRIC DISORDERS

Mental health conditions impose a rising burden on societies around the world. Yet, the society is ill-equipped to address the problem due to limited understanding of the range of effects and underlying causes of mentally ill health and a lack of appropriate individualized interventions. Psychiatric conditions are, perhaps universally, characterized by disordered social interactions. Most behavioral measures aiming to evaluate these social deficits rely on subjective scales to assess the symptoms. Truly objective, quantitative measures remain scarce in both research and clinical practice limiting the ability to independently measure social disturbances. Deep behavioral phenotyping of natural social behavior may provide a more objective window into individual social difficulties. Here, we present initial findings and future outlook of quantitative behavioral measures as potential direct and objective markers for detection and subsequent quantitative monitoring of mental health conditions through social and physical activity patterns. These measures include quantitative behavioral analysis of dyadic interactions with motion tracking, and digital interaction patterns and physical activity levels derived from smart devices. We test these measures in studies focusing on patients with autism compared with neurotypical controls. Results suggest that during the autism diagnostic observation schedule (ADOS), the time spent jointly orienting toward one another is reduced in patient-interviewer dyads as compared to control-interviewer dyads, even though instances of mutual gaze are also present in high-functioning patients. Concurrently, participant-initiated interpersonal cross-correlation of upper body and arm movements with the interviewer is reduced in patients compared to controls. Smartphone-based data collection revealed that while interest toward digital communication appears largely intact in individuals with autism, they show a preference for text-based communication and a concurrent reduction in verbal communication. These findings support further research into complex social phenotypes of mental health conditions and their characterization by means of digital phenotyping.

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TRAIT AFFECT REGULATION PREDICTS LOWER LEVELS OF NEGATIVE AFFECT IN DREAMS

Affect regulation—the process people influence the experience and expression of affect (Gross, 1998)—is central to our psychological well-being. Existing literature has consistently shown that individuals who habitually use adaptive affect regulation strategies (as compared to less adaptive ones) experience more positive affect and less negative affect in their daily lives (e.g., Gross & John, 2003; Kobylińska et al., 2022). Such habitual or trait affect regulation has been suggested to also underlies affective dream experiences (Sikka et al., 2019). However, it remains unclear how trait affect regulation is associated with dream affect due to a lack of empirical data.

Here, we investigated the relationship between trait affect regulation and dream affect. 96 participants (18-55 y, M = 24.52, SD = 6.42) filled in a questionnaire assessing their habitual use of affect regulation strategies (i.e., trait affect regulation), such as cognitive reappraisal and expressive suppression. Then, participants were asked to fill in a home dream diary every morning upon awakening for one (N = 45, n = 413) or two weeks (N = 51, n = 246). For each dream diary, participants reported their dreams and rated their dream affect and sleep quality.

Multilevel regression analyses showed that, individuals who reported higher levels of trait affect regulation, specifically the use of cognitive reappraisal, experienced lower levels of negative affect in dreams. These findings suggest that (1) individual differences in trait affect regulation may underlie affective experiences not only in wakefulness but also during sleep; and (2) there is trait-like affective continuity between wakefulness and sleep.

Steven McGannon

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ARE "NARCISSISTIC SYSTEMS" VERIDICAL SYSTEMS?

Teleosemantic theories of mental representation hold that representational content is determined by a certain privileged, naturalistic relation that exists between a given representation and what it represents. However, teleosemantic theories rest on an under-explored assumption about what are mental representations are like, namely, that they are veridical (Grush, 1997; Rusanen et al., 2021). This veridicality assumption holds that the relation between mental representations what they represent is, in some sense, accurate. Kathleen Akins (1996) argues that this assumption is false: mental representations are nonveridical and, rather, result from our self-centered, or "narcissistic," sensory systems (Akins, 1996).

In this paper, I will outline a possible objection to Akins's (1996) view. Additionally, I will propose some possible responses to this objection. I will first outline an objection with draws on Akins's own example comparing "narcissistic" thermoreceptors with "veridical" thermometers. I'll argue that there is good reason to think Akins characterization of thermoreceptors as nonveridical relies on special cases — including deception (or illusion) and overloaded capacity — and that such special cases likewise exist, in some capacity, for comparative veridical systems like thermometers. Finally, I'll propose some possible responses to this objection, including that Akins's theory of narcissistic systems better accounts for possible special cases.

Bruno Mölder

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HOW COULD INTERPRETIVISM MAKE SENSE OF THE MIND UPLOAD POSSIBILITY?

Philosophers and futurologists have entertained the admittedly far-fetched possibility of uploading minds to computers and then downloading them again to suitable bodies. However, the hypothesis about the mind upload possibility helps to throw new light on some traditional problems about the mind. In particular, this makes us ask what is necessary for the continuity of the mind given the variability of the bodily substrate and which accounts of the mind fit better with the possibility of the mind upload. For instance, functionalism seems to be the most suitable account for uploaded minds. Theories that regard embodiment as necessary for the mind are very difficult, if not impossible, to reconcile with the mind upload possibility.

This poster will focus on how interpretivism could make sense of the mind upload hypothesis. For the sake of argument, I bracket worries about its possibility. On the interpretivist approach, the possession of mental properties is essentially dependent on interpretation. According to this view, the transfer of the neural basis of the mind is not yet sufficient for the mind upload. There remains the issue of whether mental states and the mind can be ascribed to the uploads. That issue is not entirely factual and will depend on the range of application of folk psychological concepts.

Provided that we ascribe mental states to uploads, a further difficulty arises for interpretivism: how to interpret the upload or simulation located in the computer that does not exhibit any observable physical behaviour since it does not have a body? The poster will also sketch a solution to this problem, proceeding from the notion of virtual behaviour.

Sergio Navarrete Arroyo, Peixin Nie, Satu Salonen, Paula Virtala and Teija Kujala

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EARLY CHILDHOOD MATURATION OF NEURAL SPEECH PROCESSING, ASSOCIATION WITH LANGUAGE SKILLS AND IMPACT OF FAMILIAL DYSLEXIA RISK

Introduction: Foundations for speech and reading skills are formed during early development. Recording vent related potentials (ERPs) allows studying perceptual and cognitive processing already in childhood. Particularly, the mismatch response (P-MMR), the mismatch negativity (MMN) and the late discriminative negativity (LDN) responses reflect speech discrimination. These ERPs have been shown to reflect deficits associated with dyslexia risk since birth. However, there is a lack of longitudinal studies assessing the potential of neural auditory processing as a predictive marker of language development in early childhood.

Objective: We investigated the associations of neural auditory speech discrimination at 0 and 28 months with oral and written pre-reading skills at 28 months and 4.5 years of age.

Methods: We recorded ERPs at 0 (N=190) and 28 (N=146) months to assess the neural discrimination changes to vowel, duration and frequency deviants in pseudo-words in a sample over-represented by children with familial dyslexia (DD) risk. ERPs were compared with test results for phonological awareness, linguistic short-term memory, letter knowledge and fast serial naming at 28 months and 4.5 years, controlling for DD risk.

Results: We found that larger and left-lateralized P-MMR, MMN and LDN at 28 months of age predict a better development of phonological awareness, linguistic short-term memory and fast serial naming in a pre-reading stage. In addition, larger P-MMRs at birth predict a better performance in fast serial naming. No correspondence between brain responses and test scores was found for letter knowledge. Furthermore, children with DD-risk exhibited worse linguistic short-term memory, fast serial naming and letter recognition than control children.

Conclusions: Our results highlight a strong association between ERPs and pre-reading skills, possibly offering opportunities for early detection of atypical linguistic development in children worldwide.

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DEFICIENT VERBAL WORKING MEMORY IN TWO-YEAR-OLD CHILDREN WITH DYSLEXIA RISK: RESULTS FROM OUR NEW TEST FOR YOUNG CHILDREN

Dyslexia, a common learning disability, is a deficit in accurate word recognition and spelling despite normal intelligence. Previous research found that dyslexia can be connected with difficulties in verbal working memory (WM). However, whether the poorer verbal WM can already appear in the early age of children with familial dyslexia risk has been rarely investigated. We developed a verbal WM task specifically for young children. The task required children to put toys in the box in the same order as the examiner's oral instruction, and the scores depended on how many times the children could do it correctly. We measured the performance in the verbal WM task in children with (n = 51) or without (n = 37) dyslexia risk at the ages of two and five years, and the performance in other language tasks, e.g., word reasoning, verbal IQ, picture naming. The results showed that at the age of two years, children with dyslexia risk had a poorer verbal WM performance than the children without dyslexia risk. Positive associations were significant between verbal WM performance and general word knowledge, word reasoning, verbal IQ, and GLC index, in the no-dyslexia-risk children, but not in at-dyslexia-risk children. However, at the age of five years, the children with or without dyslexia risk did not differ in verbal WM performance. The verbal WM performance of the at-dyslexia-risk children was associated with general word knowledge, sentence repetition, word reasoning, and verbal IQ. No significant associations were found in no-risk children. The results suggest that verbal WM deficits can be found in at-dyslexia-risk children as early as the age of two years. Furthermore, our WM task differentiated children with or without a dyslexia risk at the age of two years, whereas for five-year olds a more demanding task is required to differentiate the groups.

Saija M. Niemi, Maria Olkkonen and Toni P. Saarela

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SHORT- AND LONG-TERM SEQUENTIAL EFFECTS EXHIBIT CONGRUENT BUT INDEPENDENT INFLUENCES ON VISUAL PERCEPTION

Visual perception is biased by previously seen stimuli. In serial dependence (SD), perception is biased towards the immediately preceding stimuli (Fischer & Whitney, 2014): seeing, for example, a red object causes the next object to appear slightly more red than it actually is. In central tendency bias (CTB), perception is biased towards the mean of all stimuli seen during an experiment or towards the mean of a perceptual category in real life (Hollingworth, 1910; Huttenlocher, Hedges & Vevea, 2000). Research on these short- and long-term sequential effects, however, has remained mostly separate. It is unknown if the effects have separate underlying causes or whether they are caused by the same mechanism.

We characterized and compared SD and CTB in visual perception in two experiments. Observers were presented with a stream of stimuli, and they compared two consecutive stimuli in terms of hue (Experiment 1) or length (Experiment 2). We estimated the effect of stimulus history on perceived hue and length by fitting a generalized linear model with a probit link to the data: the bluer/greener (Experiment 1) or shorter/longer (Experiment 2) responses were predicted using the past stimulus values as regressors.

The immediately preceding stimuli and the cumulative mean of stimulus values independently pulled the perception of the current stimulus towards them. Whether both sources of bias were included in the analysis influenced the estimated magnitude of the effects, highlighting the importance of considering both of them during analysis. We conclude that SD and CTB independently affect perception and that one is not an artifact caused by the other. As any experiment employing sequential presentation of stimuli can be affected by these sequential effects, the results have potential implications for a wide range of studies on visual perception.

Natalia Postnova and Benjamin Cowley

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THE ROLE OF JOINT VISUAL ATTENTION IN COMPETITIVE TASKS

According to the eye-mind hypothesis, our gaze reflects our cognitive process (Just et al., 1980). In tasks performed by two or more people the concept of joint visual attention is used that indicates whether people attend to the same visual stimuli in temporal synchrony. Previous studies showed that joint visual attention was predictive of collaboration quality, misunderstanding, and learning (Shvarts et al., 2019). The purpose of the present study is to investigate the role of joint visual attention during learning in a competitive game-task, Tic-Tac-Toe. Unlike collaborative efforts, when the success of the endeavour is based on the common goal and depends on mutual understanding, the competitive tasks introduce the challenge of hiding one's intention. In that context high joint visual attention is not desired by the competing parties, as it can make the game predictable and eliminate the winning possibilities. Using a tailor-made dyadic setting, we collected synchronous gaze data of Tic-Tac-Toe players. The participants played with each other and with AI, which represented a perfect player. While the games between participants were set up as a competition, the AI games encouraged learning and demonstrated the available strategies. By analyzing the amount of joint visual attention at the critical moments of the human-vs-human games, we will elucidate the role of joint visual attention in competitive tasks.

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ACTIVE INFORMATION, NEURAL PROCESSES AND CONSCIOUS EXPERIENCE

Some theories of consciousness give information a central explanatory role. Tononi et al.'s (2016) Integrated Information Theory (IIT) identifies consciousness with a certain kind of physically (and not merely functionally) integrated information. Consciousness is intrinsic to certain causal structures present in a grouping of elements within a system that have physical cause-effect power upon one another (Fallon 2023). Chalmers' (1996) double-aspect theory of information connects with Wheeler's (1990) quantum mechanical view that the physical derives from the informational ("it from bit"). Information is truly fundamental, and experience is information from the inside, while physics is information from the outside. Here yet another informational theory is explored, based on Bohm's (1990) "active information" view. Information is understood as an objective commodity which exists independently of the human mind and literally in-forms physical processes (e.g. information carried by radar waves, the DNA molecule, or a map). Bohm proposed that active information applies even at the quantum level (cf. Wheeler). Quantum active information has radically new properties: it enables context-dependence, non-locality and an irreducibly holistic way in which the information carried by the quantum wave of a many-body system orchestrates the behavior of a group of particles (e.g. in superconductivity). We postulate that active information plays a role in the brain, unifying its functions due its holistic and environmental nature. Considering Fröhlich condensation as a way for the brain to reach sufficiently long quantum coherence, active information co-ordinates the quantum information processing non-locally, organizing the dynamical evolution of the entire system and yielding the (semantic) meaning of a given brain activity. We propose that in the context of the brain, this holistic information (which involves non-conscious "awareness") is related to the appearance of consciousness as "awareness of awareness", when there is a suitable hierarchical structure of levels of information operative in the brain.

Nataliia Reva

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EVIL AS A LIVED EXPERIENCE - PHENOMENOLOGICAL AND COGNITIVE STUDY

Observing the history of philosophy, we may find there are two predominant dimensions of the study of evil - theological and ethical. While, in science prevail the biological and cognitive approaches. The absence of common ground makes many contemporary researchers find the concept of evil extremely problematic. Some even see a dilemma in its study, saying that we either see evil as a metaphysical (thus, unscientific) phenomenon or as a scientific object of studies.

In my research I try to prove that the concept of evil can be studied philosophically as a scientific phenomenon, by introducing a new term in philosophical discussion – an embodied evil – which emphasizes the connection between Evil and Human Agent through the mediation of Body (with all its biological and cognitive properties) and, at the same time, helps avoiding this misleading association of evil with something supernatural.

From such standpoint, evil becomes a deal of personal embodied experience, providing a philosophically grounded analysis by using phenomenological approach. I propose to consider embodied evil not as a finished action or a fact, but as a lived experience of the manifestation of evil (extremely bad events) in life that has an extension in space and time through the body, which acts as a mediator between what people feel and what they think. As an experience, evil then can influence humans in three ways: (1) bodily (received via senses), (2) psychologically (mental coping), and (3) cognitively (influence on the conceptualization process).

Therefore, an interdisciplinary study and the mixed of methodology from phenomenology and cognitive science (4E paradigm) become justified. The embodied evil can be studied by the use of the standardized experiments accompanied by the phenomenological interviewing. Such cooperation can ultimately lead to a more nuanced and empirically informed understanding of philosophical issues.

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EXPLORING THE LINK BETWEEN DYSLEXIA SUSCEPTIBILITY GENES AND TYPICAL NEURODEVELOPMENT: AN FMRI STUDY

Reading and writing skills are fundamental to human communication and learning. However, our current understanding of how the maturation of neural language networks in the brain supports the improvement of reading in adolescence is limited. Several genetic markers have been associated with impaired reading skills and developmental dyslexia (DD). Further, variation in DD susceptibility genes seems to explain structural alterations in the left temporo-parietal brain regions, even in the neurotypical population (Darki et al., 2014). However, the mechanisms by which such genes influence brain processes related to reading are yet to be elucidated.

In the present study, we examined the effects of DD susceptibility genes DNAAF4, DCDC2, KIAA0319, and NRSN1 on brain activity during language tasks using functional Magnetic Resonance Imaging (fMRI). The participants (n=179) were healthy adolescence with normal reading skills. During the fMRI, the participants were attending to incongruent and congruent written and spoken sentences, under both distracted and undistracted conditions. Brain activity was studied in relation to task, distractor, and congruence. Brain activity in the left inferior frontal gyrus (IFG), intraparietal sulcus (IPS), and middle temporal gyrus (MTG), was studied in relation to variation in five single nucleotide variants (DNAAF4: rs3743204, DCDC2: rs793842, NRSN1: rs10946672 and KIAA0319: rs6935076, rs9461045).

The results showed that language processing during both tasks (reading, listening) modulated brain activity in regions previously associated with language, such as the inferior frontal, superior temporal, and inferior parietal cortices. Variation in DNAAF4 explained variation in brain activity in the left IPS during both tasks. For DCDC2, there was a significant gene × task × congruence interaction in the left MTG. For NRSN1, there was a significant gene × task × distractor interaction in the left IFG. This study provides new insights into the relationship between genetic markers associated with DD and brain activity during language tasks.

Guang Rong, Lauri Ahonen and Benjamin Cowley

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IDENTIFYING EXPERTISE WITHOUT GROUND TRUTH—USING EXPERT GROUND TRUTH AND AN INSTRUMENTAL VARIABLE

Background: Identification of expertise is crucial to performance evaluation 1,2 . This is simple when a ground truth exists. However, such validated knowledge is unavailable in avalanche forecasting3 . Clear causality cannot be established, because most dangerous snow avalanches are triggered by the people involved, and the time-specific absence of avalanche for a slope can be either the result of safe conditions, or lack of triggers 4 . We seek to establish ground-truth-free indicators in the study.

Methods: The study collect data from back-country skiers through an on-site survey in a popular ski area near Tromsø, Norway, over the ski seasons of 2022 - '23. On 6 separate days, we recruit skiers who finished ski trip at the parking lot below the mountain. Information collected includes their routes, self-perceived forecast expertise, the avalanche problems/factor(s) 5 they deem relevant, etc. Additionally, we collect one instrumental indicator we presume to correlate with expertise, which is simple to measure and for which true ground truth is available. During and one day prior to these days, an expert forecaster was sent to patrol the region to make nowcasts of the avalanche problems/factors for ski routes. We will calculate multi-dimensional distance indicators (cosine similarity, Manhattan distance and Mahalanobis distance) between the expert's and skiers' selected avalanche problems/factors. Skiers' expertise will be regressed on distance indicators, nested within ski group (expert model). Furthermore, another model with same parameters but using the instrumental variable as regressor will be fitted (instrumental model). We will test if the instrumental model is comparable to the expert model.

Results planned to be reported: We will report the model fit. We will report the statistics from the hypothesis testing for the non-inferiority of instrumental model.

Expected conclusion: We seek to establish an indicator for making cost-effective estimation of skier's expertise in avalanche forecasts with acceptably good predictive validity.

Fernando Rover, Phil Husbands and Anindya Gosh

University of Sussex, GB

FRAGMENTS. A NOVEL FRAMEWORK FOR TIME EXPERIENCE.

Our conscious experience is inherently temporal. It presents to us in the form of a fleeting present with no clear beginning or end, always imbued within an evanescent stream of perceptual distinctions. Nevertheless, even if most frameworks from cognitive science and related approaches share a view in which this temporal dimension is fundamental for phenomenological experience; the physically grounded notion of punctual state-experience correlations, itself a key theoretical element, seems to directly clash with it.

In fact, we are somehow faced with an apparent paradox; On the one hand, the physical existence of any cognitive system confines it to a physical present in space and time, which in relation to the physical flux of time is unavoidably discrete (i.e. a one-to-one relation is not possible). On the other hand, perceptual experience is in itself, perception of change, which requires for the perceiver system to observe things changing, which seems to involve ‘being there’ for more than one physical frame. We believe that making sense of these facets of time may be crucial in relating the mind and matter gap.

In the attempt to reconcile these premises, we have developed a preliminary formal framework for computational modeling, centered around the idea of sensory-to-perception incompleteness. This demands a temporally-coherent integration of contentless state-correlated sensory frames, which is able to give rise to temporally textured (non-instantaneous) minimal units of perception. Therefore, accommodating physical sensory states and transitions, with a primal temporal aspect of experience.

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EXPLORING DRIVING SIMULATOR DATA CLASSIFICATION BASED ON EYE METRICS

Cognitive readiness is important to face everyday challenges. Automatic detection of weakened cognitive readiness could be beneficial in many fields where high human performance is necessary e.g. driving.

Changes in the cognitive state are reflected in various biosignals and can be detected with the help of machine learning methods. Eyes are the main instrument that allows humans to explore the world around producing a number of signals potentially usefull for cognitive states detection. Nevertheless, there is a lack of studies exploring the use of eye metrics in machine learning for cognitive state detection.

This study explores and evaluates the use of eye metrics in classification of driving simulator data. The thesis demonstrated classification procedure for distinguishing between non-crash, before-crash, after-crash, and crash events in a driving simulator game called CogCarSim.

A set of potentially discriminative features from electro-oculography (EOG) and video-oculography (VOG) signals were extracted: 7 pupil diameter features, 6 gaze point features, 11 saccade and fixation features from the VOG signal, 10 blink features from the EOG signal.

Based on extracted features a set of derivative features were generated. In the suggested approach, several machine learning methods were tested with class balancing techniques and normalization. The best result 69.94% of balanced accuracy was achieved by using the personalized Extreme Gradient Boosting model. The features extracted from pupil and gaze points were found to be the most distinguishing and contributed to the overall performance by 13.78% and 6.31% respectively.

The classification performance was increased to 75.84% utilizing both gameplay and eye-based features. While the model trained only on gameplay features performed on par with the proposed model and gave 68.52%.

The promising results of the study suggest that the selected approach could serve as a basis for future research such as real-time cognitive state detection and collision prediction.

Anna-Mari Rusanen

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CHATGPT, RETURN OF MODULARITY AND FODOR´S GHOST

In this talk, I'll analyse the contemporary discussion concerning the formal and functional linguistic competences of large language models (LLMs). LLMs are DNN- based pre-trained models, which can predict, recognize, summarize, and generate content based on information gained from datasets. Some applications of these models, such as chatGPT, have turned out to perform surprisingly well in certain language processing tasks. The success of LLMs emerges from a very different scientific paradigm than traditional psycholinguist models (cf. Goldstein & al, 2022), as they seem to learn "language" from real-world textual examples 'in the wild', with minimal prior knowledge about language structure (ibid). Some argue that to fully understand the processing principles, power and limits of LLMs, we must separate "formal" from "functional" linguistic competence (Mahowald & al, preprint). "Formal linguistic competence" refers, roughly to the lexical syntax and lexical semantics abilities, while "functional competence" is about cognitive and pragmatic semantic abilities (social modeling, world knowledge, formal reasoning etc). Further, Mahowald & al (ibid) argues that if we approach LLM research in a light of formal and functional competence distinction, we can address some of the challenges that the field faces today by introducing "modularity" to separate core language from cognitive skills. In this talk, I'll analyse critically this proposal.

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NEURAL CORRELATES OF MEANING DURING NARRATIVE LISTENING: A FUNCTIONAL MRI STUDY

When we listen to a narrative, our brain decodes acoustic speech features and unravels its meaning allowing us to immerse ourselves to the gist of the story. Here we studied which brain areas are activated by processing meaning of a naturalistic narrative in comparison to an unintelligible but phonetically similar (gibberish) version of the narrative. Furthermore, we asked how semantic processing of morphological information in a narrative context is reflected in brain activity. We presented an intelligible and gibberish narrative (duration 8 min) to participants (29 healthy right-handed females) during functional Magnetic Resonance Imaging (fMRI), and first studied the similarity of voxel-wise BOLD signals with inter-subject correlation (ISC). We also modelled the semantic content of the narrative with a word2vec-model based on co-occurrences of words in a large corpora and compared the semantic content of the stimuli with brain signal time course with ridge regression. We found that ISC was stronger for gibberish vs intact narrative bilaterally in the middle superior temporal gyrus and for intact vs gibberish narrative in temporal, parietal, and frontal cerebral cortices as well as in precuneus. When ISC with the intact narrative alone showed wide correlation on both hemispheres that partly overlapped with networks of memory and attention, ridge regression with semantic model showed more limited correlation with clusters in fronto-temporal areas and cerebellum. The present results suggest a way to separate processes involved in naturalistic language comprehension.

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DOES EMOTIONAL LANGUAGE USE IN DREAM AND MIND-WANDERING REPORTS REFLECT MENTAL WELL-BEING AND ILL-BEING?

Do the words we describe our experiences with mirror how we feel? Recent decades have seen a growing interest in whether the language people use (e.g., in social media) can reflect their well-being and ill-being. However, little is known about how the content of spontaneous thoughts and experiences—reports of daytime mind-wandering (daydreaming) and nighttime dreaming—reflects waking well-being and ill-being. Here, we investigated the relationship between emotional language use in mind-wandering and dream reports and well-being and ill-being. Participants filled in scales measuring different aspects of well-being (life satisfaction, domain satisfaction, positive affect, psychological well-being, peace of mind) and ill-being (negative affect, symptoms of anxiety and depression). We then used ecological momentary assessment by asking participants to provide reports of mind-wandering and dreaming in daily logs over two weeks. 1781 dream reports from 172 healthy adults and 1496 mind-wandering reports from 153 healthy adults were analyzed using the Linguistic Inquiry and Word Count text analysis software. Multilevel regression models showed that measures of ill-being predicted the negative tone ($\beta = 0.185$, $p < .001$) as well as the use of negative emotion words ($\beta = 0.231$, $p < .001$) in mind-wandering reports. Similarly, measures of ill-being predicted the negative tone of dream reports ($\beta = 0.101$, $p = .006$). Additionally, measures of well-being predicted the use of positive emotion words in dream reports ($\beta = 0.153$, $p = .003$). These findings show that natural language use across different states of consciousness (from mind-wandering to nighttime dreaming) reflects waking ill-being and well-being. The results also provide support for the continuity of affective experiences across different states of consciousness. Clinically, these findings may open the doors to novel, more effective prognostic and diagnostic tools in psychology and psychiatry. However, additional research is required to corroborate the observed relationships and establish their causal direction.

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HAPTIC MEMORY OF VERBAL AND NONSENSE STIMULI

Memory is often studied using visual or auditory materials. Very little is known about haptic memory. In a recognition memory task, participants are presented with stimuli to be memorized. Next, these stimuli are presented again randomly intermixed with new ones, and the task is to recall the memorized stimuli.

We studied haptic recognition memory using verbal stimuli (upper- and lower-case letters) and nonsense shapes. We hypothesized that memory would be better for the former than latter stimuli due to enhancement by verbal encoding.

Furthermore, we studied the laterality effect, i.e. differential contribution of the cerebral hemispheres in cognition. The left hemisphere is often superior in verbal processing, while the right hemisphere is superior for nonverbal material. In haptics, laterality is reflected in differences in performance between hands. Due to contralateral innervation, left hemisphere advantage is manifested as superior performance of the right hand, and vice versa.

We studied the laterality effect by having participants perform memory tasks using the right and left hand separately. We hypothesized that performance would be better for verbal stimuli when the right hand was used, and for nonsense stimuli when the left hand was used.

The results showed that haptic memory was better for upper-case letters than lower-case letters and nonsense shapes. It may be that this advantage was found only for the upper-case letters due to their less complex shape, allowing for a more effective spatial and verbal coding compared to lower-case letters.

The laterality effect existed but was rather weak. Memory performance was better with the right hand for upper-case letters, but only when it performed after the left hand. Other stimuli did not show laterality effects.

These findings may be due to the predominantly spatial and sequential nature of processing in somatosensation. Also, letters are haptically unfamiliar, diminishing verbal coding.

Menno Michiel van Calcar

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REASONING BY BUILDING: USING LEGO TO THINK

Decades of research have paved the way for conceptualizing cognition as extended, embedded, embodied and enactive (4E), instead of the dominant cognitivist view that construes cognition as the internal processing of symbolic representations. However, many are not convinced of 4E's ability to 'scale up' its explanations from basic cognitive skills to higher order cognition, such as reasoning.

I propose that we can conceive of higher order cognition as, at least, co-constituted by embodiment and action. Kiverstein and Rietveld's ecological-dynamic proposal, that we should conceive of linguistic thought as skillful engagement with enlanguaged affordances, points us in the right direction (Kiverstein & Rietveld, 2021). I add that we need agent-specific adaptable elements in the cognitive loop to explain the phenomenon of individual skill-enhancement. These elements are neural structures, which get exapted from older structures (Gould & Vrba, 1982). The characteristics of the older structures often influence the newer functions as cortical biases (Anderson, 2010). This influence forms traces in our cognitive activities. Lakoff and Johnson's famous conceptual metaphors can thus be seen as signifying traces of the basic structures used (and not as examples of conceptual mapping, Lakoff & Johnson, 2003). That means that our basic bodily engagement with the world co-constitutes higher order thought.

I argue that one form of linguistic thought, namely deductive reasoning, is built upon our more basic motoric skills in building. Our early skill at stacking, balancing, etc., is reused when we develop the skill to evaluate validity. I have designed a test to pry out this basis. The results of a pilot test I ran suggest that we should favor the ecological-dynamic view over the cognitivist view. High School pupils who motorically engaged with arguments (using LEGO) outperformed their control group. This points us toward further exploration of the enactive roots of higher order cognition.

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SPATIALLY INTERMIXED COLOR DISTRIBUTIONS ARE SEGMENTED BY HUE, NOT BY COLOR CATEGORY

Color can be used to group similar objects, but can the visual system segment scenes according to arbitrary color distributions? We examined whether observers can extract the ensemble mean hue from a target hue distribution among distractors, and whether a category boundary between target and distractor hues facilitates segmentation. Ensembles consisted of 18 uniformly colored circles with hues drawn from uniform distributions on a hue circle in CIELUV color space. Circles (0.5° of visual angle) were located randomly in a 6-by-6 invisible grid with 1° element separation. The test stimulus contained the target ensemble in the baseline condition, and the distractor and target ensembles in the experimental conditions. The comparison stimulus included one ensemble with mean hue varying around the target mean hue. In Experiment 1, mean target hue was red or green, and distractor mean hue was shifted 180° or 60° from target mean. In Experiment 2, mean target hue was on either side of the green-blue color boundary, and distractor mean shifted 45° from target mean within the same category or across the category boundary. The test and comparison stimuli were presented in two 500ms intervals, separated by 500ms. Observers indicated whether the second ensemble appeared on average bluer/purpler or yellower/greener than the first ensemble, ignoring the distractor ensemble. Psychometric functions were fit to the proportion of “bluer/purpler” or “yellower/greener” responses to estimate perceived target hue and discriminability. Observers could selectively judge the target ensemble mean hue, but discrimination thresholds were higher the closer the distractor mean was to the target mean. Perceived target ensemble mean hue was biased towards distractor hues, and bias magnitude varied between different experimental conditions. Color category boundary between target and distractor hues did not affect discriminability or bias. To conclude, observers can segment spatial color distributions within and across color category boundaries.

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JENANN ISMAEL ON CAUSATION AND FREE WILL

In her 2016 book ”How Physics Makes us Free” and 2012 paper “Causation, Free Will and Naturalism” Jenann Ismael argues that free will is possible from the view point of classical Newtonian physics. One of the worries against free will that she addresses is causal antecedents: the worry that our actions are determined by everything that has happened before in the causal chain. Ismael claims that it is not a problem for free will, because free will can exist in the open subsystems of the world. Deterministic causality works only at the level of the universe as a whole, because the universe is a closed system with no causes coming from outside of the system. If we knew all the initial conditions and the laws, we could calculate the future of the universe. Open subsystems are different in that they may have causes affecting the system from the outside. According to Ismael, free will can be found in self-governing subsystems, human agents.

I argue that Ismael’s argument about the open subsystems is not strong enough to save free will. Causal determinism doesn’t disappear at the level of a human being. Even though we have the feeling of free will and feel like we can causally intervene and affect things, it doesn’t mean that our future is open. From the bird’s eye view, assuming causation and determinism, one could calculate our future. It is not enough to say that human deliberation and the feeling of freedom mean freedom of will. In my opinion it is unlikely that freedom emerges in the way Ismael claims at the level of human being. I think that we still need something else, something more, to save free will.

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NEURAL CORRELATES OF CREATIVE VS. TRADITIONAL ARITHMETIC PROCESSING: AN FMRI STUDY

Arithmetic skills are crucial in everyday life, but a lot remains to be discovered about their neural basis. Here, we investigate the neural processes involved in arithmetic processing, focusing on the effects of traditional arithmetic problem solving as compared to the ideation of arithmetic expressions, and the effects of calculation complexity in these two tasks.

Young adults (n=20) took part in a functional magnetic resonance imaging (fMRI) experiment where they performed three types of numerical tasks: 1) Solve arithmetic problems of varying complexities (e.g., '6-4='? or '3·(3-1)='?), 2) Create equations (e.g., '8=?' given as a target solution, to which, e.g., '4*2' or '(6×6-4)/4' can be given as an answer), and 3) Match numbers (e.g., '68' is shown and the participant gives '68' as a solution). The tasks were factorially combined with four auditory distraction conditions, the analysis of which is omitted here.

The data were analyzed for main effects of Task and Complexity, and their interaction. Performing different tasks modulated activity in regions previously associated with mathematical processing, such as the dorsolateral prefrontal cortex (DLPFC), intraparietal sulcus, and posterior inferior temporal cortex, where the creative task was associated with highest activity. In these regions, main effects of Complexity were observed as well, with complex calculations being associated with higher activity. Task × Complexity interactions were also found in a widespread network of brain regions, including anterior prefrontal regions, right DLPFC, insula, anterior cingulate cortex, and the left angular gyrus. For instance, we observed that anterior prefrontal regions are especially activated during the ideation of complex arithmetic expressions, offering insight into the role of these regions in arithmetic problem solving.

To our knowledge, our results represent the first attempt to probe the neural basis of creative arithmetic ideation, and thus have implications for the cognitive neuroscience of arithmetics.

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12	Miro Ilomäki, Patrik Wikman, Marjo Flykt, Mervi Vänskä, Raija-Leena Punamäki, Kimmo Alho and Jallu Lindblom	Association of Early Life Stress and Emotion Regulation Related Brain Activity During Behavioral Emotion Regulation Task
~~13~~	~~Mona Jahangiri~~	~~Neuroethics: Memory-dampening and the problem of personal identity~~
14	Saara Kaskivuo, Soila Kuuluvainen, Martti Vainio, Eleonore Smalle and Riikka Möttönen	Overt cues for covert lessons: Learning nonadjacent regularities from continuous speech requires perceptual cues
15	Annika Kluge, Jonathan Levy, Niloufar Zebarjadi, Iiro Jääskeläinen, Inga Jasinskaja-Lahti and Matilde Tassinari	Neural oscillations reveal implicit prejudice undetected by behavioural measures
16	Jesse Kuokkanen	Abstraction and computational properties: the vertical-horizontal distinction in the mechanistic framework of cognitive science

17	Soila Kuuluvainen, Saara Kaskivuo, Martti Vainio, Eleonore Smalle and Riikka Möttönen	Statistical language learning with and without awareness
18	Elizaveta Kuznetsova, Tuisku Tammi, Natalia Postnova, Viljami Salmela, Jussi Palomäki and Benjamin Cowley	Learning and reaction time variability during continuous performance test in adults with ADHD
19	Juha Lahnakoski, Jürgen Dukart and Leonhard Schilbach	Interaction-based phenotyping for observer-independent measures of social impairments in psychiatric disorders
20	Enyu Lin, Hilda Engelbrektsson, James Gross, Antti Revonsuo and Pilleriin Sikka	Trait affect regulation predicts lower levels of negative affect in dreams
21	Steven McGannon	Are “narcissistic systems” veridical systems?
22	Bruno Mölder	How could interpretivism make sense of the mind upload possibility?
23	Sergio Navarrete Arroyo, Peixin Nie, Satu Salonen, Paula Virtala and Teija Kujala	Early childhood maturation of neural speech processing, association with language skills and impact of familial dyslexia risk
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25	Peixin Nie, Paula Virtala, Johanna Mäkelä and Teija Kujala	Deficient Verbal Working Memory in Two-year-old Children with Dyslexia Risk: Results from Our New Test for Young Children
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