

Acceptance of artificial intelligence producing natural language

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In recent years, artificial intelligence (AI) has rapidly entered people's everyday life. More and more written and even spoken natural language is produced by AI-based systems such as conversational AIs (e.g., Siri, Alexa), or bots for instance in consumer interaction. Given their growing prevalence, it is important to understand whether the aversion against algorithmic decision-making that has been found in earlier research generalizes to AIs producing natural language. This symposium features experimental research on three questions related to the acceptance of language produced by AIs. First, Talk 1 by Gunser et al. answers the question whether lay people can differentiate texts that are written by humans from those written by an AI (here in case of poetry). Second, Talks 2 and 3 target the question of whether the same text is more accepted when it has ostensibly been produced by a human being versus an AI. Klein et al. (Talk 2) studied social interaction in a chat, whereas Lermann Henestrosa et al. (Talk 3) examined science communication. The final two talks focus on the question of whether special features of AI-based communication contribute to its acceptance. Gaiser et al. (Talk 4) tested the effect of modality (text vs. spoken language) and Gieselmann et al. (Talk 5) studied the impact of competencies ascribed to conversational AIs on their acceptance. Across presentations, results indicate that lay people are able to differentiate between human- and AI-based texts. When one and the same text is presented as human- vs. AI-generated, the acceptance of the text is not influenced by the information about the source. However, specific features of AI such as modality and (ascribed) competencies influence acceptance.

Advances in TVA-based visual attention research: Progress toward new stimuli, tasks, and data

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The Theory of Visual Attention (TVA) understands visual perception as a competition in which visual categorizations compete for encoding into visual short-term memory, biased by attentional and perceptual parameters. With its mathematical framework, TVA formalizes this process rigorously, linking data to theoretical concepts. A trend that has now lasted several years is that some TVA research is moving toward new and more complex stimuli, tasks, and data. Continuing our last-year symposium on this development, we discuss work on how TVA can be applied to a broad range of experimental data and situations: Banh and Scharlau report effects of negation in instructions on visual attention and show how TVA can help to understand the processing of negation. While TVA has already been applied to study the effects of visual salience on attentional processing in the past, social salience effects have not been studied with TVA so far. Scheller et al. present recent work that studies such effects (salience induced by self-association) with TVA. The influence of eye and hand movements on TVA parameters is in the focus of Kreyenmeier et al.'s work. Kristjánsson and Tagu investigate the benefits of the visual-foraging tasks for

assessing the flexibility of attentional control in continuous behavioral situations. Tünnermann and Schubö connect to this with a study of the dynamics of attentional-template switching in visual foraging with the help of TVA-based simulations. A novel extension of TVA for including reaction time data in TVA analyses is presented by Blurton et al.

Akzeptanz automatisierter Fahrzeuge

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Zukünftige automatisierte Fahrzeuge werden sich noch lange Zeit im Mischverkehr mit menschlichen Verkehrsteilnehmern (andere Autofahrer, Fußgänger und Radfahrer) aufhalten und mit diesen interagieren. Für die Akzeptanz der Fahrzeuge und damit deren Gebrauch bzw. Kauf ist wichtig, dass sich einerseits die Insassen dieser Fahrzeuge (als Passagiere), andererseits die anderen menschlichen Verkehrsteilnehmer bei diesen Interaktionen und dem speziellen Verhalten der automatisierten Fahrzeuge wohl und sicher fühlen. In diesem Symposium werden Ansätze und Ergebnisse zu diesem Problemkreis diskutiert, um so zu einer menschenzentrierten Entwicklung der Automation beizutragen. Von der psychologischen Seite her geht es um ein besseres Verständnis davon, welches Verhalten in Interaktionen im Verkehr angenehm und angemessen erscheint.

An interdisciplinary view on trust processes in human-technology interaction

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Trust as a subjective prerequisite for interpersonal reliance has gained importance in the application to the interaction with technology in various fields (e.g., AI-based diagnostic, automated driving, human-robot interaction). The goal of this symposium is bringing together researchers from different psychological domains investigating trust processes in technology interaction. With this, we hope to initiate a fruitful discussion to enhance communication and consensus in theorizing and methods in different fields of applied psychological trust research. The first talk of Kraus introduces the Three Stages of Trust framework as a psychological framework for experimentally investigating trust in the interaction with technological systems. The second talk of Scholz et al. introduces a validation study of a propensity to trust scale along with implications for experimental trust in technology research. The third talk of Schlicker et al. presents a study in which the role of prior experience and explanation styles on trust in automated decision making. The fourth talk of Langer et al. presents a study in which formation and calibration of trust in human- vs. technology-based personnel selection over time were compared. The fifth talk of Sondern et al. summarize an experiment in which the effects of a human and an AI in job negotiations on trust were compared. In the sixth talk of Heinrich et al. an online study is presented, which indicated higher trust levels for a cooperative vs. non-cooperative driving automation and a conservative automated driving style. Taken together, the six talks present interdisciplinary work on the role

of psychological processes involved in formation and calibration of technology trust and compare human-human and human-technology trust.

Basal and early cognition – thinking with no or little brain

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Kiel University

Recently the scope of cognition research has broadened. In addition to the focus on the complex mammalian brains, mental faculties of life have been studied from molecules over unicellular organisms and plants to simple nervous systems. Findings in all these groups suggest that behavioral flexibility, memory and cognition are not exclusive to complex brains, but instead can be found in a multitude of organisms with simple nervous systems and those without neurons. This suggests that many cognitive adaptations may have evolved convergently in unrelated species, making cognition a trait of life itself. Here we report studies performed at Kiel University on cognition in flatworms and plants. These were conducted to investigate which cognitive traits may be similar to many forms of life. In flatworms, we can show that one of the earliest brains in evolution is capable of learning and may exhibit universal features of more complex animals like lateralization and ongoing neural oscillations in the EEG signal. Furthermore, we suggest that very different structures from another evolutionary pathway may achieve a comparable functionality to a nervous system. This is supported by two studies on plants, showing habituation and memory in two very different species.

Bayesian advances in cognitive modeling

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Bayesian modeling has become a popular tool to analyze data in cognitive psychology. One reason for this development are computational advances paired with more accessible software tools for statistical analysis. Despite these innovations, Bayesian modeling still comes with its challenges, and more innovation is needed to address them. Three areas of recent development that are highlighted in this symposium are modeling of hierarchical data, model comparison using Bayes factor, and the implementation of theory in Bayesian models using ordinal constraints. These three areas are highly relevant for experimental psychology where hierarchical data structures are common and studies are often designed to test competing hypotheses. In this symposium, we discuss recent technical and statistical developments relevant to experimental psychology, and highlight several applications including consciousness, recognition memory, cognitive inhibition, and creativity.

Beyond the switch: Using (voluntary) task switching to investigate psychological questions other than task switching per se

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In this symposium, we gathered researchers who are using task switching, and the immense knowledge about its effects and indices, as a tool to investigate other psychological phenomena beyond task switching per se; processes such as goal-directed action, control adjustments, affect, motivation, memory, and trust. The first two talks focus on voluntary task switching, and find that flexible behavior can serve persistent goal pursuit (Talk 1), and that conflict in task switching biases decision making away from conflict due to its aversive nature (Talk 2). Talk 3 follows this logic more directly by explicitly investigating the affective nature of task switching and the consequences on effort-based decision making. Talks 4 and 5 use task switching to examine different aspects of performance. Talk 4 examines the conditions under which reward enhances performance, and the role flexibility and rigidity play in this context, and Talk 5 demonstrates that different types of cognitive control demands – switching vs. congruency – differentially influence memory by reducing and enhancing top-down attention, respectively. Finally, relying on indices within task switching paradigms such as the switch cost asymmetry, Talk 6 demonstrates that trust is a more dominant response tendency than mistrust.

Cognition in the context of language and culture I: Processing and representing linguistic information

Annelie Rothe-Wulf

University of Freiburg

Commonly, cognitive and perceptual processes are investigated independently from the specific linguistic, social or cultural context. The two-part symposium intends to close this gap by focusing upon the interplay of language and cognition and by exploring the variability of cognitive processes based on diverse cultural, social or linguistic systems. This first session focusses on the processes involved when we perceive, encode, and represent linguistic information. The experiment of Gerwien and Stutterheim thoughtfully scrutinizes the cognitive processes fundamental to verbal interference effects which are frequently used to investigate language-cognition interactions. In addition, Beck and Konieczny will shed light on the way we perceive and process language by examining the connection of eye-movements and rhythmic subvocalization during silent reading of rhymed language. Using saccadic and mouse tracking measures, Marberg et al. investigate top-down and bottom-up factors that moderate the patterns of attention allocation when generating gist. The final three talks will account for the impact of social, cultural and communicative contexts on cognition. Investigating adults and children in German or Arabic language contexts, Schlenter and Penke scrutinize the way animacy of noun words and the literacy of participants affect performance in a picture naming task. Feldmeth presents a series of four experiments that examine whether linguistically represented gen-

der characteristics influence perspective taking in the action-sentence compatibility effect paradigm. Finally, the study of temporal referencing representations of Herb and Rothe-Wulf intends to unravel linguistic influences on cognition by manipulating the specific language context and by scrutinizing variations in the dominant language.

Cognition in the context of language and culture II: Diversity across domains and human development

Annelie Rothe-Wulf

University of Freiburg

What factors of linguistic and cultural diversity might drive differences in cognitive processes? How does culturally and linguistically embedded cognition evolve during human development? What methods can we apply to tackle these questions across domains? The second part of the symposium attempts to catch a glimpse of possible research approaches across a variety of domains that are capable to respond to these questions. Kuhlen and Rahman introduce the shared picture-word interference paradigm for two participants that uncovers the influence of social interaction on language processing. Jurkat and Kärtner look at the role of language for the development of holistic vs. analytical attention styles in 4- to 9-year-old children, thus exploring two fundamental concepts of cross-cultural research. Investigating space-pitch associations of Turkish and Dutch children, Dolscheid et al. provide evidence for cross-cultural similarities in the acquisition of thickness-pitch associations, but variability for the development of height-pitch terminology. Considering the domains of space and time, Heer and Rothe-Wulf investigate to what extent temporal concepts of Aymara-Spanish speakers vary with changes in the linguistic contexts. In line with these findings, Dudojć and Bender show the prevalence of cultural diversity in finger counting systems highlighting the variability in numeral cognition and discussing the impact of finger counting habits and notational systems on cognitive number processing. Finally, the symposium concludes with the overarching talk of Straffon and Øhrn looking at the co-evolution of cognition and culture by investigating how human technologies evolved during human evolution and what cognitive capabilities are required for these accomplishments.

Conducting chronometric research online: Examples, tools, and best practices from language and eye tracking research

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In the wake of the pandemic, labs closed down and many researchers resorted to conducting their experiments online. Aside from supporting pandemic containment, online research comes with many other benefits compared to lab-based research, and is therefore likely to stay: Online studies promise greater efficiency in data collection, in particular when testing larger samples, and the possibility to reach out to a more heterogeneous subject population. In this symposium we will feature different approaches for running chronometric studies online. Our focus will be on best practice examples in fields that,

upon first sight, may not lend themselves easily to online solutions and have therefore only recently begun to explore these potentials. For example, experiments relying on very precise measurements of reaction times or eye movements, experiments requiring the recording (and analysis) of overt speech and its tight synchronization with visual stimulus presentation, experimental settings that enable or evoke the impression of being in a social interaction, or experiments targeting sensitive populations. Our speakers have each innovated unique and creative approaches to address these challenges and will present their approaches alongside different platform combinations, for example jsPsych, SoSci Survey, Gorilla, and JATOS.

“Denkpsychologie” today

Amory H. Danek

Heidelberg University

Classical psychology of thinking (“Denkpsychologie”), as for example represented by the Gestalt school, was later largely neglected, because of discontent with the often mere observational, anecdotal approach. Today, new methodological approaches have revived the study of insight problem solving and resulted in a surge of new studies. Hundred years after Köhler’s chimpanzee observations on Tenerife, this has become an exciting area of research, with links to metacognition, memory, creativity and emotion. Research addressing the phenomenology of insight (Aha! experiences) has seen the most interest recently. This symposium brings together researchers from Norway, Belgium, Germany and the USA and represents a selection of contemporary efforts to understand human problem solving, with a focus on measuring feelings of insight. Topics to be discussed are the accuracy effect of insight (Danek), the unconscious nature of insight (Stuyck, Cleeremans, & Van den Bussche), the pleasure inherent in Gestalt detection (Muth), a developmental perspective on Aha! experiences (Haugen, Prenevost, Nilsen, & Reber), a neuronal mechanism for the insight memory effect (Becker), and fixation and mental set (Wiley).

Dynamic perception and action in virtual environments

Meaghan McManus & Immo Schütz

Giessen University

Historically, human perception and action research has been constrained by real world limitations in how stimuli can be presented and manipulated, and performance has typically been measured using button presses or restricted movements. Virtual reality (VR) is a powerful method to present naturalistic but highly controlled environments in a way not possible before. Using VR displays labs are now able to record continuous behavior from active participants. Technologies such as eye tracking or mobile EEG further enable collection of dynamic behavioral measures. This symposium discusses recent work on dynamic behavior that would have been difficult to study before VR. The first set of talks will highlight the importance of gaze in natural locomotion. Bremer will present work on predicting a person’s movements through a virtual environment using gaze data and

Machine Learning, and Nolte will present a study on face perception and eye movements towards virtual pedestrians while participants explored a virtual city. The second set of talks focus on highly specific environments where VR can help to overcome some of the challenges faced when creating such unusual settings. Kopiske will discuss gaze-gait interactions while participants traversed a simulated slippery road surface, and Bury will present a study on how the perception of self-motion through a virtual hallway was affected during parabolic flight. The last set of talks use VR to manipulate how people interact with objects in their environment. Schuetz will show that free-hand pointing to objects in VR is attracted by an object's center of gravity, and McManus will present a study investigating predictive changes in tactile sensitivity while participants slice dynamic objects with a virtual "sword".

Experimental aesthetics I–III: Following Fechner's conceptions

Thomas Jacobsen

Helmut Schmidt University – University of the Federal Armed Forces Hamburg

The year 1876 marks the beginning of second-oldest branch of Experimental Psychology, namely Experimental Aesthetics. In his major work *Vorschule der Ästhetik*, Gustav Theodor Fechner suggested the empirical, experimental study of aesthetics "from below", applying empirical knowledge. To date, the psychology of aesthetics has been the subject of increasing interest. The present symposia comprise contributions investigating a variety of aesthetic domains including, inter alia, music, materials, and visual artworks. Furthermore, the researchers address questions of the influence of several stimuli's and individual's characteristics, for example, complexity and memory resources, respectively.

Experimental engineering psychology and human factors

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The facilitated integration of technology into people's lives highlights the importance of examining its impact on experience and behavior. Experimental approaches help to determine the underlying psychological processes of this impact. This symposium summarizes experimental studies examining various contexts of technology use and psychological aspects of Engineering Psychology and Human Factors. The first talk of Yuxuan Guo investigates whether people shift back and forth from ambient to focal processing based on internal triggers, such as the shift within and across the processing of tasks while no external event is given. The second talk of Matti Krueger addresses how technology can be designed to augment situation awareness, specifically in the context of traffic. Several prototypes and associated user studies are presented to demonstrate the utility of this approach. The third talk of Agnes Rosner describes an experimental study addressing memory retrieval processes in comprehension of dynamic traffic situations by using the so called looking-at-nothing phenomenon. The fourth talk of Tim Schrills describes a study in the field of Human-AI Interaction in Personalized Medicine. Here, the authors ran an experiment with diabetic patients assessing their subjective information processing

awareness. The fifth talk of Franziska Babel addresses a specific aspect of human-robot interaction: robot bullying. In an online experiment it was investigated which interaction patterns varying from friendly to severely bullying participants preferred when interacting with a robot in a goal conflict situation. The sixth talk of Thilo Kremer examines the impact of four contexts of technology use like online shopping on the importance ratings of 12 standardized user values.

Experimental validation of cognitive modeling

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Cognitive modeling is a core method to explain cognitive function and experimental results. In contrast to statistical analysis, it aims for identifying cognitive processes and their respective interplay and provide a functional explanation of observed data. In that sense cognitive models are executable psychological theories. They are tightly linked to psychological experimentation as they can be derived from and validated by psychological experiments. This symposium aims to focus on (i) real experimental data that can support/reject a model, (ii) features of cognitive models to be predictive, (iii) experimental validation methods and measures for cognitive models and similar aspects. The motivation of the symposium is to bring together experimental psychologists and cognitive modelers. We are open for any type of cognitive models and any form of experimental validation.

Face perception from laboratory to naturalistic contexts

Mario Reutter & Matthias Gamer

Julius Maximilian University of Würzburg

Humans are visual creatures. While other animals may recognize conspecifics by olfactory or auditory signals, humans mostly employ visual cues originating from the face. Having relied on this information for millennia, *Homo sapiens* has developed an outstanding capability to recognize and interpret faces under varying conditions. This ability has been studied for decades using still images, but recent technical developments provided novel approaches that are more immersive and interactive. In this symposium, different perspectives on face perception are highlighted, ranging from controlled laboratory settings to ecologically valid naturalistic contexts. First, we learn how 3D scanning of real faces enables a dissociation of texture and shape information in face recognition. Second, the impact of attentional deployment towards distinct facial features are discussed with respect to the phenomenon of fear generalization. Third, we look at reliable differences in social attention across visually rich images and their relation to social anxiety or alexithymia. Fourth, we shift focus to the interplay between self-focused attention and social anxiety during live video calls. Finally, gaze coordination in a real social interaction between parents and children is addressed by presenting data from a minimally invasive dual eye-tracking setup. Taken together, this symposium covers the broad spectrum from isolated face perception to social information processing in complex scenes and it integrates

findings on face recognition, social attention, and mechanisms of social interaction. This multi-angled approach, closely linked to the conceptual framework of cognitive ethology, is crucial to both accurately describe social phenomena and to identify the underlying processes.

Facets and determinants of pro- and antisocial behavior

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University of Cologne

Pro-social behavior is vital for the functioning of interpersonal relations, organizations, and societies at large. Correspondingly, the study of pro-social behavior and its counterpart – anti-social behavior – has gained considerable attention in all areas within psychology. In this symposium, we will bring together recent findings on different facets of prosocial behaviors and their determinants. Specifically, the symposium will present different facets of altruistic behavior (i.e., help-giving, moral courage, and peer punishment) as well as correlates of dispositional pro-sociality (i.e., benign and malicious envy). Furthermore, contextual facilitators (i.e., intergroup contact, shared group membership) and barriers (i.e., a bad reputation) of prosocial actions will be presented. Finally, we will discuss country-level differences in pro- and antisocial behaviors (i.e., social mindfulness and bribery behavior). Overall, the symposium offers an up-to-date summary of recent research on the composition of pro-social behavior and its determinants. Ultimately, it aims at encouraging the discussion about where the field stands and where it should head towards in the future.

From coordinating bodies to coordinating minds – decision making processes in joint action

Luke McEllin & Arianna Curioni

Central European University

From dancing tango to moving office furniture, many of our daily interactions involve joint actions whereby we coordinate our actions in space and time in order to achieve individual and shared goals. Whilst the sensorimotor processes that guide action coordination, such as motor planning, action prediction, and movement adaptation are well understood, the decision-making processes that support joint action have been relatively less investigated. This is surprising considering the multitude of decisions that we need to make in social settings, even before we start to coordinate with each other. Deciding who to interact with and who to avoid, judging the properties of objects in the environment in light of each other's perspectives, and figuring out how to distribute effort between actors, are crucial in ensuring the interaction runs smoothly. Sometimes we even need to consider whether or not it's worth carrying out a task jointly in the first place. This symposium aims to advance our understanding of the decision-making processes involved in joint action by presenting several empirical studies that explore how actors deal with the different decisions they are faced with, and how these decisions affect (and are affected by) the joint action. We will explore the mechanisms by which actors decide firstly whether or

not to engage in a coordinated interaction (Talk 1), secondly who to interact with (Talk 2). We will then talk about how individual actors use their partner's perspective to make more accurate judgements (Talk 3), and how individuals use their partner's effort level in order to decide themselves how much effort to invest into a task (Talk 4). The last two talks will explore how efficiency (Talk 5) and fairness (Talk 6) influence decisions on task distribution.

Fundamental processes and applied aspects of effort

David Framorando

University of Geneva

In recent decades, there has been a growing interest in studying the intensity dimension of motivation - effort - through physiological measurements. This research draws on motivational intensity theory (Brehm & Self, 1989), which identifies the conditions under which one should exert more or less effort. Wright (1996) linked Brehm's theory with Obrist's (1981) active coping approach and concluded that effort can be assessed by cardiovascular reactivity. On this basis, recent research in the field of motivational psychology has focused on identifying variables that might influence cardiovascular reactivity. This symposium will present exemplary recent work examining the role of implicit motives, lighting color temperature, objective ability, personal task choice, fatigue and self-control, and posture in the context of effort.

Indirect assessment of beliefs and attitudes: Conceptual elaboration and incremental validity of the propositional evaluation paradigm (PEP)

Maria Wirth & M. Clara P. de Paula Couto

Friedrich Schiller University Jena

The Propositional Evaluation Paradigm (PEP) has been recently introduced as an implicit measure to assess multiple propositional beliefs. First empirical evidence attests to the task's validity. In this symposium, we elaborate on procedural, conceptual, and practical aspects of the PEP. In the presentation by Cummins and colleagues, several research findings will be discussed that relate to the ability of the PEP to capture and reflect propositional beliefs. Best practices, advantages, and barriers of the task will be presented. Jusepeitis and colleagues present evidence for incremental validity of the PEP in predicting self-esteem correlates over and above established explicit self-esteem measures. Huang and colleagues present additional evidence for incremental validity of the PEP in the realm of implicit age stereotypes. Implicit endorsement predicted behavior even after controlling for endorsement of explicit age stereotypes. De Paula Couto and colleagues further investigate explicit and implicit endorsement of prescriptive age stereotypes and their age-specificity among young and older adults. PEP effects and explicitly endorsed stereotypes were found to be independent. Wirth and colleagues show that implicit endorsement of prescriptive age stereotypes measured by the PEP is sensitive to increased accessibility of these stereotypes. A matching effect between primed and

endorsed age norm was found.

Interaction with artificial intelligence – an interdisciplinary perspective

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Artificial intelligence (AI) applications are increasingly used in everyday life. Whereas some of them are widely accepted (e.g., automatically compiled playlists), others are highly controversial (e.g., use of AI in the classroom). While on the one hand, the usage of autonomous cars could save about 50 million lives within the next 50 years this AI application is still viewed with skepticism. On the other hand, people already interact with AI daily online; often unaware of how this interaction might influence their beliefs and behaviors. This shows that the question about what kind of factors influence people's willingness to interact with AI is of utmost importance. Aim of this symposium is to present novel insights into human-AI interaction by bringing together research from cognitive psychology and philosophy to address two questions: (i) what factors are influencing our perceptions of and ultimately our interaction with AI and (ii) how does interacting with AI in turn influences us? To provide answers for those questions the first talk focuses on the role of AI risk-opportunity perceptions as well as AI knowledge in people's willingness to use AI-based applications in different fields. Going beyond abstract algorithms, the second talk then tackles the question under which conditions people are willing to help robots. The third talk focuses on the cognitive factors that are relevant for cooperation with AI. The fourth talk will then give an overview on how our interaction with AI in turn shapes and challenges people's perception of social interaction. In the final talk, the question how AI should be modeled as interaction partners is discussed. Jointly, these talks will give a broad overview on human-AI interaction by examining the topic from different perspectives.

Interplay between prior knowledge with new learning and memory

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Prior knowledge provides mental schemas and frameworks that promote efficient incorporation of new information during learning and benefit subsequent memory. At the same time, when new information does not fit into pre-existing schemas, it has been shown to both hinder and benefit learning and memory. In this symposium with six talks, we provide empirical insights about the interplay between learning/memory and prior knowledge, using experimental paradigms, virtual reality, functional magnetic resonance imaging, eye tracking techniques, as well as neuro-pharmacological approach. We showed that (i) when remembering recent experiences, semantic substitution may lead to memory bias depending on the task-relevance; (ii) the (in)congruency effect differentially impacts memory accuracy and precision and follows different temporal dynamics

in the developing brain; (iii) prediction error as a result of mismatch between sensory evidence and prior knowledge may boost memory; (iv) schema-congruency determines the susceptibility of early memory formation and consolidation to the modulation by general anesthesia; (v) new schemas formed either through active agency or from an observer's perspective are associated with different neural correlates and memory malleability; (vi) pre-existing schemas of episodic information accumulation during active virtual navigation enhance long-delay memory consolidation and follow distinct developmental trajectories. Together, the presentations of this symposium provide empirical evidence that the effects of (in)congruency of new information on new learning and memory is complex and depends on several important modulating factors (i.e. developmental status, agency, schema strength, situation relevance, prediction error).

Mechanisms of learning and memory: Novel insights from EEG research

Siri-Maria Kamp
University of Trier

Mechanisms of learning and memory are difficult to study, in part because the different stages of memory processing cannot be easily separated based on behavioral outcomes alone, and because task or population characteristics limit the use of some behavioral analysis techniques. This symposium presents novel research capturing EEG activity during learning and memory tasks, including oscillatory activity and event-related potentials (ERPs), thus tracking neurocognitive activity in real-time and independently of behavior. The first talk reports that theta-oscillations recorded from intracranial EEG in the hippocampus occur during map-based spatial navigation in a spatial learning task. The second talk shows that theta-rhythms are already observed in early childhood and support the integration of newly learned category information into a semantic model of the world. The third talk examines the interleaving effect in inductive learning and shows that the effect is driven by a decrease in attentional processes during massing, reflected by alpha/beta-power during encoding. The fourth talk reports that fear and safety learning are tracked by the late positive potential and the P300 during learning and provides novel insights into this association. The fifth talk reports that familiarity, indexed by the early ERP old/new effect, contributes to associative memory retrieval when schema-supported associative processes are active during encoding. The last talk discusses the effect of stimulus properties on item retrieval mechanisms, indexed by ERPs during a recognition test, and on inter-item associative memory. Together, the results presented in this symposium open fruitful routes for future research promising novel insights into the mechanisms of learning and memory.

Metamemory

Beatrice G. Kuhlmann & Monika Undorf
University of Mannheim

Metamemory research focuses on people's knowledge about learning and memory and

on the assessment (monitoring) and regulation (control) of their ongoing learning and memory processes. This symposium presents current research on metamemory from labs in Poland, Portugal, Turkey, and Germany. The first two talks demonstrate the specific sensitivity of metamemory judgments in established memory paradigms. Using a misinformation paradigm, Yüksel and Besken show that degraded viewing conditions reduce both memory predictions and actual memory performance, but the integration of misinformation to retrieval remains unaffected. Hanczakowski et al. demonstrate that metamemory judgments disclose modulating effects of the number of context-to-item associations on context reinstatement even when the respective effects on recognition memory are inconclusive. The next two talks focus on the basis of people's predictions of their future memory performance (judgments of learning, JOLs). Mendes and Undorf present research indicating that JOLs rely on objective and subjective word frequency in multiple-cue situations. Undorf, Navarro-Báez, and Bröder present a novel methodological approach for uncovering hitherto elusive influences of idiosyncratic information on JOLs. The final two talks investigate the debiasing of metamemory illusions. Schaper et al. report evidence that alleviating the expectancy illusion improves the accuracy of metamemory monitoring and control but has little effect on actual memory performance. Zimdahl and Undorf report results showing that neither warnings nor incentives reduce the hindsight bias on JOLs. Together, the six talks of this symposium present new insights on metamemory monitoring and control.

Modelling cognition I: Model development, comparison, validation and application

Constantin G. Meyer-Grant & Anne Voormann
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In recent years, formal models have become increasingly popular among researchers in cognitive psychology thanks to their many advantages over non-formal theories. Compared to the latter, mathematical and statistical models are easier to falsify, force theorists to be precise, allow the deduction of consequences following the model assumptions, make accurate predictions, and often have several practical applications (Bjork, 1973). Utilizing such models for psychological research usually involves several different steps: model development, model comparison, model validation, and model application. In the first part of this symposium, we highlight these different aspects of working with formal models across numerous fields within cognitive psychology. We will start by looking at an instance of model development – namely, a novel evidence accumulation based model for binary choice tasks. This is followed by a talk about model comparison introducing a deep-learning based method for comparing complex Bayesian hierarchical models. Furthermore, we will take a closer look at model validation regarding different recognition memory models of paired stimuli. We will then shift our focus more towards the application of mathematical and statistical models. Hence, we will conclude the first part of the symposium with talks on how to model advice taking in a multilevel framework and on what multinomial processing tree models can tell us about the effect of alcohol consumption on memory.

Modelling cognition II: Understanding memory via modelling

Anne Voormann & Constantin G. Meyer-Grant

University of Freiburg

This second part of the symposium addresses one specific area within cognition: Memory. Since long time, various types of mathematical and statistical models help us to grasp and better understand the different aspects of memory. Through their formalization of processes, models provide a deeper understanding about the actual processes involved in memory decisions beyond recognition and recall performance. Additionally, models can be used as a statistic tool to address and solve research questions hard to assess otherwise. Thus, within this symposium, we aim to shed light on different aspects of memory using statistical modelling. However, not the models will be in the focus of this symposium but the memory processes that models help us to understand. Thus, we will start with inspecting the role of semantic associations in working memory and how models can capture binding effects in episodic memory. Next, we will have a closer look to the connection between working memory and long-term memory. Regarding long-term memory, we will subsequently assess certain phenomena that appear within long-term memory and will hear about the processes that must be assumed in order to explain such phenomena. We will close the symposium with a talk about metamemory, the ability to use cues for predictions about the own memory ability.

More than “truth by repetition” – novel insights on the effects of repeating information

Felix Speckmann & Anne Irena Weitzel

University of Cologne

Judging a given statement as true or false is an important but non-trivial task that people perform every day. In times of fake news, conspiracy theories, alternative facts, and misinformation campaigns, it can be difficult to correctly judge the truthfulness of a statement. This judgment process is influenced by repetition: People are more likely to believe repeated information than novel information. This effect is called the “repetition-induced truth effect” or simply the “truth effect”. Understanding the underpinnings of and the processes involved in the truth effect is highly relevant because it can lead to effective interventions targeted at reducing the credibility of false information. In this symposium, we present our work on various aspects of the truth effect while also going beyond mere truth judgments to include different effects of repetition. First, Teresa Garcia-Marques will present work on the attenuation of the truth effect when using emotional statements. Second, Christian Unkelbach will present research on the interplay of monetary incentives and advisors and how they influence truth judgments. Third, Anne Irena Weitzel talk about work on the evaluative consequences for advisors if their advice is incongruent with repetition. Fourth, Rita Silva will present research examining the influence of source trustworthiness on judgments of truth. Fifth, Felix Speckmann will present work on the effect of repetition on judgments of knowledge (i.e., “Did you know this before the experiment?”). Sixth, Jasmin Richter will show work examining the influence of repetition on perceived morality of statements.

Multimodal multitasking: The influence of modality compatibility in the context of task-switching and dual-tasking

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Talking on a cell-phone while driving – this classic multitasking example indicates that we are acting in a multimodal environment choosing from a vast variety of possible responses. While numerous studies demonstrated that multitasking is costly, these multitasking costs vary substantially depending on the specific modality mappings (i.e., compatibility) even if the degree of sensory and motor interference is equated across conditions. More specifically, performing multiple modality-compatible tasks either simultaneously (i.e., dual task) or in alternation (i.e., task switching) over a short time range leads to less performance costs than performing incompatible tasks. To explain this influence of modality compatibility the ideomotor idea is embraced, suggesting that actions are preceded by the anticipation of their sensory consequences. Accordingly, it is argued that stimuli matching the anticipated response consequences in terms of modality are modality-compatible (e.g., vocal responses generate auditory effects, i.e., auditory-vocal tasks are modality-compatible). This symposium provides an overview of the current state of the art followed by the new and diverse insights regarding modality compatibility, like the role of natural effects of the responses (i.e., sound of one's own speech) in contrast to inducing action effects experimentally, the effect of modality compatibility on voluntary task choices, the influence of fatigue on modality-compatibility effects, the impact of modality compatibility on between-task adjustments, as well as possible training effects. Against this background, different explanations for the cause of modality-compatibility effects – a monitoring bottleneck, shortened central stages, resource competition, or crosstalk – will be discussed.

Perception and action in sports

Iris Güldenpenning¹ & Andrea Polzien²
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Action planning in sports is based on the perception of mostly complex situations and the intention to achieve a certain goal. Therefore, the study of the interplay between perception and action is a central topic of sports psychology. A particularly relevant aspect of perception in sport is anticipation, that is, the prediction of perceived actions. To make the right decisions, athletes, but also referees, rely on different sensory modalities (e.g., visual, auditory, tactile) as well as contextual information. In the first presentation, Müller and colleagues speak about the use of auditory and contextual information for anticipating ball flight in tennis. Following this, Meyer and colleagues show that the anticipation of the direction of penalty kicks is facilitated when a weight is attached to the kicking leg of the shooters. Wühr and Memmert studied the offside decisions of referees and were able to show that a better contrast between the background (i.e., football turf) and the players (i.e., the jersey color) leads to more offside decisions. In basketball, timeouts are used to give tactical instructions to the players. The fourth

presentation by Krause and Weigelt focuses on how different rotation angles of visual tactic boards in basketball affect the information processing and execution performance of athletes and novices. Athletes not only use different sensory and contextual information to anticipate actions, but also use deceptive actions to hinder their opponents' anticipation performance. The question arises whether the execution of a deceptive action comes with a cost for the deceptive player. Böer and colleagues address this question in the fifth talk, which examines the cost of performing a head fake in basketball.

Perspectives on error processing and error awareness

Eva Niessen

University of Cologne

The symposium highlights recent neuroscientific advances in the field of error processing. Errors are useful sources for individual improvements, and processing errors is essential for action adaptation. The presenting authors investigate error processing with diverse and multi-methodological approaches (e.g., experimental manipulations complemented by innovative analysing techniques). Overall, the symposium conveys recent ideas about the neural mechanisms underlying error awareness and behavioural and neural consequences thereof. We will present different influential factors that induce changes in error detection (Niessen, Porth, Steinhauser). These manipulations will be extended by approaches that identify important sources for the formation of error awareness (Overhoff, Porth). The presented findings can be largely generalized, because the tested samples range from young, healthy participants (Mattes, Niessen, Porth, Steinhauser) over participants across the adult lifespan (Overhoff) to a clinical sample (Balzus). One study elucidates the influence of individual differences on neural mechanisms of error processing and behavioural adaptations by differentiating two dimensions of perfectionism (Mattes). Extreme and clinically relevant perfectionism can result in obsessive-compulsive disorder (OCD), which will be of interest in the clinical study (Balzus). Thus, the presentations nicely complement each other. Most talks include neuroscientific measures in terms of EEG (Balzus, Mattes, Porth, Steinhauser) and inform about the neural mechanisms underlying error processing. Finally, we introduce two experimental approaches as potential ways to assess error awareness with high ecological validity because they reflect error processing in everyday tasks (Niessen, Steinhauser).

Recent advances in binding and retrieval in action control I: Action plans, responses and outcomes

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Humans interact with their environment with remarkable ease. This is astonishing given that, in most situations, humans have the option to act in various ways, but must choose the appropriate actions to achieve a certain goal. Mechanisms underlying human action control have been traditionally studied in several research domains, focussing on different but related phenomena, theories, and experimental approaches. Recently, the Binding

and Retrieval in Action Control framework (BRAC, Frings et al. 2020) offered a unifying perspective on research on human action control by proposing stimulus binding and retrieval as two basic, functionally separable processes that can account for a broad range of related experimental phenomena across a variety of tasks. The first part of the symposium introduces the BRAC framework and its core mechanisms, followed by recent advances regarding the continuous measurement of the impact of S-R binding on performance, the formation of S-R episodes in action planning and after error commission as well as the binding between sequential responses. The last contribution of part I is concerned with the impact of affective consequences on binding and retrieval of S-R episodes. Together, the research presented in the symposium highlights the utility of the BRAC framework as a starting point to generate new insights into the mechanisms that guide controlled human behaviour.

Recent advances in binding and retrieval in action control II: Context, learning, and binding by observation

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Humans interact with their environment with remarkable ease. This is astonishing given that, in most situations, humans have the option to act in various ways, but must choose the appropriate actions to achieve a certain goal. Mechanisms underlying human action control have been traditionally studied in several research domains, focussing on different but related phenomena, theories, and experimental approaches. Recently, the Binding and Retrieval in Action Control framework (BRAC, Frings et al. 2020) offered a unifying perspective on research on human action control by proposing stimulus binding and retrieval as two basic, functionally separable processes that can account for a broad range of related experimental phenomena across a variety of tasks. The second part of the symposium starts with a focus on the inclusion of task-irrelevant cue and context information in S-R bindings, the structure of S-R bindings involving context, as well as the relation between context binding and cognitive control. The subsequent talk connects the BRAC framework to contingency learning while the final contribution presents evidence that S-R bindings can be acquired by observation even in online settings beyond the laboratory. Together, the research presented in the symposium highlights the utility of the BRAC framework as a starting point to generate new insights into the mechanisms that guide controlled human behaviour.

Scalable interactions

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The global advancement of ubiquitous computing environments shapes our day-to-day interactions. Notebooks, smartphones, desktop computers, cars, intelligent lighting, or multi-room entertainment systems offer a plethora of interaction techniques using touch, voice, mouse, gestures, or gaze. The shift from interacting with dedicated “computers” to

interacting with distributed ensembles of computational devices (so-called pervasive computing environments) will fundamentally change our understanding of interacting with a “system”. While the trend towards pervasive computing environments is already apparent, we have a scant understanding of how to scale interaction paradigms to assure for recognition and comparable functioning, when the number, diversity and complexity of devices increase. In the DFG priority program 2199 “Scalable Interaction Paradigms for Pervasive Computing Environments”, an interdisciplinary consortium investigates scalable interaction paradigms. From a psychological perspective, relevant questions address design issues as well as effects of various ways of scaling interaction in pervasive environments. In this symposium, we present project-related research that is of special interest to experimental psychologists. In particular, we show how to investigate crowd attention in large online environments (Marian Sauter et al), how interactions with technology in safety-critical domains (i.e. anesthesiology) shape user experience (Anna Hohm et al), how drones can be used to facilitate interactions in virtual and mixed reality (Matthias Hoppe et al), how sensory illusions can be used to enrich haptic experiences (Marco Kurzweg et al) and finally, how we can further study technology interactions in large dynamic social contexts (Alarith Uhde et al).

Sichere und komfortable Interaktion von Verkehrsteilnehmenden mit hochautomatisierten Fahrzeugen im Straßenverkehr

Christine Sutter¹ & Michael Oehl²

¹German Police University, ²German Aerospace Center

Der Mischverkehr mit Fahrzeugen unterschiedlicher Automatisierungsgrade wird das Straßenverkehrsgeschehen der kommenden Jahre prägen. Eine wichtige Voraussetzung für die Verkehrssicherheit wird dabei die sichere, eindeutige und erwartungskonforme Interaktion der Verkehrsteilnehmenden mit hoch- und vollautomatisiert betriebenen Fahrzeugen sein – im Fahrzeuginneren mit den Nutzenden des Fahrzeugs sowie außerhalb des Fahrzeugs mit umgebenden Verkehrsteilnehmenden. Diese Interaktion kann beispielsweise nach außen über externale Mensch-Maschine-Schnittstellen erfolgen, deren Designs bislang in eher nur 1-zu-1-Szenarien untersucht wurden. Inzwischen müssen diese Mensch-Maschine-Interaktionen allerdings ökologisch valider bspw. für urbanen Mischverkehr in zunehmend komplexeren Verkehrsszenarien erforscht werden. In den sechs ausführlichen Vorträgen des Symposiums werden dazu empirische Befunde vorgestellt und jeweils kurz diskutiert. Der Fokus wird besonders auf den verkehrspsychologischen Determinanten einer sicheren und komfortablen Interaktion für die Verkehrsteilnehmenden mit Fahrzeugen im hoch- oder vollautomatisierten Betrieb liegen. In der abschließenden Gesamtdiskussion im Plenum werden die Grenzen der Mensch-Maschine-Schnittstellen in komplexeren Verkehrsszenarien ausgelotet sowie die Bandbreite der Gestaltungs- und Evaluierungsmöglichkeiten einer sicheren und komfortablen Verkehrsraumnutzung durch Fahrzeugautomatisierung auf Grundlage der neuen empirischen Befunde erörtert.

Source memory

Nikoletta Symeonidou & Hilal Tanyas

University of Mannheim

Source memory is a crucial cognitive function that enables us to remember episodic details of information. This symposium will bring together six researchers who will present recent evidence obtained from various substantive and methodological research questions about source memory. First, Tanyas et al. present an extension of the two-high-threshold multinomial processing tree model of source monitoring to response time data to measure the relative speeds of item and source memory in addition to item and source memory performance. Then, Kuhlmann et al. report recent results on the differences in patterns of item versus source forgetting, revealing that hippocampus-dependent source memory is more resilient to shorter-term interference-based forgetting but susceptible to longer-term decay-based forgetting (relative to item memory). Focusing on more applied source memory research, Kroneisen and Thielmann showed that especially people with low levels on the HEXACO personality factor “Agreeableness” had better source memory for cheaters. Following this, Symeonidou et al. present two studies investigating whether the age-related positivity bias found in item memory also shows in source memory for positive sources. Next, Schellhaas et al. query whether processing of faces in threatening contexts/sources can influence our automatic emotional reaction towards these faces in the absence of conscious recollection. Finally, Niedzialkowska et al. investigate memory processes that contribute to false recognition of distractors that share source features (e.g., category and color) with targets.

Test-potentiated learning: Recent research in the memory laboratory and applied educational settings

Bernhard Pastötter

University of Trier

Testing potentiates learning and long-term retention. For instance, a direct benefit of testing, referred to as the (backward) testing effect, is the finding that retrieval practice of previously studied information improves its long-term retention more than other forms of reprocessing the information do (e.g., restudy or concept mapping). In addition, there are indirect benefits of testing. For instance, testing potentiates relearning of the previously studied information (test-potentiated learning with feedback) and also enhances new learning of subsequently studied other information (forward testing effect). The speakers of this symposium present their recent research on the benefits of testing, both in the memory laboratory (Abel, Kliegl, Pastötter) and applied educational settings (Glaser, Kubik, Weissgerber), examining mediating and moderating factors and addressing both theoretical and practical aspects.

The active information sampler – information sampling approaches to judgement and decision making

Linda McCaughey
Heidelberg University

Cognitive-ecological approaches have emphasised the influence of the information sample on judgements and decisions. Yet, samples are often actively solicited, implying a causal path from the cognitive processing stage back to the sampling stage, adding rich endogenous sampling aspects to the framework. Niese will demonstrate how the sample available to the decision-maker can induce framing effects without assuming biased information processing. Prager will discuss how the evidence conveyed by a sample of character traits influences the decision to truncate an unfolding sample, resulting impression judgements, and perceived target homogeneity. Also concerned with sample truncation, McCaughey will present findings suggesting that the sampling process is influenced by cost considerations. And although decision makers are sensitive to changing information sampling costs, this sensitivity is limited. Alves will introduce a sampling principle according to which people often rely on samples of distinct and surprising information, among which negative information is overrepresented. A number of well-known evaluative biases can be explained by the priority of distinct information in the formation of attitudes. Biella will elaborate on how an individual's sampling goal influences the sources they select. In sampling social information, a hedonic sampling goal induces a stronger tendency to move on to the next source after negative information than an epistemic goal. Focussing on the interplay between information sampling and contingency inference, Bott will present evidence that despite premature exploitation, self-determined sampling can, under certain conditions, foster the proper use of the sampled information for contingency judgements.

The role of modal and amodal representations in cognitive functions

Karin Maria Bausenhart & Nicoletta Simi
University of Tübingen

Historically, it was often assumed that central cognitive functions, such as thinking, decision making, and speech comprehension, are based on abstract or symbolic cognitive representations. Such representations would not directly preserve the structural properties of their physical referents, but encode them in an amodal fashion, for example, in the form of propositional or schematic representations. Therefore, sensory-motor experience based on specific modal properties of the referents should have little impact on central processing. In contrast, alternative theoretical approaches proceed from a more embodied perspective. Such accounts suppose that cognitive processes operate on rather concrete and experiential representations. Accordingly, such representations would still preserve the modal properties of their referents, and these modal properties may in turn impact on the results of cognitive operations. There is increasing evidence that such modal representations based on sensory-motor experience not only emerge in perceptual and motor stages of processing, but also play an important role in more central cognitive

processes. To reconcile these originally opposing views, it seems promising to assume that cognitive representations at all processing stages may range on a continuum from modal to amodal, where different representational formats may inform various cognitive operations and serve different goals. In this symposium, we will explore the role of modality, embodied experience, and abstraction in various aspects of cognitive processing, such as language production (Abdel Rahman & Vogt), cognitive control (Simi et al.), multi-tasking performance (Koch & Stephan), orientation behavior (LeVinh et al.), and motor planning (Bhatia et al.).

Virtualizing sensory-motor interactions in normal and clinical settings

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Advances in technology often allow for new approaches in their respective field. Due to continuous improvements and increasing affordability, the integration of virtual reality (VR) has established itself as a useful tool in the study of human cognition in the laboratory. VR devices release the visual system from stimuli off the real world and compute a new environment, which the participant is immersed into by creating a sensation of presence in this virtual world. As virtual environments are fully controllable, VR devices allow for innovative manipulations of the sensory input. This symposium provides an overview of state-of-the-art approaches integrating VR into normal and clinical settings, and aims to highlight the scope and limits of virtualizing sensory-motor interactions. First, Lengenhager will present research examining the adaptiveness of the bodily self through VR immersion and synchronous multisensory stimulation. Next, Belger, Wagner, Gaebler and Thöne-Otto will present a new tool for the assessment of visuo-spatial neglect in individuals after stroke via a novel VR street crossing task. Then, Graman will provide an overview of experimental approaches used in the Berlin Mobile Brain/Body Imaging Labs, and discuss the advantages and limits of combining VR with EEG and motion capture. Wiesing and Zimmermann, as well as Kiepe and Hesselmann, will demonstrate innovative approaches to investigate sensory-motor interactions in VR. Last, Keshava, Gottschewsky, Balle, Nezami, Schüler and König will present their research investigating differences in visual attention orienting between low realism- versus high realism virtual environments.