

Talks I

Johanna Falk, University of Geneva | How We Engage in Action Matters: Task Choice Immunizes Against Incidental Affective Influences on Effort-Related Cardiovascular Response | Johanna R. Falk¹, Guido H.E. Gendolla¹, Peter M. Gollwitzer^{2,3,4} & Gabriele Oettingen^{2,5}

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We tested whether working on a task by personal choice vs. external assignment moderates the effect of incidental affective stimulation on effort-related cardiovascular response. We expected a high receptivity towards external affective influences only when the task was assigned, but strong action shielding when the task was self-chosen. Given the difficult nature of the task that we administered, we predicted high effort due to high commitment when the task was chosen, independent of the incidental happy or sad music presentation that we used to induce affect. By contrast, for assigned-task participants, we expected higher effort when they were exposed to happy music and low effort due to disengagement when they were exposed to sad music. As expected, responses of cardiac pre-ejection period were significantly weaker when the task was assigned and participants were exposed to sad music as compared to the other three conditions. Systolic blood pressure and heart rate responses revealed corresponding patterns of results. Apparently, the personal choice of a task leads to action shielding against incidental affective influences on effort mobilization, whereas individuals remain receptive to affective influences when a task is assigned.

Marthe Gründahl, University of Würzburg | Ängstlichkeit und kardiovaskuläre Reaktionen in alltäglichen sozialen Interaktionen | Marthe Gründahl, Martin Weiß & Grit Hein

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Soziale Interaktionen beeinflussen unser Wohlbefinden und unsere Leistungsfähigkeit. Es ist jedoch eine Herausforderung, soziale Interaktionen im Labor authentisch zu rekonstruieren. Mithilfe von Ecological Momentary Assessment (EMA) können wir die Auswirkungen sozialer Interaktionen auf Körper und Geist in der authentischsten Umgebung untersuchen: dem alltäglichen Leben.

In unserer fortlaufenden Studie verwenden wir Smartphones und tragbare Elektrokardiogramm (EKG) - Sensoren, um die Auswirkungen verschiedener Interaktionspartner und -settings auf Ängstlichkeit und damit verbundene Veränderungen der Herzrate (HR) und der Herzratenvariabilität (HRV) zu untersuchen. An fünf aufeinander folgenden Tagen beantworten unsere Teilnehmer*innen (Alter: 18-35 Jahre) täglich bis zu sechs zufällig getimte Umfragen.

Wir erwarten, dass höhere Ängstlichkeit (als State und Trait) positiv mit der HR und negativ mit der HRV zusammenhängt. Wir nehmen an, dass weniger ängstliche Personen von ähnlicheren bzw. vertrauteren Interaktionspartnern profitieren (verringerte HR, erhöhte HRV). Das Gegenteil wird für ängstliche Personen erwartet. Diese Effekte sollten zudem im direkten, persönlichen Kontakt stärker sein als bei virtuellen Interaktionen. Davon ausgenommen sind Personen mit hoher sozialer Interaktionsangst, bei denen virtuelle Interaktionen zu stärkeren stressreduzierenden Effekten führen sollten.

Vorläufige Ergebnisse (N = 32, Mai 2021) deuten darauf hin, dass soziale Interaktionsangst während sozialen Interaktionen mit höherer HR einhergeht, die HRV jedoch nicht beeinflusst. Ähnlichkeit und Vertrautheit haben hingegen einen substantiellen stressreduzierenden Effekt auf HR und HRV. Hohe soziale Interaktionsangst hängt mit stärkeren physiologischen Effekten von virtuellen Kontakten zusammen. Entgegen unseren Erwartungen profitieren jedoch hoch ängstliche Personen stärker von großer Ähnlichkeit mit dem Gegenüber.

Barbara K. Kreis, University of Mannheim | (When) is Hindsight Bias a By-Product of Knowledge Updating?

Learning about a numerical fact makes it difficult for people to reconstruct their prior (naïve) knowledge. In hindsight, people tend to overestimate what they knew in foresight. Their recalled answer is usually biased towards the correct answer. This phenomenon is known as hindsight bias (Blank et al., 2007; Roese & Vohs, 2012). Various theoretical accounts exist that aim at explaining the phenomenon and its underlying processes (Blank et al., 2007; Hawkins & Hastie, 1990; Roese & Vohs, 2012).

Traditionally, hindsight bias has been viewed as the result of biased information processing, such as anchoring-and-adjustment processes. However, an alternative account proposes that hindsight bias could be a by-product of adaptive learning and knowledge updating processes (Hawkins & Hastie, 1990; Hoffrage et al., 2000). Until now, those two accounts have not been systematically tested against each other. To examine and quantify knowledge-updating processes in the context hindsight bias, we propose a new integrative framework that makes use of another line of numerical estimation research – seeding effects (Brown & Siegler, 1993, 2001). Seeding effects reflect processes of knowledge-updating in real-life numerical estimation situations. The goal of our research project is manifold. First, we aim at contributing to a better understanding of knowledge-updating as a potential underlying mechanism of hindsight bias. Furthermore, we will examine the boundary conditions under which the updating hypothesis might be true and contrast it with the anchoring-and-adjustment account. Lastly, we want to further the theoretical understanding of numerical estimation phenomena by integrating separate research lines.

Jonathan Mendl, University of Regensburg | On the interplay of introspective switch costs, objective switch costs, and the voluntary switch rate | Jonathan Mendl & Gesine Dreisbach

In everyday life, being able to switch flexibly between different cognitive tasks represents an often required and fundamental ability. Previous studies have indicated that the rate of voluntarily choosing to switch tasks is related to actual task switching performance. If you are good at switching, you do so more often. The present study investigated the role of introspection about the task-switching performance: To what degree is the choice behavior in voluntary task switching governed by the objective or the subjective switch costs? The experiment consisted of two phases: (a) A (hybrid) voluntary task switching phase in which the voluntary switch rate (VSR) was the main dependent measure and (b) an introspection phase with forced task switching in which participants had to estimate their reaction times after every second response on a visual analog scale to measure the introspective switch costs. The order of phases was counterbalanced across participants. The results show that the objective switch costs from (a) predict the VSR. Furthermore, participants had introspection about their task switching performance as indicated by subjective switch costs. As opposed to the objective switch costs, the subjective switch costs did not further predict the voluntary switch rate. This suggests that participants' choice behavior is economically guided by objective performance whereas the potential role of introspection about this performance remains unclear.

Poster I

01 | Pia Fenske, University Hildesheim | Vestibular and Stimulus Location Influences on the Simon Effect

Clinical researchers have found that if the vestibular system malfunctions, cognitive functions such as visuospatial abilities and attention and even executive functions can also be in disorder (Bigelow & Agrawal, 2014). But - although, not many studies with healthy participants exist - it seems that stimulation of the vestibular system can also enhance the performance in cognitive tasks.

The present study functions as a baseline study to investigate how the vestibular system influences cognition. Participants are asked to perform a Simon Task with colored circles two times: sitting and standing up. The well-known Simon Paradigm investigates how an irrelevant stimulus position influences the reaction times in a spatial stimulus-response task (Simon & Rudell, 1967). In trials where stimulus and response key position are compatible, reaction times are usually faster than on incompatible trials. While being one of the most reliable effects, not many studies have examined if the Simon Effect also appears when the stimuli are presented in the most outer eccentricities of a computer screen. Hommel (1993) results showed a Simon Effect only in the low eccentricity condition.

We conducted an experiment with a 2 (compatibility: compatible vs. incompatible) x 2 (body position: sitting vs. standing) x 3 (eccentricity: low, medium, high) experimental design. We expect to find a Simon Effect with faster reaction times in compatible trials. Besides, we expect the Simon Effect to be modulated by the eccentricity – a larger Simon Effect in the low eccentricity and by body position.

02 | Devu Mahesan, University of Greifswald | Interference in dual tasks: The impact of Task 2 response inhibition on processing affective Task 1 stimuli | Devu Mahesan & Rico Fischer

Backward crosstalk effects (BCE) are observed in dual-task studies when the characteristics of Task 2 (T2) influences Task 1(T1) performance. A particularly interesting type of BCE, known as the nogo BCE, is reported when T2 is a go/no-go task. The usual observation is that when T2 is a nogo (withholding the response), T1 processing takes longer than when T2 is a go. Nogo BCE is due to the response inhibition needed to inhibit an already prepared R2 spilling over to T1 motor execution. Growing evidence shows that response inhibition causes affective devaluation of the associated stimuli, possibly due to the negative affect immediately elicited by inhibition. It is unclear how nogo BCE based on response inhibition would impact affective processing in T1? In two experiments, participants categorized S1 as positive or negative, followed by a T2 which required a go/no-go response depending on the color. Results showed a large nogo BCE when S1 was positive. That is, withholding R2 considerably slowed R1 execution when reacting to positive T1. Surprisingly, the nogo BCE was absent when S1 was negative. Results are discussed in the context of an affective mismatch between S1 valence and R2 response-type (go vs. no-go).

03 | Hannah Dames, University of Freiburg & University of Zurich | Directed Forgetting of Stimulus-Action and Stimulus-Classification Associations | Hannah Dames¹, Marco Ragni^{1,2}, Andrea Kiesel¹ & Christina U. Pfeuffer¹

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Directed forgetting (DF) experiments demonstrate that humans can intentionally forget previously-learned information. Whereas many studies have demonstrated DF for item memory, it is still unclear if (and how) DF affects item-based associations. In the present study, we investigated whether the instruction to remember or forget a stimulus affected the formation or retrieval of corresponding stimulus-action (S-A; stimulus - motor output) and stimulus-classification (S-C; stimulus – task-specific semantic classification) associations. To do so, we combined the DF item-method and item-specific priming. In a prime phase, participants formed associations between presented stimuli and actions/classifications. After stimulus offset, a memory cue indicated whether participants should remember or forget the stimulus for a memory test at the end of the experiment. In the following probe phase, participants responded to the same stimuli and S-C or S-A mappings item-specifically repeated or switched. Unexpectedly, in our first experiments, probe performance did not differ between to-be-remembered and to-be-forgotten stimuli regarding S-A priming effects. However, we found indications that the memory instructions themselves affected learning. Currently, we are conducting follow-up experiments to further investigate DF of S-C associations. We discuss how the voluntary control of item and associative memory can be investigated in the future and whether/how associations between items and actions/classification can be intentionally forgotten or not.

04 | Sebastian Hellmann, University of Eichstätt-Ingolstadt | Sequential sampling models for confidence in perceptual decision-making

Many decisions must be made with incomplete information. The ability to evaluate the resulting uncertainty is a key aspect of metacognition. As both confidence judgments and reaction times are expected to be closely related to sensory uncertainty, a mathematical model of human perceptual decision-making should be able to explain them both. We propose the new two-stage dynamical evidence and visibility model, an extension of the popular drift diffusion model of decision making, to account for choices, reaction times and confidence at the same time. The decision process in a binary perceptual task is described as a Wiener process accumulating sensory evidence about the choice options bounded by two constant thresholds. To account for confidence judgments, we assume parallel accumulation of information about the reliability of the present stimulus. In addition, there is a period of post-decisional accumulation of sensory evidence to allow for changes of mind. We examined model fits in a post-masked orientation discrimination task with varying stimulus-onset-asynchrony and subsequent confidence judgments. A comparison between the two-stage evidence and visibility, two-stage dynamical signal detection theory and several versions of the race models of decision making showed that only the new two-stage evidence and visibility model produced an acceptable fit to choices, confidence, and reaction time. This finding suggests that confidence judgments may depend on parallel estimates of sensory uncertainty. Further work will focus on the application of the idea of an additional visibility accumulation to race models.

05 | Vanessa Mitschke, University of Würzburg | Validating a new paradigm for the measurement of aggressive tendencies in competition / cooperation

Aversive Image TAP - Developing a version of the Taylor Aggression Paradigm using aversive images as punishment. We collected data about punishment decisions based on prior provocation, indicators of current state (valence, arousal, dominance) and overall attitudes towards the opponent (fairness and liking ratings) and modulations due to trait aggressiveness. We gathered data from a first pilot study and now want to discuss how to proceed with validating the paradigm and add a cooperation variant (featuring positive images).

06 | Marlene Wessels, University of Mainz | Improving time-to-collision estimation for accelerating vehicles

Previous studies have shown that people make significant errors in judging the time-to-collision (TTC) of visually presented accelerating objects, as acceleration information is largely unconsidered. However, there may be cues that can help assess acceleration information and thus improve TTC estimation. In an initial study, we presented a vehicle in an urban traffic scenario either audiovisually or only visually to investigate the potentially supporting role of auditory information. Participants estimated the TTC of vehicles approaching either at constant speed or under acceleration. At constant speed, TTC estimates for audiovisually presented vehicles were similar to those in the visual-only condition. For accelerating vehicles, however, TTC was significantly overestimated in the visual-only condition. In comparison, the extent of TTC overestimation was significantly reduced for audiovisually presented accelerating vehicles. Thus, complementary auditory information provides a significant advantage for estimating TTC for accelerating vehicles in traffic scenarios. In an ongoing second study, we address the question whether visual cues can be similarly helpful in TTC estimation. Here, participants estimate TTC of visually presented vehicles in a traffic scenario similar to the first study. In the acceleration condition, a visual marker on the vehicle indicating a present acceleration is either displayed or not. We expect the visual marker to improve the TTC estimation for accelerating vehicles.

Online 1 | Solveig Tonn, University of Würzburg | Agency for prevention behavior | Solveig Tonn, Lisa Weller, Katharina Schwarz, Wilfried Kunde & Roland Pfister

When acting, we affect our environment. In doing so, we generally feel in control of our actions and their consequences, a phenomenon termed sense of agency. Agency is well documented for actions that aim at causing perceivable effects in the environment, but not all actions aim at causing an effect – rather, actions may also aim at preventing a certain event from occurring. Such prevention behavior poses a critical challenge to the cognitive system, because successful prevention inherently revolves around the absence of a perceivable change. Based on a series of experiments, we will show that this state of affairs leads to a profound dissociation of explicit and implicit measurements of agency: Whereas participants reported high levels of agency in explicit judgements, there was no sign of agency in corresponding implicit proxies, i.e., temporal binding. These results attest to an altered action representation for prevention behavior and support recent proposals to model related processes such as avoidance learning in terms of propositional rather than associative terms.

Online 2 | Sarah Koch, University of Halle-Wittenberg | The influence of magnitude expectation on the processing of loudness and pitch

Previous research suggests the existence of a generalized magnitude representation system (e.g. A Theory of Magnitude, Walsh, 2003) for various magnitude dimensions like numbers, time, or space. A few studies indicate possible interaction effects between magnitude dimensions and auditory dimensions like pitch and loudness (e.g. Campbell & Scheepers, 2015; Hartmann & Mast, 2017). However, whether these auditory dimensions are also represented by a generalized magnitude representation system is still an open question. I will investigate this assumption in an online experiment by testing the effect of magnitude expectation on reaction times in a loudness discrimination task and a pitch discrimination task. In each trial, participants will see a number sequence in ascending, descending, or random order to induce an expectation about the next item's magnitude. After the last number, a tone varying in either loudness or pitch will be presented, and participants will have to decide whether the tone was loud/gentle or high/low. If loudness, pitch, and numbers are represented on the same generalized magnitude representation system, the tone's characteristic will either confirm the magnitude expectation (a loud/high tone after ascending order and a gentle/low tone after descending order) or violate the magnitude expectation. Reaction times should be shorter when the magnitude expectation is confirmed in comparison to the random order. Likewise, reaction times should be longer when the tone's characteristic violates the magnitude expectation. Preliminary data will be presented and the implications for a generalized magnitude representation system for loudness and pitch will be discussed.

Talks II

Mrudula Arunkumar, University of Jena | Dissociating the role of episodic bindings versus insight-based contingency awareness for overshadowing effects in contingency learning | Mrudula Arunkumar, Dr. Carina G. Giesen & Prof. Dr. Klaus Rothermund

Overshadowing is a common phenomenon existing in the classical conditioning literature related to learning. Previous studies exploring overshadowing in humans have shown mixed results where the preference of one salient cue over another nonsalient cue is present when participants are instructed to learn but is absent in situations like incidental learning (Schmidt & DeHouwer, 2010). Our study aims to explore overshadowing in contingency learning and whether these effects can be attributed to incidental episodic bindings or rather stem from insight (detection of contingencies). In our task, irrelevant salient or nonsalient distractors are equally predictive for responses to the target stimuli. No prior information was given on this predictiveness, but participants were asked to guess the response to try and hint at the contingencies after the first block. Results of Experiment 1 show that participants learnt the associations better with salient distractors, which reflects overshadowing in contingency learning. However, this effect seemed to be evident only in those participants who detected the contingency. In Experiment 2, we explore the influence of incidental episodic bindings and their relation to the overshadowing phenomenon when contingency awareness is measured only at the very end of the study, thus reducing the impact of insight. This allows us to investigate whether episodic bindings can indeed explain the associations learnt between salient distractors and targets in an incidental learning setup.

Keywords: overshadowing, learning, binding, awareness.

Larissa Duffek, University of Düsseldorf | The influence of shame and guilt on prospective memory

Event-based prospective memory (PM) refers to performing a previously planned action at a certain point in the future. PM consists of two components: the prospective (i.e. remembering that something has to be done) and the retrospective component (remembering what has to be done and when it has to be done). As PM is crucial for many tasks in everyday life, it is important to investigate factors influencing PM performance. In two previous experiments, we showed that induced shame led to an impairment in the prospective component of PM. A similar emotion is guilt. Surprisingly, in a third experiment using a guilt induction, our data showed that guilt led to an improvement in the prospective component. The aim of the current study was twofold. First, we want to replicate our previous findings by investigating both emotions in one experiment. We expect that shame leads to an impairment in the prospective component, whereas guilt leads to an improvement. Second, we want to investigate possible explanations for the positive influence of guilt on the prospective component. Participants were randomly assigned to one of three mood conditions (neutral vs. shame vs. guilt) before working on a standard PM task. To investigate whether the positive influence of guilt on PM might be due to an increase in general working motivation, participants then worked on unsolvable anagrams. Results will be analyzed using Smith & Bayen's (2004) multinomial processing tree model of event-based PM to obtain unconfounded measures for the prospective and retrospective component of PM.

Carolyn Hey, University of Düsseldorf | Misinformant Credibility and Retractor Credibility both affect the Continued Influence Effect of Misinformation

The *Continued Influence Effect* (CIE) of misinformation refers to the phenomenon that people continue to rely on misinformation for judgments and inferences, even after the misinformation has been retracted. Past research suggests a rational basis for the CIE: Misinformation reliance depends on the credibility of the source that retracts the misinformation (the retractor). High-credibility retractors led to lower misinformation reliance, whereas low-credibility retractors did not (Ecker & Antonio, 2021). However, the effect of the credibility of the source that presents the misinformation (the misinformant) on the CIE has never been systematically studied. In two experiments, I simultaneously and independently manipulated misinformant credibility and retractor credibility. Participants read a news report in which misinformation and retraction were each presented either by a reputable journalist or by a discredited blogger. I measured spontaneous misinformation agreement in an additional control group that saw neither misinformation nor retraction. As expected, misinformant and retractor credibility affected misinformation reliance: Participants more strongly relied on misinformation presented by the high-credibility misinformant compared to the low-credibility misinformant. Conversely, participants relied less on misinformation retracted by the high-credibility retractor compared to the low-credibility retractor. Participants relied on misinformation more than the control group when the misinformant was at least as credible as the retractor. Only when the retractor was more credible than the misinformant, misinformation concurrence was as low as in the control group. Thus, participants relied on the information provided by the more credible source. These findings provide evidence for a rational component of the CIE.

Bruno Richter, University of Tübingen | Learning and memory mechanisms of identification conditioning: An MPT modeling approach

The Shared Features Principle predicts that when two stimuli share a feature, people assume that they share other features as well. I provide preliminary evidence that this tendency can be conditioned to neutral objects (CS) by means of co-occurrence with ingroup (US+) versus outgroup (US-) members. During pretesting, participants were shown 60 CS and asked how much they identify with them. During learning, the 20 most neutrally rated CS were selected, 10 of which were paired with 4 US+ and 10 of which were paired with 4 US-. During posttesting, participants were asked how much they identify with the 20 CS. Participants identified more strongly with CS that were paired with US+ compared to US-. A second prediction derived from the Attractor Field Model suggests diminished memory for ingroup versus outgroup pairings. I assessed memory performance via a 4-picture recognition paradigm. Group memory was diminished for CS-US+ pairings contrasted with CS-US- pairings. A corresponding MPT model validated the observed memory bias. The MPT model fits the data well; the respective parameter for group memory is significantly smaller for CS-US+ pairings. The findings provide tentative evidence that (1) identification can be learnt by virtue of conditioning, (2) memory performance is diminished for CS-US+ pairings, and (3) the relevant memory and guessing processes can be modeled via an MPT. I discuss implications of these findings with respect to the Shared Features Principle and provide an explanation of the detected memory bias along the lines of the Attractor Field Model.

Florian Ermark, University of Heidelberg | A matter of aggregation levels: collective reasoning in multi-level regulation

Before making judgments evidence is often aggregated. One must not only integrate the evidence, but also monitor the adequacy of the aggregation behind it since it can severely affect the implied judgments. In our project we will investigate underlying processes as well as remedies to cognitive shortcomings in multi-level reasoning and conflict regulation. Multi-level aggregation problems constitute a major source of social and political conflict. Considering the same problem at different aggregation levels can lead to completely different implications for the decision process and subsequent action. Different players can address a problem from the very aggregation level that best suits their interests, creating a potential source of conflict and fallacies. Crucial to improved multi-level reasoning is not the amount of big data or their resolution level; it is rather essential to understand that different layers of truth can exist at different aggregation levels. Through metacognitive monitoring people can make sense of seemingly contradictory data and validate counter-intuitive inferences. Thus, a deeper understanding of the inherent levels of aggregation in data can bridge the gap between knowledge of data and adequate action. In the course of the project we will investigate the decision process when reasoning about information presented on different levels of aggregation. We will identify boundary conditions of improving multi-level reasoning through collective interaction (e.g., inducing epistemic vigilance), debiasing approaches using dialectical strategies (e.g., consider the opposite), and exploiting the potential of modern IT ecologies for virtual interaction to facilitate collective search and reasoning.

Talks III

Julia Eck, University of Würzburg, Disembodiment in the context of virtual action effects

Evidence from multisensory body illusions suggests that body representations can be expanded by embodying external objects. However, adjusting body representations to current task demands implies also that parts become disembodied from the body representation if they are no longer required. In the current study, we induced embodiment of a 2D virtual hand that could be controlled through active movements of a computer mouse or on a touchpad. After the virtual hand was embodied we probed for disembodiment by comparing two conditions: Participants either continued moving the virtual hand or stopped moving it. Based on accounts that conceptualize body representations as a set of multisensory bindings we expected gradual disembodiment of the virtual hand if its current body representation would no longer be updated through correlated visuo-motor signals. In contrast to our prediction, the virtual hand was instantly disembodied as soon as participants stopped moving it. This result was replicated in two follow-up experiments. The observed rapid disembodiment suggests that humans might have already become experts in adjusting body representations to changing virtual tools and task demands by daily interacting in virtual environments.

Elisa Straub, University of Freiburg | Stand vs Sit - Influence of posture on cognitive control

Recent studies show that performance in cognitive conflict tasks (e.g., Color Stroop tasks) is improved when subjects perform the task while standing compared to sitting. These studies suggest that requirements to control postural muscles while standing consumes central resources, which improves selectivity of attention in cognitive control tasks. However, an extensive study fails to replicate these findings. Thus, we systematically investigate body posture (standing vs sitting) on cognitive control and conduct a meta-analysis on our and previous studies' results.

It is a common finding that stimulus and response features are bound together and stored in an episodic representation, called *event file* (Hommel, 2004). Moreover, a unitary binding between stimulus and response has been coined *binary* binding. Using a four-alternative auditory negative priming paradigm, a previous study found that a completely response-irrelevant context stimulus modulated the binding between the distractor and response, instead of being bound directly with the response in a binary fashion. This finding raises the questions whether contextual information can also enter a binary binding and, if so, what determines its integration. Given that the variability and saliency properties of the context were found to influence memory-based processes, we systematically manipulated these properties in a four-alternative auditory negative priming task. In Experiment 1, context variability was varied between participants with either 9 (high variability) or 2 (low variability) individual sounds. In the group with low variability, context modulated the binding between the distractor and response, but context was bound directly with the response in the high variability group. Context saliency was manipulated by varying its loudness or emotional valence in Experiment 2 and 3, respectively. Results showed that context sounds of low saliency were not integrated at all. Context sounds of moderate saliency modulated the binding between the distractor and response, whereas context sounds of high saliency were bound directly with the response. Further causes for the current findings and their theoretical implications will be discussed.

Katrin Köllnberger, University of Regensburg | Binding Music: Integration of two-tone chords into event files | Katrin Köllnberger, Johanna Bogon & Gesine Dreisbach

The ability to perceive an object as one coherent representation is due to binding processes between its features. Empirically, such binding processes can be measured via partial repetition costs, a performance pattern of faster reaction times when either all features of a given object repeat or switch as compared to the repetition (or switch) of only one feature. Feature binding has been shown for a large number of features in the visual and auditory domain. The purpose of the present two experiments was to investigate whether such binding effects can also be found in the domain of music. More precisely, we aimed to examine whether the tones of a two-tone chord are temporarily integrated into a music event-file. In the first experiment, we applied a pitch classification task. The auditory stimulus consisted of two simultaneous tones (one out of two upper tones of different pitch, and one out of two lower tones of different pitch). Participants responded with a left or right keypress to the pitch of the upper tone. The two-tone chord was always consonant. The lower tone was irrelevant but could also be low or high. Analyses of reaction times and error rates revealed partial repetition costs indicating binding: performance was better when both tones repeated or alternated relative to partial repetitions (only the upper or the lower tone repeated). The results thus show that two consonant tones are integrated into one event-file. In a second experiment, we are currently investigating whether the same holds true for dissonant harmonies.

Poster II

01 | Céline Haciahmet, University of Trier | Common Coding in Stroop Conflict: an EEG power analysis of early sensory conflict detection | Céline Haciahmet, Christian Frings & Bernhard Pastötter

The common coding theory of perception and action (Hommel, Müsseler, Aschersleben, & Prinz, 2001; Prinz, 1997) suggests that action execution is coded in terms of perceptual events in a common representational domain (Van der Wel, Sebanz, & Knoblich, 2013). Up to date, the neural mechanisms behind the common coding account are rather unclear for most executive functioning, such as cognitive conflict. There is ample evidence from EEG research (Pastötter & Frings, 2018; Opitz et al., 2020) that response conflict arising in later processing stages can influence early sensory processing of flanking distractors. Here we present EEG time-frequency data (N = 50) from a lateralized colour-word Stroop task as a further piece in the search for the neural basis of common event coding. In general, behavioural and EEG results replicate midfrontal stimulus and response conflict in theta power (4-8 Hz). Regarding early conflict detection, the sensory processing of distractive colour words in parieto-occipital theta power is increased during response conflict, but not during stimulus conflict. In fact, the early detection of upcoming response conflict in parieto-occipital areas correlated negatively with midfrontal theta power increase during the response selection stage. This data pattern supports the idea of a representational link between stimulus perception and associated response features, as recent action control accounts (BRAC; Frings et al., 2020) would suggest.

Normally, one is pointing by extending arm and hand and putting the index finger in the line between one's eyes and the target, while observers extrapolate the vector defined by the pointer's shoulder and index finger. In this study, we focus on interpretation of non-canonical pointing gesture where the pointing arm and hand are oriented differently, e.g. because the target is hidden behind another object. As indicated by a pilot study, observers base their interpretation mainly but not solely on the hand orientation. Now, we examined whether the arm orientation also serves as directional cue, which is contributing to the interpretation of the target location or whether the arm is affecting the hand orientation by means of a simultaneous contrast. In the former case, the estimated target location should be biased towards the extrapolation of the arm while in the latter case the target location should be perceived as further away from the extended arm. In an online study, participants saw screenshots with a virtual pointer from a sideward perspective with varying arm ($-15^\circ, 0^\circ, 15^\circ$) and hand elevations ($-30^\circ, -15^\circ, 0^\circ, 15^\circ, 30^\circ$) pointing to a vertical pole at different distances (25cm, 100cm, 175cm). They were asked to determine where on the pole the pointer was pointing. Generally, the arm orientation was perceived as a contrast, leading to a repulsion of the finger orientation from that of the arm. However, when the arm direction was oriented upwards, the estimated target location was biased towards the extended arm line, indicating an assimilation.

03 | Melanie Richter, TU Dortmund | Relative, not absolute, stimulus size is responsible for a congruency effect between physical stimulus size and left/right response positions

Recent studies demonstrated a novel congruency effect between physical stimulus size and horizontally aligned response position: Right-hand responses are shorter and more accurate to a small stimulus, compared to a large stimulus, whereas the opposite is true for left-hand responses. The present study investigated whether relative or absolute size is responsible for the effect. If relative size was important, a particular stimulus would elicit faster left-hand responses if the other stimuli in the set were larger, but the same stimulus would elicit a faster right-hand response if the other stimuli in the set were smaller. In two experiments, participants performed a discrimination task in which they had to respond to stimulus color (Experiment I) or to stimulus shape (Experiment II) with their left/right hand. Stimulus size varied as an irrelevant stimulus feature, thus leading to congruent (small-left; large-right) and incongruent (small-right; large-left) conditions. While in one half of the experiment, a set of small stimulus sizes was employed, in the other half a set of large sizes was used. The consistently significant two-way interaction between stimulus size and response position reliably demonstrated the presence of the congruency effect. The three-way interaction between stimulus size, response position and stimulus set, however, never reached significance. The pattern of results, thus, demonstrates that relative, but not absolute, stimulus size is crucial for the congruency effect between physical stimulus size and response position. Hence, the associations between stimulus size and the categories (responses) “left” and “right” are established on the fly, depending on task-context.

04 | Alejandra Rodríguez-Velásquez, University of Freiburg | Evidence for Time-based Expectancy in the Tactile Domain

When a particular stimulus appears more frequently after a certain time interval than after another, participants adapt to such regularity by responding faster to frequent interval-stimulus combinations than to infrequent ones. This phenomenon is known as time-based expectancy (Thomaschke et al. 2015). Most studies on time-based expectancy have primarily focused on the visual domain using modified versions of the time-event correlation paradigm (Wagener, & Hoffmann, 2010). However, given current assumptions of different sensory-dependent human timing mechanisms that work in parallel, the question whether such expectancies can also be formed in the tactile domain remains open. We will present a series of experiments where we explored whether participants could build time-based expectancies for vibrotactile stimulation. Our findings will be discussed in relation to human timing research and its implications for future research in multitasking.

05 | Irina Monno, University of Freiburg | Exploring strategies for cost balancing in self-organized task switching | Irina Monno, Jeff Miller & Andrea Kiesel

In voluntary task switching, individuals aim to optimize their performance by balancing cognitive constraints (switching costs) and environmental constraints (waiting time). In the self-organized task switching paradigm, the stimulus associated with a task repetition occurred with stimulus onset asynchrony (SOA), which increased continuously with the number of repetitions until a task switch reset the SOA. Thus, the waiting time for the repetition stimulus increased with the number of successive task repetitions. We examined how individuals balanced switching costs and waiting time in different experimental settings. We observed two different cost-balancing strategies. That is, some individuals switched tasks when the waiting cost was approximately equal to the individual switching cost, i.e., they used the local strategy. Other individuals switched tasks before the waiting cost reached the individual switching cost, i.e., they used the global strategy. Interesting, the preferred strategy was used consistently across different experimental settings, suggesting interindividual stable strategies.

Empathy, i.e., sharing another's feelings, and reciprocity, i.e., reciprocating kindness, are two strong motives for prosocial behaviors. However, so far, it is unclear which of the two motives is more sustainable over time. Here we use a reinforcement learning approach to investigate how empathy and reciprocity motives develop and decay over time in the absence of further reinforcement. In the first experimental phase (corresponding to acquisition), we reinforced the respective motive (empathy/reciprocity) with high probability (80%) and in a second phase (corresponding to extinction) with low probability (20%). In a parallel control condition, the motive was randomly reinforced (50%) in both phases. We observed that the strength of the reciprocity motive closely mirrors the frequencies of reinforcement in the respective phase, i.e., increased in the first phase and decreased in the second phase. In contrast, the strength of the empathy motive increased in the first phase and persevered in the second phase. When modeling motive strength over time using a variant of the Rescorla-Wagner model, this difference in motive development was reflected by a significant difference in one key model parameter. Follow-up analyses revealed that this model parameter is likely to capture the motive dependent influence of emotional valence on motive development. Together, these results suggest (i) that the empathy motive might be more sustainable than the reciprocity motive and (ii) that differences in motive development over time can be well captured and described in terms of standard reinforcement learning models.

Online 1 | Philipp Raßbach, University of Würzburg | The effects of action costs and cognitive crosstalk from lower to higher levels in nested multitasking | Philipp Rassbach, Eric Griessbach, Rouwen Cañal-Bruland & Oliver Herbort

Humans engage in nested multitasking when they regularly make higher-level cognitive decisions (e.g., deciding whether or not to cross a street) while continuously performing a low-level motor task (e.g., walking). Sequential choice models predict an influence of higher cognitive to lower motor levels, but only embodied choice models predict bidirectional influences between action and decision making. Here we examined whether low-level motor task execution biases higher-level cognitive decision making due to cognitive crosstalk and action cost related discounting. Participants performed a multilane tracking task comprising a low-level motor task of tracking a stimulus on a lane and a higher-level cognitive decision task of moving to an upper or lower lane offering equal or unequal rewards; to disentangle cognitive crosstalk from action cost related discounting, the action costs for moving to the upper or lower lane varied as a function of the state of the low-level motor task. Higher-level cognitive decisions were biased both by the state of the low-level motor task and the varying action costs. Specifically, we observed the largest biasing effects if rewards were equal but smaller biasing effects persisted when rewards were unequal. These findings indicate that humans are prone to making biased decisions due to crosstalk effects from lower to higher levels in nested multitasking. This supports embodied choice models of decision making that emphasize bidirectional influences between action and decision making.

Keywords: multitasking, decision making, embodied choice, crosstalk, action-based models.

Talks IV

Elena Benini, University of Freiburg | Is Language Bound in Task Switching when it is Task-irrelevant? | Elena Benini, Iring Koch, Susanne Mayr, Christian Frings & Andrea M. Philipp

Task-switching paradigms are typically employed to examine cognitive control. However, automatic processes also intervene in such multitasking settings. For example, in task-switching, response-repetition benefits are observed in task repetitions, but response-repetition costs in task switches. The interaction of task repetition (vs. switch) with response repetition (vs. switch) may be explained in terms of task-response features binding. Binding is the process through which the features of a stimulus are automatically integrated into a coherent representation. Many pieces of evidence suggest that this representation is retrieved from memory upon reencountering at least one feature. In this study, we used cued task switching and added a task-irrelevant feature to examine its influence on binding. Namely, we presented verbal task cues either in Spanish or in English, while the target was always in German. We predicted that repeating the cue language in the subsequent trial would retrieve the features of the previous trial, despite language was a task-irrelevant feature throughout the task. We observed a three-way interaction of repetition (vs. switch) of task, response, and cue language. When cue language switched from the previous trial, the response repetition benefit in task repetitions turned into a small repetition cost, while task-switch trials were largely unaffected by a cue language switch. We discuss the findings in light of binding and retrieval mechanisms: when the cue language repeated, it retrieved the previous task-response binding, yielding the response repetition benefits, whereas such binding could not be retrieved when language switched.

Viola Mocke, University of Würzburg | Exploring the Binding of Different Types of Features in Action Planning

Action planning, that is, the top-down processes preceding an action's eventual execution, can be construed as activation and binding of features of anticipated action effects. Most previous studies have focused on the spatial features “left” and “right” to describe planned body movements. A series of four online experiments aimed at testing whether other (non-)spatial features are bound to action plans as well. Overall, we did not find indications for differences in binding or retrieval of temporal (“short” and “long”) or vertical (“top” and “bottom”) features as opposed to horizontal (“left” and “right”) features. As binding effects did not show consistently, we additionally identified two conditions which, when met, seem to enhance these processes in general. First, the clearest signs of binding and retrieval showed when there was uncertainty regarding all features of an action, up to the point in time it had to be planned or executed. Secondly, indications for feature binding appeared to be more likely when actions were described in terms of features that are not very commonly used to describe the respective body movements, and which in that sense are unfamiliar. These observations have important methodical implications for the future study of feature binding in action planning.

Juhi Jayesh Parmar, University of Jena | Stimulus-response binding and retrieval is independent of affective consequences: Implications for theories of learning and behaviour automatization

Stimulus-response binding and retrieval (SRBR) is a fundamental mechanism driving behaviour automatization. In our 4-part experiment series, we investigated the modulatory role of performance-dependent and performance-independent affective consequences on SRBR effects in order to test whether binding/retrieval can explain instrumental learning (e.g., the “law of effect”). SRBR effects were assessed with a colour categorisation task in a sequential prime-probe design, with an orthogonal variation of Response relation (colour repetition vs. change) by Distractor relation (word repetition vs. change). Binding/retrieval effects are measured by an interaction of the two factors, with distractor repetition leading to facilitation in conditions where the response must be repeated, but leading to interference when the response changes from prime to probe. Positive, neutral, or negative events consisting of visual, auditory, and monetary events were interspersed between primes and probes to investigate whether affective consequences modulate the binding/retrieval effect. Consistently across all 4 experiments (total $n=334$), we did not find any evidence for an affective modulation of RT-based binding/retrieval effects, indicating that these effects are fully automatic and independent of (performance dependent and independent) feedback. Results are discussed with regard to their implications for theories of learning and habit formation.

Silvia Selimi, University of Trier | Hand position effects in response-response binding

Responding to a stimulus leads to the integration of stimulus and response features into an event representation (event file). Consequently, repeating one of these features retrieves the whole event file, influencing further responding. Recently it has been shown that the same mechanisms of binding and retrieval can also affect multiple responses: Executing two individually planned responses in sequence leads to integration of them so that repeating one of the responses later on retrieves the other (Moeller & Frings, 2019). Recent findings show that hand position might influence binding of manual responses: Distance between hands giving responses modulated binding, with larger binding effects for responses with hands positioned close together than far apart. As the exact mechanisms behind this effect are unknown, possible explanations are discussed.

Philip Schmalbrock, University of Trier | Gestalt Principles in Stimulus-Response Binding

We constantly produce action and that almost effortlessly. However, internal processes that lead to our actions are all but simple. The action control literature describes several processes that make actions possible without perceiving their production as effortful. One of these processes that enables us to act intentionally is the binding of stimuli and responses (S-R Binding). Comprising stimulus and response features in a short-lived memory trace (event file), we are able to quickly represent information input and action output in a single format without additional translation- or processing steps. Yet, S-R binding is not one unified process but consists of two separate strands that contribute to it. In a first step, features are *integrated* into an event file. In a second step, the previously integrated event file is retrieved. Further, both processes can be modulated by other variables that increase or decrease integration or retrieval strength. One set of factors that have been shown to modulate S-R binding *in general* are gestalt principles. For example, binding is absent when stimulus features are presented in the background compared to when forming their own figure in front of the background (figure-ground segmentation). However, it is unclear which of the two strands of S-R binding are actually targeted by such gestalt manipulations. In this talk, I want to give a closer look at how integration and retrieval are modulated by two gestalt principles, namely figure-ground segmentation and perceptual grouping.

Poster III

01 | Marvin P. Liesner, University of Würzburg | Spatial binding of visual and proprioceptive effects in the presence and absence of active motor control | Marvin Liesner, Colin Schwinum & Wilfried Kunde

Spatial action-effect binding describes the phenomenon that the perceived distance between an object controlled by one's movements and the body effector controlling that object movement shrinks compared to when the object is not under one's control. Spatial binding reflects the integration of visual signals from the controlled object and proprioceptive signals from the body and is often interpreted as an implicit measure for a sense of ownership over the controlled object. Recently, we showed that conflicting sensory information from the controlled object and the body effector when body movements are transformed into spatially inverted object movements eliminates spatial binding. This elimination is possibly caused by interference of the inverted visual and proprioceptive signals during movement planning. To overcome this interference, the system most likely 'neglects' one of the two interfering components which is beneficial for motor control, but prevents integration of the signals. In the current study, we wanted to identify the influence that motor planning has on spatial binding. We compared a classical condition in which participants performed actions with the controlled object themselves with a condition in which the participant's body effector was moved passively. Without motor planning in the passive condition, there should be less reason to neglect one of the two inverted sensory components and therefore the difference between inverted and straight relationships of body effector and object in spatial binding should be reduced. Without active control in the passive condition, also the overall level of binding might be reduced.

Keywords: action effects, action generation, ideomotor theory, multisensory integration, perception and action, proprioceptive drift, spatial binding, tool use.

02 | Inga Lück, University of Greifswald | Extremely (in)flexible: Switching induced flexibility does not transfer to dual tasking | Inga Lück, Gesine Dreisbach & Rico Fischer

How tasks are processed is often determined by external context features. Studies showed that frequent forced switches within a task switching (TS) paradigm promote a more flexible control state, which transferred to subsequent voluntary switches. Thus, control states can be induced and transferred to other task contexts.

We investigated whether this transfer maintains if the temporal proximity of tasks changes. For this, we combined the TS-paradigm with a dual task-paradigm (DT). The same two tasks were either presented one at a time (TS blocks) or temporally overlapping (DT blocks). In two experiments, TS blocks, consisting of either high or low proportion of task switches, preceded a DT mini block. Following previous research, the switch proportion significantly affected the switch costs within TS blocks. High switch blocks induced flexibility (i.e., reduced switch costs), whereas low switch blocks favoured rather stable control (i.e., high switch costs). Surprisingly, we did not find any indication of transfer when the same tasks were presented with high temporal overlap (DT). Neither T1 (crosstalk effects) nor T2 (PRP effect) performance was significantly impacted by the switch proportion.

We hypothesize that differences in temporal task characteristics between TS and DT may prevent a transfer of control states, indicating a structural limitation. Alternatively, transfer effects may rather be short lived, because participants may quickly discard a certain control state when task characteristics change, indicating meta-flexibility. To test this possibility, in a current third experiment, single DT trials are inserted randomly within the high and low proportion TS blocks.

03 | Amy Strivens, Aachen University | Switching Attention Between Simultaneous Voices: The Effect of Switch Probability | Amy Strivens¹, Iring Koch¹ & Aureliu Lavric²

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Listeners can attend (“tune in”) to one of multiple concurrent voices, but switching attention between voices incurs a substantial performance “switch cost”. Starting about a decade ago with the Koch, Lawo, Fels and Vorlander (2011) research, several studies by the Aachen group found no reduction in switch cost (RISC) with increasing the preparation interval between the cue specifying the target voice and the multispeaker compound. This suggested that it may not be possible to shift attention to another speaker in advance of hearing his/her voice. However, in our recent experiments (particularly in those conducted at Exeter, including Monsell, Lavric, Strivens and Paul, 2019) we found a robust RISC effect suggesting that such advance “re-tuning” may in fact be possible. Here we examine one of the likely sources of the discrepancy between the two series of experiments – switch probability, which was higher in the earlier experiments (0.5, or 50% switch trials in Koch et al., 2011) than in the more recent experiments (0.33 in Monsell et al., 2019). In the present set of experiments, we first aimed to reproduce the settings from our recent experiments that found a robust RISC effect – except using the switch probability of 0.5 instead of 0.33. One experiment revealed a reliable RISC effect, but the second did not. For clarity, our next two experiments will directly manipulate switch probability within-participants: 0.25 vs. 0.75.

04 | Moritz Schiltenwolf, University of Tübingen | Contextualized Control: An effect of memory or disruption?

Conflict between our action goals and distracting information leads to a reduction of the influence of distractors. This fundamental ability to shield ourselves against interferences is traditionally attributed towards dynamic adaptations in cognitive control after conflict experiences. However, recent studies could show that, if task-irrelevant context features, like stimulus format or modality, change, these control adaptations can become smaller or even disappear. This effect could be explained by a memory account that would suggest that control states become bound to the context feature and reencountering the context feature leads to the retrieval of the bound control state. Alternatively, a disruption account would assume that control is sustained over time, but context changes disrupt the control state leading to its deterioration. In this study, we contrasted these two accounts by analyzing in an interference task trials with ABA context sequences. The memory account would predict control retrieval because of the repetition of the A context. However, the disruption account would suggest a double control deterioration because of the two consecutive context changes ($A \rightarrow B$ and $B \rightarrow A$).

05 | Philine Thomasius, University of Cologne | Exploring optimal conditions for unconscious conditioning

It is not clear whether unconscious learning, e.g. conditioning without awareness of the contingency between CS and US, is possible. A wide-spread technique to make subjects unaware of the contingency is to present the CSs in a way that they are not identifiable. However, a problem of the commonly used pattern-masking is that it interrupts the stimulus processing at a very early level that might eliminate a potential unconscious learning effect. In contrast, metacontrast-masking is a masking technique that interrupts stimulus processing at a higher level and with which other unconscious processes (response priming) have already been shown. I am planning to conduct a response-learning experiment and to render CSs unidentifiable with metacontrast-masking to produce optimal conditions for finding unconscious conditioning.

Online 1 | Valentin Koob, University of Bremen | A Confound-Free Evaluation of Congruency Sequence Effects: Implementing Cognitive Control within the Diffusion Model Framework | Valentin Koob, Ian Mackenzie, Rolf Ulrich, Hartmut Leuthold & Markus Janczyk

In conflict tasks, like the Stroop, Simon, or flanker task, the congruency effect is often reduced after an incongruent compared to a congruent trial: the congruency sequence effect (CSE). Despite extensive research, three issues are still unsettled. First, the origin of the CSE: Does it reflect conflict-driven adaptation in control sets or (confounding) factors, such as feature integration? Second, the adaptation mechanism: Does the CSE reflect increased processing of task-relevant features, suppression of task-irrelevant features, or both? Third, the temporal dynamics: Does adaptation in processing occur within a trial already, or does it occur between two successive trials? To evaluate each of these issues, we took a mathematical approach by implementing a pure mechanism of conflict-driven adaptation within the established Diffusion Model for Conflict tasks (DMC). Based on simulations, we argue that the task-irrelevant feature is suppressed after experiencing conflict, and adaptation in control settings occurs between two trials. Importantly, since the mathematical approach predicted the typical CSE pattern, the present results demonstrate that CSEs even emerge in the absence of potential confounds. Further exploratory simulations demonstrated that the implemented conflict-resolution mechanism also predicts list-wide proportion congruency effects.

Online 2 | Ekaterina Varkentin, University of Tübingen | Risk perception and codality in a cross-cultural context

People receive daily warnings of dangers and risks through images (e.g. pictograms). The wide usage is based on the assumption that pictorial information transmission (unlike text) is universally understandable, independently of language skills, culture, or education. However, there are findings that the linguistic and/or the cultural background has an influence on cognitive processes such as reading and visual narrative comprehension (Dobel et al., 2007, 2014; Schwan & Ildirar, 2010; Yum et al., 2021). In this dissertation project, I want to take a closer look at how culture and language shape the processes underlying the perception of risk information presented in different codalities (such as texts and images).

This project starts by investigating risk perception in different cultures. Russian speakers represent one of the biggest non-native groups in Germany (Kühn et al. 2012), therefore the first study will focus on a comparison between Russia and Germany. Participants will be presented with risk scenarios and are asked to judge perceived risk. Scenarios were carefully elaborated in cooperation with representatives of both cultures and are based on the common typologies and literature on the risk perception research. Further studies will investigate the influence of bilingualism of the comprehenders and codality (text vs. image) of the presented risk scenarios. Manipulating the language of the presented scenario, follow-up studies will test processes of risk perception in first and second language. These results will provide new insights about effects of culture and language on information processing, which is especially relevant for integration policy and professional training.