

# BOOK OF ABSTRACTS

10th International  
Symposium on  
Brain and Cognitive  
Science

1 June 2024



Dear Participants,

We are delighted to welcome you to the 10th edition of our international symposium, an event that highlights a decade of academic and professional achievements in cognitive science. Over these ten years, our symposium has established itself as a hallmark of interdisciplinary collaboration, drawing participants from all around Turkey and the world.

Each contribution included in this book of abstracts represents a step forward in our collective quest for knowledge. The breadth of research presented here underscores the symposium's commitment to fostering an environment where diverse ideas can converge and flourish.

As we gather to share insights and explore new frontiers, we are reminded of the power of collaboration and the importance of continuing our efforts to bridge gaps between disciplines such as psychology, artificial intelligence, linguistics, language learning, anthropology, neuroscience, and philosophy. The 10th edition of our symposium is a testament to the strength of our academic community and the pursuit of excellence that drives us all.

We extend our deepest gratitude to all participants, our invited speakers, and the Middle East Technical University who have contributed to making this symposium a success. We hope that this book of abstracts serves as both a record of the intellectual contributions made and a source of inspiration for future endeavors.

Welcome to the 10th International Symposium on Brain and Cognitive Science! Let us celebrate our shared achievements and look ahead to the new horizons that await us.

Warmest regards,

Co-Organizers

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# Enhancing Visual Question Answering Through Question-Driven Image Captions as Prompts

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Visual question answering (VQA) is known as an AI-complete task as it requires understanding, reasoning, and inferring about the vision and the language content. Over the past few years, numerous neural architectures have been suggested for the VQA problem. However, achieving success in zero-shot VQA remains a challenge due to its requirement for advanced generalization and reasoning skills. This study explores the impact of incorporating image captioning as an intermediary process within the VQA pipeline. Specifically, we explore the efficacy of utilizing image captions instead of images and leveraging large language models (LLMs) to establish a zero-shot setting. Since image captioning is the most crucial step in this process, we compare the impact of state-of-the-art image captioning models on VQA performance across various question types in terms of structure and semantics. We propose a straightforward and efficient question-driven image captioning approach within this pipeline to transfer contextual information into the question-answering (QA) model. This method involves extracting keywords from the question, generating a caption for each image-question pair using the keywords, and incorporating the question-driven caption into the LLM prompt. We evaluate the efficacy of using general-purpose and question-driven image captions in the VQA pipeline. Our study highlights the potential of employing image captions and harnessing the capabilities of LLMs to achieve competitive performance on GQA under the zero-shot setting. (The complete version of this study has been accepted at the CVPR 2024 Workshop on Prompting in Vision and is included in the CVPR2024 proceedings.)



# **Mnemonic Emotion Regulation: The Role of Visual Perspective And Emotion Type**

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The present study focuses on the emotion regulation function of autobiographical remembering, investigating the modulating factors in the process. Previous research has shown that visual perspective at retrieval influences the emotional impact of memory (Küçüktaş, & St Jacques, 2022). While field perspective provides an immersed recollection, an observer perspective distances the individual from the memory and reduces the emotional intensity of the event (Ayduk & Kross, 2008). However, there is also evidence suggesting that, for social emotions such as shame or guilt, adopting an observer perspective results in the retrieval of more intense emotions (Katzir & Eyal, 2013). In the present study, we aimed to investigate the effectiveness of mnemonic emotion regulation, depending on the type of emotion to be regulated (anger, shame) and the visual perspective at retrieval (field, observer). We also aimed to investigate whether and how these mnemonic processes are reflected on executive functioning. We expected that more mnemonic effort would be required to regulate the shame recalled from an observer perspective and anger recalled from a field perspective, which would result in the retrieval of more positively valenced memories reported with a greater sense of reliving. In line, we also expected that this regulation effort will be reflected on the executive functions, resulting in poorer performance on inhibition and cognitive flexibility tasks. We randomly assigned participants to report either anger or shame-inducing memories from either a field or an observer perspective. They were then asked to recall a specific positive event that came to mind and rated the phenomenology of their memory. Lastly, they completed an emotional stroop task (inhibition) and an affective shift task (cognitive flexibility). Results indicated that those who reported anger memories from a field perspective and those who reported shame memories from an observer perspective reported greater sense of reliving and imagery for the positive memories during subsequent recall and these individuals showed poorer performance on both executive function tasks. These findings highlight the role of phenomenology in the mnemonic regulation of emotions and will be discussed focusing on the factors underlying the functions of autobiographical remembering.

## **What Makes a Novel Spatial Metaphor of Time?**

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Metaphors are expressions that describe an abstract concept in terms of a more concrete entity (Lakoff & Johnson, 1980). We comprehend such expressions by finding the commonalities between these two components (Holyoak & Stamenkovic, 2018). Among these metaphors, some of them are used to express time in terms of space. For example, we say things like, “The week ahead will be an exciting one.” Such metaphors are called spatial metaphors of time because they talk about time in terms of space, even though the next week is not ahead of us like a concrete object is. Some metaphors are conventional, meaning that they are easily understandable and frequent in daily life. Others are novel metaphors, which are more literary or newly created metaphors; they are less frequent and more difficult to understand. Metaphor comprehension studies have investigated how we process metaphors by pitting conventional metaphors against novel ones (Bowdle & Gentner, 2005). Although metaphor comprehension studies have yielded much data on how we comprehend metaphors, no research has specifically examined how we process novel spatial metaphors of time. We compiled a stimuli pool of 80 spatial metaphors of time for the stimuli standardization procedure of a behavioral experiment. Forty of them were conventional time metaphors compiled from everyday examples, whereas the other 40 were novel spatial metaphors of time put together by the authors of this study. We created novel metaphors using verbs that do not conventionally express temporal motion in Turkish. For example, “Mezuniyet gününe doğru emekliyoruz” is novel because Turkish people typically do not use this motion verb while talking about time. Both types of metaphors were evenly divided between the Moving-Ego (an observer moving toward a temporal event: “I am approaching the vacation.”) and the Moving-Time perspectives (a temporal event moving toward a stationary observer: “The vacation is approaching.”) Forty participants rated these metaphors on Qualtrics, using a 5 point likert scale. The metaphors were rated on the following criteria: Aptness (whether the sentence is suitable for explaining a situation about time), Conventionality, Metaphoricity (whether the sentence has a highly abstract/metaphorical meaning), Ease of Interpretation, Imageability (Whether the participants can create an image of the sentence in their minds), and Possible Interpretations (whether the sentence can express multiple meanings). The participants’ ratings showed that the novel metaphors had more possible interpretations, were more difficult to interpret, were less apt, and were less conventional. A second pilot study with 10 participants showed that these properties of metaphors were linked to time-related hand gestures in various ways. These two

pilot studies provided us with valuable preliminary data and a standardized stimuli set to be used in metaphor comprehension experiments that focus on spatial metaphors of time.

# **Multimodal Language of Autobiographical Narratives: The Role of Hand Gestures on Subjective Ratings and Episodic Elements of The Past Experiences**

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Comparing autobiographical narratives in one's native language (L1) with those in a second language (L2) is valuable for investigating the role of gestures when cognitive load is related to the verbal communication channel (Kita et al., 2017). Gesture's role in emotional intensity ratings of non-autobiographical narratives has been shown in L2 use (Özder et al., 2023). Moreover, its role in accessing details of autobiographical events using L1 has also been shown (Aydın et al., 2023). In this study, we asked about gestures' differentiating roles in narrating emotional autobiographical events in L1 and L2. We first examined gestures' roles in phenomenological (reliving, visual imagery, auditory imagery, and importance) and emotional intensity ratings of positively vs. negatively valenced autobiographical events using L1 vs. L2. We then assessed their roles in recollecting the events by aiding the activation of episodic elements in L1 vs. L2 and positive vs. negative events. Based on the gesture for conceptualization hypothesis (Kita et al., 2017), we expected (1) gesture use to increase phenomenological and emotional intensity ratings in both languages, (2) to support episodic event representations by activating more episodic elements in both languages and, (3) the effect to be more prominent in L2 than L1, where cognitive load increases. Thirty-six participants (Mage= 21.19, SDage = 2.19, twenty-two females) narrated positive and negative events as a response to cue words in L1-Turkish vs. L2-English. Results revealed no main effects of language or language and valence interactions (N= 36, ps >.05) on narratives' phenomenological and emotional intensity ratings, controlling for English proficiency and current mood. Additionally, regression analyses revealed no association between any of the ratings in either L1 or L2 (N= 36, ps > .05). However, there was an association between representational gesture use and visual imagery of negatively-valenced narratives in Turkish (N= 29,  $\beta = .39$ , SE= .02). Non-representational gesture use, on the other hand, was associated with emotional intensity (N= 29,  $\beta = .50$ , SE= .04) and reliving for negative events (N= 29,  $\beta = .48$ , SE=.04) in L2. Further analyses are ongoing to investigate the association between gesture use and episodic elements of autobiographical narratives. These results align with the previous findings on the functions of representational and non-representational gestures. Especially for the negative events, representational gestures might have helped the recollective experience of past events, thus increasing the subjective rating of visual imagery. On the other hand, non-representational gestures'

fluency-resolving function might have increased the subjective ratings of emotional intensity and reliving for the negative events.

## **Investigating The Mechanisms Behind Music-Induced Analgesia: An Effect of Affective or Cognitive Modulation?**

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Music- and distraction-induced pain reduction have been investigated extensively, yet whether the analgesic effect of music is mediated by induction of a relaxed affective state or diversion of attention from own suffering remains unknown. Previous studies used within-subject designs and self-report measurements to compare the analgesic effects of music and no music conditions, which casts doubt on the reported findings due to potential subject-expectancy effects. In the present study, we used the cold pressor task to objectively compare the pain tolerances of participants in a four-group between-subjects design: a music group that listened to a classical music piece in the absence of any explicit tasks, a music-and-attention-to-music group that listened to the same piece while also rating the arousal levels in the music piece every five seconds, a music-and-attention-to-pain group that rated their own pain levels every five seconds while listening to the same piece, and a silence group as control. Using a chronometer, we measured how long participants were able to withstand the cold water to determine their pain tolerances. By intending to reduce the potential distractive effect of music in the music-and-attention-to-pain condition and intending to enhance the potential affective effect of music in the music-and-attention-to-music condition, we compared these critical conditions with the music group to assess whether music-induced analgesia predominantly works through cognitive or affective modulation. Pain tolerance data was found to be bimodally distributed as revealed by a significant Hartigan's dip test for unimodality. We thus used the betamix algorithm from the betareg R package, which divided the whole sample into two beta-disturbed subsamples: low and high pain threshold subsamples. In the low pain threshold subsample, we did not find a pain tolerance difference between the music and silence conditions, which indicated that, contrary to our hypothesis, listening to music alone in the absence of any explicit instructions or tasks did not play a significant analgesic role. However, there was a positive correlation between pain tolerance levels and how relaxing the music was rated by the participants at the end of the experiment in the music condition. These findings indicate that a relatively small analgesic effect of music might be mediated by how relaxing people find a specific music piece. Pain tolerances in the music-and-attention-to-music condition were greater than those in the other three conditions, indicating that engagement in an external task induced effective analgesia. Pain tolerances in the music-and-attention-to-pain condition were not different from those in the silence and music conditions, showing that when the attentional engagement was towards one's own

suffering, no analgesic effect was observed. The high pain threshold subsample did not reveal any differences among the experimental groups. Taken together, our findings indicate that listening to music or attending to one's own suffering does not induce significant changes in tolerance to pain, but diverting attention from own pain through explicitly attending to the arousal levels in a music piece does.

## **Effects Of Watching Short-Form Videos on Cognitive Skills: Prospective Memory, Short-Term Memory, And Attention**

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**Objective:** The present study examines the effect of short-term exposure to social media platforms such as TikTok, which provides short-form video content, on cognitive functions (attention, short-term memory, and prospective memory). The primary purpose of this study is to determine whether there is a difference in task performances of individuals after short-term exposure to TikTok, compared to those who are not exposed. The main hypothesis is that individuals exposed to TikTok use will show lower performance on some memory and attention tests compared to non-exposed individuals. **Method:** We obtained approval from the Yeditepe University Ethics Board of Social Sciences and Humanities. The sample is planned to consist of 160 participants from Yeditepe University undergraduate programmes. The research is currently being conducted face-to-face in the laboratories of Yeditepe University Psychology Department. Thus far, we have collected data from 60 participants. This study has a 2(pre- and post-test)x4 (TikTok, Twitter, YouTube, and Control conditions) design; participants are randomly assigned to one of four conditions in which they either engage in one of three social media apps (TikTok, Twitter, and YouTube) or are given no manipulation. We measure participants' cognitive skills in a pre-test and a post-test. In the control condition, participants avoid using any apps or tech devices within the specified time frame (10 minutes) and in other conditions they use the social media app they are assigned to. Twitter is included in the study because of its similarity to TikTok in terms of fast-streaming content and YouTube is included because of its similarity in terms of content type. Participants are tested by using distinct versions of Serial Digit Learning Test (SDLT), Stroop Test, and Prospective Memory Task during the pre-test and post-test measures. **Preliminary Results:** We conducted a preliminary analysis (N=60) and employed repeated measures ANOVA to examine the effects of time, condition, and time-condition interaction. Overall, there was a decrease in digit span and prospective memory response time from pre-test to post-test. There was a decrease in the control condition too, however, the decrease was more pronounced for other conditions. In the color naming during Stroop task measuring attention and cognitive flexibility, we found a significant decrease in participants' response time from pre-test to post-test. We could not find any significant condition differences across cognitive skills measured. We found no other significant differences, which we believe is the result of our small sample size. Or engaging in social media for a short



time frame may not have a substantial effect on participants' cognitive skills. We will discuss these findings in relation to extant literature. We are still in the process of recruiting participants, we will present and discuss our findings about the effects of social media use on cognitive skills, among college students.

**Keywords:** TikTok, Social Media, Prospective Memory, Short-Term Memory, Attention

# **Investigating the Effectiveness of Large Language Models in Rating Valence of Autobiographical Memories**

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The use of large language models (LLM) recently entered the toolkit of social science researchers. Due to their flexibility and relative cost-effectiveness compared to human annotators, they have attracted interest from a variety of fields, including psychological research (Ziems et al., 2023). Although there is ongoing debate about whether closed-source LLM tools such as GPT models introduce bias in classifying and annotating data (Ollion et al., 2023), and studies have questioned its ability to handle data in languages other than English (Lai et al., 2023), it is beyond doubt that new methods can facilitate the process of handling large datasets, and as a side benefit, researchers can ask creative research questions that cannot be asked before, thanks to large language models (Ziems et al., 2023). Moreover, language models have no memory store which paves the way for more reliable scores by aggregating of each iteration of a prompt (Reiss, 2023). However, it should be acknowledged that different LLM models might give contrasting results. Additionally, the structure of the data, the type of analysis, the language, and the prompt (zero shot vs. a few shot) may affect the quality of the outcome (Ziems et al., 2023). Nevertheless, the capabilities of language models are evolving faster, and concerns probably will become obsolete within a brief time period (Bail, 2023). Therefore, our main goal is to explore the limits of LLMs specifically handling autobiographical memory data, whether they can generate rating scores for self-reported valence scores, comparable to human annotation. By doing so, we can explore a sub-domain where generative AI tools are effective. The second goal is to apply new cost and time-effective methods to social science research where human and economic resources are not abundant. This study involved 156 undergraduate students from Boğaziçi University, 113 of whom were female ( $M = 20.50$ ,  $SD = 1.41$ ) and 43 were male ( $M = 20.93$ ,  $SD = 1.61$ ), who participated in exchange for one credit in their psychology courses. They each retrieved and rated the valence of nine autobiographical memories, prompted by different cue words, totaling 1404 memories. Both GPT-4 and human annotators independently assessed these valence ratings. The results showed a strong correlation between GPT-4 ratings and self-reported valence, as well as between human ratings and GPT-4. In cases where significant discrepancies occurred between GPT-4 ratings and self-reports, GPT-4 ratings often more closely matched the consensus, indicating human rating errors. The rating distribution by GPT-4 was bimodal, with peaks at -2 and 2, and a lesser tendency to rate memories as neutral (0). These findings demonstrate the potential of LLMs to accurately interpret emotional

content and suggest their utility as reliable, efficient tools in psychological research, particularly where traditional resources are limited. This study supports the integration of LLMs into social science methodologies, offering new areas for data analysis and hypothesis generation.

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## **Unbounded Number Line Task with Feedback Can Also Support the Log-To-Linear Shift and Reduce the Biases in Estimating Numbers**

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The mental representations of numerical magnitudes are essential for numerosity perception (Odic & Starr, 2018). Numbers are mentally represented along a number line and are either perceived logarithmically or linearly (Crollen & Seron, 2012; Dehaene, 2008). Up to some point, numbers are represented linearly in our mental number line, and the distance between them gets closer as the numbers increase (i.e., logarithmically compressed). Therefore, being logarithmically compressed, our mental number line leads to underestimating or overestimating numerosities (Crollen et al., 2011). For example, underestimation bias is observed when non-symbolic numerosities (e.g., collection of dots) are converted into symbolic ones (e.g., Arabic numerals). However, when symbolic stimuli are converted to non-symbolic ones, an overestimation bias is observed (e.g., Crollen et al., 2011). One way to measure numerical representation is to use a bounded number line estimation task in which participants must locate the target number in line with certain intervals (e.g., 0-100) (Reinert, 2019). Our number representations shift from logarithmic to linear due to developmental factors (Opfer & Siegler, 2007). However, this shift can also be observed when feedback is given to the participants in a bounded number line estimation task (Opfer & Siegler, 2009). However, since this task includes certain intervals, it supports the proportion judgment of participants, resulting in unreliable results (Barth & Slusser, 2016). Therefore, the unbounded number line estimation task, which only includes a starting point and a scaling unit (e.g., 0-1), became important (Cohen & Blanc-Goldhammer, 2011). Even though researchers have supported the log-to-linear shift by using an unbounded number line task, no study, so far, has used the impact of feedback on this task. Therefore, to support the transition from log to linear in the literature, conducting a study using feedback in unbounded number line tasks is crucial. Data is currently being collected by using PsychoPy (Peirce et al., 2019) and collected from 103 university students. So far, one versions of unbounded number line estimation task, perception is used. In perception task, participants are asked to estimate which number corresponds to gray bar on number line (conversion from non-symbolic to symbolic stimuli). After estimating numbers, they received feedback. Last part included the same questions in first part to investigate the effect of feedback. Also, production task will be used and participants will be asked to estimate target numbers in rectangular box on the number line by moving forward and backward with the help of slider (from symbolic to non-symbolic). After generating their answers, participants will receive

feedback on where the target number corresponds to on the number line. In the last phase, first part will be repeated to see the effect of the feedback. Results should corroborate the findings, in which participants underestimate the numbers in perception task but overestimate them in production task. In addition, we expect that due to the help of the feedback, these biases will be reduced, and participants will estimate numbers more accurately. In conclusion, the log-to-linear shift hypothesis can be supported with an unbounded number line task using feedback.

**Keywords:** mental number representations, unbounded number line estimation task, feedback

# **Influence Of Disfluencies and Gestures in Assessing Others' Knowledge: A Feelings of Another's Knowing (FOAK) Study**

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People use several communicative cues, such as disfluencies and co-speech gestures, to assess others' knowledge levels about a topic, also named as feelings-of-another's-knowing (FOAK). Studies have shown that fluency is a significant signal for expertise and knowledge assessment (Brennan & Williams, 1995). Although there are studies indicating that the presence of gestures can boost persuasiveness of the speaker (Maricchiolo et al., 2009). However, no specific study examined the impact of gestures on judging expertise of others. We argue that gestures and disfluencies may play an active role in knowledge judgments of the listeners. Thus, we examined whether the presence or absence of gestures and disfluencies may affect the judgments of the listeners regarding others' knowledge levels in their answers. In total, 42 participants (Mage=21.05) watched 44 short videos of speakers in four counter-balanced conditions: gesture with fluent or disfluent speech, no gesture with fluent or disfluent speech. In gesture conditions, the speaker produces at least one or more representational and beat gestures. For disfluent conditions, there is again at least one repair, repetition or filled pauses in the speaker's speech. Each video was approximately 5-9 seconds long, in which a person is talking about going from random location A to B (e.g., from market to hospital). Listeners (i.e., participants) did not have any prior knowledge of the answer or locations. They could only form knowledge judgments based on communicative cues of the speaker in the video. After watching each video, participants responded to the FOAK question of "How well do you think does this person know the answer?" in 1-5 Likert scale. We conducted a mixed effects analysis by taking gesture, disfluency, and their interaction as fixed factors, whereas trial and subjects intercepts were included as the random effects. Results showed that disfluency was a significant factor in FOAK scores,  $\beta = -0.45$ ,  $SE = 0.14$ ,  $t = -3.24$ ,  $p < .01$ . Fluent speech received higher FOAK scores than disfluent speech. Gesturing was not a significant predictor,  $\beta = 0.04$ ,  $SE = 0.14$ ,  $t = 0.28$ ,  $p = .779$ . Moreover, there was also no interaction between disfluency and gestures,  $\beta = 0.50$ ,  $SE = 0.27$ ,  $t = 1.82$ ,  $p = .076$ . However, there was a trend for the positive influence of gestures particularly for disfluent speech. In conclusion, these findings suggest that fluency might be a prominent cue more than gestures when assessing others' knowledge levels. Participants rated speakers as more knowledgeable and certain in their responses if their speech does not have any disfluent segments. However, the presence or absence of gestures did not affect their responses regarding knowledge. In our stimuli, there were several visual

elements that vary across videos such as background, speaker appearance, facial movements, and eye-gaze. We deliberately did not control those visual features to better represent ecologically valid language comprehension environment. It is possible to argue that the existence of various visual elements may diminish the importance of gestures on knowledge assessment.

## **Evaluation of Different Eye Tracking Measures for Modeling Demonstrative Use with Rational Speech Act Framework**

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Mental state attribution (or Theory of Mind, ToM) and mechanisms enabling this capacity are claimed to be different for people diagnosed with autism spectrum disorder (ASD). Previous research has found differences in brain function and behavioral measures of typically developed non-clinical controls and ASD groups. In their recent research Mançe Çalışır et al. (2024) [A Dual Eye Tracking Study of Joint Attention in Adults with Autism Spectrum Disorder [Unpublished manuscript]] observed dyadic interactions of participants from both groups. Participants were asked to solve a Tangram puzzle which required both initiating and responding to joint attention (JA). Authors' setup made dual eye tracking data available concurrently to the actions of participants in addition to their speech recordings. The JA performance was quantified by measuring the gaze recurrences (GR) of dyad's gaze locations, and one major finding, among others, was that the GR was lower for the ASD group. Current study is based on this experiment, with a narrower focus on demonstrative use. In our previous work we utilized the Rational Speech Act (RSA) framework as a probabilistic model of demonstrative use behavior. We aimed to model demonstrative use by combining contextual information with gaze location data and came up with a model that parameterizes ToM complexity, level of context-dependence, and allows for testing hypothesis based on different semantic interpretations of the Turkish demonstrative-system. However, our initial model was based on the instance of utterance of the demonstrative (a single frame of gaze location data), which lacked the ability to capture the information available in gaze dynamics. Here we extend our analysis to gaze-object distances within a temporal window centered around the utterance. We define areas of interests (AOI) by processing video recordings, and extract gaze density maps, scanpaths, and consider several among plenty of eye-movement measures based on fixations. This is a work in progress and we aim to explore different measures for a better characterization of the data used to quantify the "literal listener's" (first level of RSA) utterance-object association strengths.



## Cognitive Offloading and Aging

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We often use external tools and resources to learn and remember information in our everyday lives. In other words, we offload information onto an external store to remember it, referring to the phenomenon called "cognitive offloading". Cognitive offloading occurs in various forms, such as setting reminders to remember a prospective event or taking notes to remember information. Even though cognitive offloading is a phenomenon we experience every day, it has rarely been the focus of experimental studies. Therefore, we aim to evaluate this phenomenon by focusing on note-taking behavior among young and older adults. In this study, we present the preliminary data obtained from older adults. Thirty-six older adults who were above 65 ( $M_{age} = 71.67$ ,  $SD_{age} = 5.58$ ) participated in the present study. The study consisted of two food recipe videos that were presented in two separate cycles. Participants were to take longhand notes in each cycle while watching the recipe video. After a 5-minute distractor task, they were asked to recall the recipe by writing on paper. In the first cycle, before the presentation of the recipe video, all of the participants were told that they will have access to their notes during the recall, and they were given their notes during the recall. In the second cycle, half of the participants were told that they will have access to their notes, while the other half was told that they will not. However, none of the participants were given their notes during recall for the second cycle. We tested the cognitive offloading phenomenon within a mixed design of a 2 (recipe: cycle 1 versus cycle 2) x 2 (offloading: warning versus no-warning). The quantity (i.e., number of words written) and quality (i.e., the amount of detail written) of participants' longhand notes and recall performance were evaluated. We hypothesized that neither note-taking behavior nor recall performance would differ among offloading conditions in the first cycle. For the second cycle, participants in the no-warning condition would take more notes than those in the warning condition. Moreover, if cognitive offloading decreases memory, recall performance should be better in the warning condition. In line with our expectations, for the first cycle, the quality and quantity of the notes and recall performance did not differ among offloading conditions ( $p > .05$ ). For the second cycle, the quantity of notes was higher in the no-warning condition than in the warning condition ( $p < .05$ ). Besides, there was a numerical nonsignificant trend in difference in the quality of notes among conditions ( $p = .077$ ). These findings showed that participants offload more information when they think they would have access to the information. On the other hand, recall performance did not differ among conditions ( $p = .710$ ). Even though the metacognitive strategies in remembering the information change in line with the warnings, they do not affect ultimate memory performance.

## **Mu Suppression During Action Observation Only in The Lower, Not in The Higher, Frequency Subband**

**Ayşe N. Badakul<sup>1</sup>, Efe Soyman<sup>2</sup>**

<sup>1</sup> Kadir Has University, <sup>2</sup> Koç University

Ayşe Nur Badakul, Efe Soyman Mu suppression, characterized by the desynchronization of neural oscillations in central EEG electrodes during both action observation and execution, has garnered significant attention and investigation as an indicator of mirror neuron system functioning in the human brain. Nevertheless, a significant limitation in the field has been that the great majority of studies in the literature quantified mu oscillations in the conventional alpha frequency range (8-13 Hz) following early studies. Inspired by the scattered findings from a few studies that are typically overlooked in the literature, we adopted a data-driven approach to investigate the spectral and temporal dynamics of oscillatory power during the observation of motion videos involving hand, face, and artificial pattern movements. Thirty participants aged between 19 and 34 years old (Mean=22, SD=3; female/male=24/6) were included in the study. EEG recordings were collected in a Faraday cage using the Brain Vision actiCHamp system (Brain Products, Munich, Germany) from 32 active electrodes placed in a cap following the international 10-20 system while the participants completed a motion rating task. To be used in this motion rating task, a novel stimulus set comprising 156 grayscale videos depicting hand, face, or pattern movements was created. The motion task comprised two repetitions of each of the 156 video stimuli for 312 trials distributed across four blocks. In 78 trials (1/4 of all trials), after the offset of the video, a motion rating screen was presented to the participants to report their ratings on a 9-point scale. Our time-frequency analyses revealed a significant suppression in neural oscillations in central EEG electrodes only in the lower mu subband (8-10.5 Hz) during the observation of actions, whereas there was no suppression in the higher mu subband (10.5-13 Hz). No such subband differentiation was apparent in alpha oscillations recorded from the occipital electrodes. In the lower subband, there were significantly and selectively stronger suppressions for hand actions in central EEG electrodes positioned over the hand region of sensorimotor cortices and for facial actions in frontotemporal EEG electrodes positioned over the face region of sensorimotor cortices. In the higher subband, such selective suppression was revealed only for facial actions in frontotemporal electrodes. Moreover, oscillations in the lower subband precisely aligned with the temporal patterning of biological motion depicted in the videos. These findings indicate that neural oscillations in the lower mu subband spectrally and temporally indicate characteristics suggestive of neural mirroring

processes. However, those in the higher mu subband may reflect alternative neural mechanisms, the precise understanding of which requires further investigation.

## **The Influence of Prior Knowledge on Event Segmentation**

**Burhan Bağlar<sup>1</sup>, Eren Günseli<sup>1</sup>**

<sup>1</sup> Sabanci University

Our lives are composed of continuous experiences, but memories of those experiences are retrieved in separate chunks. Each memory chunk encompasses coherent instances separated from one another by event boundaries. This phenomenon is known as event segmentation. Despite the well-established role of priors in many aspects of cognition, the influence of prior knowledge on event segmentation remains unclear. We hypothesized that prior knowledge would make more familiar experiences less segmented (unitization) and unfamiliar experiences more segmented (differentiation). In the present experiment ( $N = 37$ ), participants were randomly assigned to trained and untrained groups. In the main phase, all participants were presented with continuous image sequences on the screen (e.g., chair, ball, radio, etc). They were instructed to press the space key whenever they detected a meaningful sequence change. To explore the effects of perceptual changes, some sequences included a color change on the fifth image. To test the effects of prior knowledge, one group of participants was trained on three series of eight images. We also had random sequences that served as controls. In our ongoing study, we observed a prior-knowledge effect on event segmentation behavior in differentiation but not in unitization. Specifically, participants who received prior training tended to segment trained but unimplemented color transitions (i.e., invalid color sequences) more than untrained participants. Thus, the findings of our study demonstrate how prior knowledge influences event segmentation processes, highlighting the differential effects on differentiation compared to unitization.

## **Investigating Terror Management Theory with Causal Models**

**Elif Öykü Başerdem<sup>1</sup>**

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Motivation: The replication crisis is a global and vital issue in scientific communities, especially in psychology. Today, many psychological theories have been shown to be unsupported by data. One such theory is the Terror Management Theory (TMT), which posits that humans are the only organisms to be conscious of their mortality; hence, they try to protect themselves from the terror elicited by their death. Failure to replicate the core hypotheses of TMT indicates that the issue may not only be methodological but might stem from causal assumptions that support the statistical analyses not being explicitly stated. Causal models can resolve this issue via directed acyclic graphs (DAGs) to show the causal relationships and their directions. The current work, which constitutes the first phase of the author's dissertation, aims to discover the relationship between the main variables of TMT by using the causal model-building approach named Evidence Synthesis for Constructing Directed Acyclic Graphs (ESC-DAG). Method: PRISMA was used to screen and evaluate all the relevant articles. For the literature review, mortality salience was used as the exposure variable, and risk-taking was used as the outcome variable. At the end of the literature review, 21 articles out of 279 were selected, and an integrated DAG (called I-DAG) was drawn by examining these articles in three steps. In the mapping stage, relationships between mediators, moderators, outcomes, and exposures were explicitly drawn. In the translation stage, each edge was evaluated individually depending on the (1) theoretical evidence and the (2) results of the study that discovered the edge. Moreover, counterfactual thought experiments were formed for each edge, and depending on these assessments, the edges were either discarded or retained. Finally, in the integration stage, all edges and nodes were combined into the I-DAG. During this stage, nodes representing the same concepts were also merged into one node. Results: The resulting I-DAG had 81 edges and 46 nodes, which were grouped into eight blocks. The concept of risk-taking was divided into risk-taking intentions and risk-taking behavior. Risk-taking behavior, other than mortality salience as a primary exposure, was influenced by several variables such as personality traits (sensation seeking, optimism, locus of control, impulsivity, reactance, ideology, self-efficacy), self-esteem, manipulations other than mortality salience (freedom threat, time perspective, collectivism/individualism), and other aspects related to experimental design such as number of trials and the usage of delay. It was also found that mortality salience manipulation tends to operate with an interaction effect; it can only influence the outcome variable while another variable affects the outcome. This suggests that researchers must consider many confounders while working on these concepts. Risk-taking behavior was generally studied as the intention to take

risks, indicating that studies that directly measure risk-taking behavior in an experiment are rare. Thus, (1) taking the potential interaction effects into account and (2) studying behavior rather than self-reported attitudes can allow researchers to understand how mortality salience influences risk-taking behavior.

## **Assessing Object Vs. Spatial Dimensions of Childhood**

### **Visual Play in A Field Edutainment Study**

**Olesya Blazhenkova<sup>1</sup>, Alexey Kotov<sup>2</sup>, Tatyana Kotova<sup>3</sup>,  
Veronika Roshchina<sup>1</sup>, Elifnur Asilkefeli<sup>4</sup>, Ezgi Bostanci<sup>1</sup>**

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Our research investigates the development of individual differences in visual-object imagery (processing pictorial appearance of objects in terms of their shape, color etc.) and visual-spatial imagery (processing of spatial relations, and spatial transformations). As imagery assessment at preschool age is quite challenging, one promising direction is looking at play. We consider visual play preferences as an environmentally sensitive manifestation of individual differences in imagery, which may potentially serve as an indirect or related measure of visualization ability in preschool children. In our previous studies, using factor analysis, we observed a dissociation between visual-object play (e.g., exploring drawing media or decorative crafts) and visual-spatial play (e.g., assembling and disassembling mechanisms or playing with construction toys), consistent with object and spatial visual imagery dimensions. Our ongoing research focuses on developing comprehensive assessments of visual play, including questionnaires and tasks involving different types of manipulative visual play activities, that would be linked with object and spatial visualization abilities. We study both children's preferences and performance in different types of visual play. In the current longitudinal field research, we examine how children engage in different types of play activities and how this links to their visualization abilities and school performance in STEM and art fields. Our research involves organizing an edutainment field study, where children aged 4 to 8 interact with different types of visual-spatial and visual-object activities using traditional manipulative toys like constructors and creative design sets. We observe children's toy and play task choices in ecologically valid, naturalistic settings ('Play and Learn' festival). During the study, children freely select activities at different 15 play stations (e.g., tables), equipped with toy sets (e.g., educational toys, art supplies). At each play station children select between the visual-spatial or visual-object play activities, based on the materials, and then select the level of difficulty. They are provided with the instructions, and upon the completion of each task, participants will have their festival passports stamped. Depending on age, a different number of stamps has to be collected. Parents accompany each child individually, and research assistants at each play station make observations. We record play choices, performance, time spent for each activity, use of instructions, and interaction with parents. After completing the activities, children show their festival passports with stamps at 'Prize Market' and select gift toys (either visual-object or visual-

spatial). We integrate combined child-adult assessment to examine how children's play preferences and performance are linked to their parents' attitudes and behavior. Prior to their children's participation in the research in the festival, mothers complete the online survey. We assess parental control, warmth, perception of children's play and visualization characteristics, as well as amounts of toys and other stimulating environments. Subsequently, based on the visuals depicting the step-by-step instructions for each play task, we will design further assessments of play preferences and performance that will be made available for researchers and practitioners for early identification, training and improving visualization skills.



## **A Richer Context for Conformity in Mate Choice**

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Human mate choice is influenced by the choices of others, a manner of social learning termed mate-choice copying (MCC). One of the remaining open questions regarding MCC in humans is how substantially it affects real mate choice. Field studies with other animals in the wild have tried to quantify the extent that real mate choice is affected by social forces. With humans, however, MCC research has been exclusive to contrived laboratory paradigms presenting a few seconds of mate choice information on a computer screen. In such paradigms, MCC is highly reproducible, but effect sizes have tended to be quite small. This is assumed to be an underestimation; MCC is expected to have a strong impact on real human mate choice. The proposed study is an effort to pull out this effect by presenting richer, more natural information. The present study brought small groups (2-3) of young adults into a room to discuss at substantial length (20-40 minutes) and collectively rank 15 dater profiles from a real speed-dating event. Prior to and again following this group session, participants each rated the same profiles individually, via Qualtrics. This permits us to quantify the extent that independent ratings concord within groups, relative to between groups. Furthermore, each conversant was introduced with his/her true age noted, permitting us to test whether younger conversants conform more than older, expected if MCC leads one to selectively learn from more experienced rivals. Initial data are described.

## **Timing on The Court**

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Time perception can be studied in the context of any ongoing activity, with at least two response options. The present study presented participants with a reversal learning problem in the context of a basketball court, in which one wins points by scoring baskets. After each passage of a fixed interval of time, the correct basket changed, making it a timing problem. Initially, the time to switch was signalled to train the target time interval. Then on intermittent test trials, signals were removed in order to assess timing. The task varied in difficulty; trivially achieved by varying minimum shooting distance. In this context, we are able to see some known timing effects, including effects of 1) physical strain; 2) task difficulty, and 3) expertise on time perception. We discuss the prospects of studying timing on the basketball court.

## **Revisiting Turkish Counterfactuals: A Linguistic and Causal Analysis**

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Counterfactual statements are defined as conditional statements whose antecedents are false or unrealized (e.g., Anderson, 1951; Barwise, 1986; Ruhi et al., 2000; Pearl et al., 2016 among many others), which is one of the claims we challenge. The utilization and comprehension of counterfactual statements involve intricate cognitive mechanisms, including the ability to disregard actual events, the maintenance of both factual and counterfactual representations within mind, and the capacity to alternate between these representations. Counterfactuals have been extensively studied from a linguistic perspective, and more recently, they have been an important part of causality and causal modeling research with Judea Pearl at helm. The goal of this work is to contribute to this literature by combining these two perspectives in analyzing counterfactuals in Turkish, which we believe is a fresh approach that will shed new light on their nature. The research topics and questions include the following: whether the antecedent needs to be false or unrealized for one to be able to use a counterfactual construction, the use of -sAydl, a complex suffix in Turkish, and its relation to counterfactual interpretation, the difference between -DIysA and -sAydl, the rungs of Pearl & Mackenzie's (2018) Ladder of Causation that sentences involving the use of -DIysA and -sAydl fall, and the role of pragmatics or context in the interpretation of a counterfactual statement. The contributions of the study include being the first to have a clear focus on Turkish counterfactuals and making use of Bayesian networks to graphically represent counterfactual scenarios in Turkish. PS: This work builds upon a presentation given at ISBCS 2022. While the previous presentation discussed an ongoing study, this current work presents the findings and conclusions of the completed research.

# **The Role of Spatial Uncertainty in The Context-Specific Proportion Congruency Effect**

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This study was already published: Bozkurt, O., Misirlisoy, M., & Atalay, N. B. (2024). The role of spatial uncertainty in the context-specific proportion congruency effect. *Attention, Perception, & Psychophysics*, 1-16. The prime-probe version of the Stroop task has been predominantly used to demonstrate the context-specific proportion congruency (CSPC) effect. In this version, the location of the color is not known until its presentation, creating a spatial uncertainty for the color dimension. We propose that spatial uncertainty plays an important role in observing the CSPC effect. In this study, we investigated the role of spatial uncertainty with two experiments. In Experiment 1 (N = 53), we used a spatially separated version of the Stroop task having spatial uncertainty on the color dimension and observed a significant CSPC effect. For Experiment 2, we conducted a preregistered prime-probe CSPC experiment with a considerably large sample (N = 128), eliminating the uncertainty of only the color dimension in one condition and both the color and the word dimensions in the other. Results showed that the CSPC effect was not observed in the first condition, while it was very small yet significant in the second condition. The Bayesian approach confirmed frequentist analyses of Experiment 1 and the first condition of Experiment 2. However, in the second condition of Experiment 2, there was no evidence regarding the existence of the CSPC effect. These findings support our claim that the spatial uncertainty of the color dimension, inherent in the prime-probe version Stroop task, contributed to the CSPC effect.

# **Investigating Semantic Similarity Effect on Episodic Memory Recall Using Word Embeddings**

**Burak Büyükyaprak<sup>1</sup>, Barbaros Yet<sup>1</sup>, Ashlı Kılıç<sup>1</sup>**

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Episodic memory is a type of long-term memory that retrieves personal experiences associated with their context, such as place, time, and associations. Previous episodic memory studies showed that the context of retrieved information may boost or impair the performance of retrieved information. If semantic factors are not controlled, they can be confounders. So, it becomes crucial to study the semantic proximity effect by comparing the study lists that include semantically related or unrelated words. No episodic memory studies that use Turkish words have yet investigated semantic factors by utilizing neural networks. In natural language processing studies, word meanings and relations among words can be successfully represented by learning word vectors in a large text corpus using neural networks. The study aimed to investigate the impact of semantic factors on free recall tasks by creating word lists that include semantically related and unrelated meaningful words obtained through neural networks' word embeddings. In the study, Turkish word representations were obtained by using pre-trained word vectors of fastText and word2vec libraries, and semantically related and unrelated lists were created. A word pool was used that includes 1558 words. Cosine similarity between word vectors was compared to decide if a word should be added to the study list. To create semantically related word lists random words were added to the list regarding the closest word vector. Later, words with the most distant word vectors from the word pool were selected to create a new list. Random words from the word pool were selected once to create semantically unrelated word lists. Later, words from the word pool were added to the list that did not exceed 0.30 cosine similarity, determined by try and error. Therefore, there were ten lists, each containing 12 words for both kinds of lists. The preliminary results are presented to evaluate the quality of the word vectors on the free recall task, Spearman's rank correlation of coefficients conducted between human judgment, and cosine similarity between the word vectors. 278 participants (Mage =31.08; SD = 9.03) were recruited. A significant positive correlation was found between cosine values and human judgment for fastText word embeddings  $r(274) = .79, p < 0.001$ , and Word2vec word embeddings  $r(274) = .66, p < 0.001$ . The main experiment was conducted between subject design 2 (word embedding: fastText and word2vec) X 2 (semantic relation: semantically related and unrelated) over ten sessions. A session consisted of three consecutive phases: 1. Participants were instructed to study words on the screen. Participants were required to simultaneously judge whether each presented word was concrete or abstract<sup>1</sup> to reduce rehearsal. 2.

They are given a 60-s arithmetic distractor task to reduce recency effect. 3. The recall task was followed on 90-s. The data is currently being collected from participants. The experiment was designed on PsychoPy. Preliminary results will be presented regarding the impact of semantic associations and temporal organization of words in free recall considering latency and transitions, false recalls, and intrusions.

## **Transcutaneous Vagus Nerve Stimulation**

### **Enhances Probabilistic Learning**

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**Ataberk Erdinç<sup>2</sup>, Maria G Veldhuizen<sup>2</sup>**

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**Introduction** Recent research suggested that optogenetic vagus nerve stimulation induces dopamine release in dorsal striatum in mice. Operant conditioning depends on striatal dopamine signals. This finding raises the possibility that non-invasive vagus nerve stimulation in humans could enhance probability learning. Furthermore, while emerging evidence suggests that the vagus nerve regulates some reward-related behaviors, its specific effect on probabilistic reinforcement learning remains unclear. Here we aimed to investigate the effects of tVNS on reinforcement learning and extinction using a modified probabilistic learning task. **Material and methods** in a single-blind, randomized controlled experiment, participants underwent transcutaneous vagus nerve stimulation (tVNS) during a modified Probabilistic Learning Task (mPLT) with constant probability levels in a learning phase (accuracy feedback provided to participants) followed by an extinction phase (no feedback). Participants were randomly divided into the vagus stimulation group (tVNS) and the sham stimulation group (sham) for the mPLT. Cognitive traits were assessed using the Wisconsin Card Sorting Test (WCST) and Flanker Test before the mPLT and tVNS administration to ensure group comparability. **Results** The groups did not differ in cognitive flexibility or response inhibition abilities ( $p > .05$ ). During the learning phase, both tVNS and sham groups started at ~ 50% accuracy, increasing to ~65% for tVNS and 55% for sham. A repeated measures ANOVA revealed a main effect of group (tVNS/Sham) ( $p < .001$ ) and block ( $p < .001$ ), indicating increasing accuracy over blocks but no interaction between group and block. The tVNS group showed greater accuracy in blocks 4, 5, and 6 ( $p < .05$ ) compared to sham. In the extinction phase, the tVNS group started with ~50% accuracy, increasing to ~55%, while the sham group started at ~45%, increasing to ~50%. A significant main effect of group ( $p = 0.006$ ) and block ( $p = 0.002$ ) was observed, with the tVNS group showing higher accuracy overall and in block 3 ( $p < .05$ ). Overall, tVNS enhanced probabilistic learning compared to sham and this advantage was maintained during extinction. **Conclusion** Our findings demonstrate that tVNS improves accuracy and persistence in probabilistic learning tasks among healthy individuals. This enhancement may stem from the modulation of cognitive and reward circuits in the brain, possibly through noradrenergic and/or dopamine pathways.

## **Integration of Systemic Physiology Biomarkers for Arousal Detection in fMRI**

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Resting-state functional magnetic resonance imaging (rs-fMRI) offers a window into the functional organization of the human brain. Recent research has demonstrated that the resting-state functional connectivity patterns are influenced by the changes in the arousal level (Liu et al., 2018; Falahpour et al., 2018). An accurate interpretation of rs-fMRI in relation to functional networks will rely on properly accounting for the arousal-related fluctuations in the fMRI signal. It has been shown that the changes in pupil size reflect arousal fluctuations (Ferencová et al., 2021). Therefore, we seek to utilize pupil size, which is a marker of sympathetic activity, for classifying subjects into two groups based on arousal levels. Furthermore, we expect that the identification of sympathetic activity related patterns within the fMRI blood oxygen level dependent (BOLD) signal will support the arousal classification. We utilized the open dataset "Yale Resting State fMRI/Pupillometry: Arousal Study", comprising 27 subjects with an average age of 26.52 years, consisting of 25 right-handed subjects, 16 females (Lee et al., 2022). In order to identify the spatiotemporal patterns of sympathetic activity within the fMRI BOLD signal, we created correlation maps by calculating the cross-correlation between each voxel within the brain and z-scored pupil size, CSF signal from the 4th ventricle, and whole brain average signal, across lags of +/- 10 TR. Next, we performed group level independent component analysis (ICA) for identifying network patterns in two arousal groups. The z-scored pupil size served as a proxy for arousal, facilitating the classification of subjects into two distinct arousal groups. The number of occurrences of positive and negative z-scored pupil sizes was then tallied for each subject. Subjects exhibiting an overall higher number of positive z-scores were categorized as 'high arousal'. The high arousal group consisted of 17 subjects. Part of the findings were also submitted to the 2024 OHMB Annual Meeting, by Can E. & Ozbay P.S. (2024). In our findings, we discovered a distinguished negative correlation in the ventricular area, in contrast to a more positive correlation pattern within the gray matter. In addition, we observed a negative correlation pattern in the insula region for the high arousal group. Within the pupil size & fMRI correlation maps, we noted a more pronounced negative correlation between pupil size and the visual area in the high arousal group. Whole-brain average correlations revealed a stronger pattern in the ventricular and gray matter regions, which aligns with previous observations during altered sympathetic activity, such as during light sleep or deep breaths (Ozbay et al., 2018). ICA maps yielded a substantial ventricle-GM contrast for the low arousal group, emphasizing the neural



differences associated with diminished arousal states. Moreover, a distinctive negative activation profile emerged within the insula region, accompanied by a positive activation in the middle temporal gyrus. This work advances our knowledge of the neurophysiological mechanisms underlying cognitive states and contributes to fMRI-based arousal classification.

# **The Role of Visual and Lexical Cues in Shaping Odor Recognition and Hedonic Responses**

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This study explored the cognitive processes in odor recognition and the cross-modal relationship between smell and color using behavioral and EEG methods. Visual cues, such as colors, significantly influence odor recognition, with colors and smells often being associated in a non-random manner, even when a distinct source object or association is not readily apparent. The study aimed to compare the effects of matching colors and lexical cues on odor recognition. While previous research has examined odor pleasantness's impact on recognition using various methods, there's a gap in understanding color preference's influence on odor liking. This study compared color preference effects on odor liking using single and cross-modal approaches. We also examined how hedonic ratings affect color and odor perception and the impact of color hedonic ratings on odor evaluations. Forty participants underwent olfactory tests with Sniffin' Sticks, followed by color and semantic cue presentations. Participants named the smells after cues, with EEG recording brain waves. Cross-modal perception was investigated by presenting colors, smells, and their combination sequentially on a computer. Participants rated each scenario from 0 to 10 based on preference. Behavioral results showed that lexical cues (i.e. presenting random letter of the name of the odor source) improved accuracy, while color cues led to quicker responses. We will further report on the cue dependent odor-identification mechanisms in the brain.

**Keywords:** odor memory, odor identification, odor recognition

## **A Study on Tip-of-the Tongue (TOT) States in Turkish EFL Learners: On Cognate and Non-cognate Words**

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Tip-of-the-tongue (TOT) states are the temporary performance failures where speakers know they know a word but they cannot retrieve it at the moment of speech. Gollan and Acenas (2004). TOT states are common and experienced by people from all language backgrounds. Bilinguals have been found to experience more TOT states compared to monolinguals (Gollan & Silverberg, 2001). Cross-lexical similarities play a role in the occurrences of TOT states. As cognate words are phonologically and orthographically similar in both languages that a speaker uses, processing is expected to be faster and to encounter less failures (Hoshino & Kroll, 2008; Gollan & Acenas, 2004). On the other hand, this similarity may also lead to problems due to the activation of more than one representation at the same time. There have been many studies conducted in different language contexts. A resolution part where speakers are given cues such as syllables or sounds is used to validate and consolidate findings that the experiences are real TOT states. The most salient attribute is the first syllables of words as it activates the other parts of words like key (Cholin, Levelt, & Schiller, 2006). Recognition of words that cause TOT states can show how mental lexicon is organized. The present study aimed to reveal the effect of proficiency and cognateness status on TOT state occurrences and the effect priming on TOT state resolution. To our knowledge, this is the first study conducted in Turkish language context. The effect of proficiency and cognateness on TOT states were investigated. Regarding the resolution of TOT states, the first syllables of words were used. A picture naming task with 26 cognate and 26 noncognate words along with 52 filler cognate and noncognate words was conducted with 102 Turkish learners of English. The collected data were analyzed using LMM for reaction times and GLMM for response data. Reaction times were analyzed so as to assess latency caused by TOT states. The findings of this study showed a significant proficiency effect such that higher proficient group had faster reaction times and experienced less TOT states. Priming the first syllable helped the participants resolve from their TOT states successfully. Regarding the effect of condition and proficiency on the resolution, more tot states were revealed to be experienced with cognate words. Also, the low proficient group were found to resolve more from their TOT states. In conclusion, the findings of this study suggest a significant proficiency effect on TOT states while no significant effect of cognateness was revealed.

# **Meaning, Referentiality and Distribution: A Computational Investigation of Markers in German Compounding**

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This abstract reports the results of our study which we presented in preliminary form in ISBCS 2023 and elaborates on it. Compounding is one of the known ways of word-formation with crosslinguistic variations (see Lieber & Štekauer, 2009), and it is a productive way of word formation in German (Neef, 2009). Compounds in German are mostly formed with the combination of two stems more (Schlücker, 2019). German compounding makes use of some markers, mostly called linking elements, between the constituents such as -s- in Kapitän-s-mütze (Neef, 2009, p. 390), and these markers belong to the modifier, namely the first constituent as Neef (2009) calls it. The linking elements in German include -s-, -e-, -n-, -en-, -ens-, -es-, and -er- (Becker, 1992, as cited in Neef, 2009, p. 392; Krott et al., 2007). Whether such markers have any meaning or what primary functions they have are seemingly controversial. Out of the linking elements portrayed above, -e-, -er- and -(e)n- are homophonous with plural suffixes, which leads some people to believe that these linking elements come from plural suffixes (Wegener, 2008). Wegener (2008) rejects this idea, and claims they are distinctive distinguishable morphs, being in some cases linking element and in some others plural suffix in the compound. Accordingly, she means that we have two formally identical but different morphs in the compounds in Kind-er-chor ‘children’s choir’ and Kind-er-star ‘child star’: the morph -er- is a plural suffix in the former compound while it is a linking element in the latter one because there is no reference to the plural. Following the tradition of categorial grammar going back to Ajdukiewicz (1935) that referential differences and meaning can be related to distribution and cause the existence of distinctive categories for the homophonous linguistic items, these two categories can be identified. With the help of word embeddings, which are basically vectorial representations of the word meanings, this categorization is possible from a computational perspective as well. To this end, we trained several classification models also following the steps taken for idiomatic compound detection with word embeddings in Krotova et al. (2020) to some degree, which led us to use the concatenation of word embeddings of compound and constituents for feature representation and logistic regression for classification model. We also benefitted from some data sets such as Schäfer and Pankratz (2018a) and GermaNet discussed in Henrich and Hinrichs (2011) to some degree. We achieved overall accuracy scores ranging from around 0.62 up to around 0.85 depending on the choice of data set, linguistic items (the whole compound, modifier, head) and preprocessing (word embeddings as they are, scaled word

embeddings and word embeddings with lower amount of dimension attained with principal component analysis). The overall results show us the possibility of distinguishing different linguistic categories computationally based on meaning with word embeddings, and particularly the semantics of the heads seems to play a significant role. However, the existence of some borderline heads that can create both singular and plural interpretation in modifier such as *Mannschaft* ‘team’ (Translation ours) as in *Frauenmannschaft* ‘women’s team’ (Translation ours), or *Nationmannschaft* ‘national team’ (Translation ours and German equivalent provided in singular by us) as given in Schäfer and Pankratz (2018a) (Similar issues related to this are touched upon in Schäfer and Pankratz (2018b) as well) might indicate the insufficiency of only-head-based classification and the need for the meaning of the modifier as well. The results of this study can also open up the way to question the situation of modifier with respect to referentiality. The modifier in German compounds is normally seen as non-referential as portrayed in Schlücker (2018). However, with the possibility to have plural interpretation in modifier, we might also have some referentiality in modifier because this plurality might be the indication of or linked with some reference to some entities in the world.

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# **Multifaceted Analysis of Older Adults' and Caretakers' Attitudes Toward Social Robots**

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An impending demographic phenomenon is the sharp increase in the aging population; it is estimated that the number of individuals over 60 will reach two billion by 2050, up from 605 million in 2000 (Shishehgar et al., 2018). In addition, we know that adults experience many physical and psychological difficulties as they age. While they are facing these difficulties, it is essential that they can remain at their home and “age in place” (Davey, de Joux, Nana, & Arcus, 2004) since this gives them a sense of security (Gillsjö, Schwartz-Barcott, & von Post, 2011; Gillsjö & Schwartz-Barcott, 2011). However, it is important to ensure that the quality of life of older adults is maintained and that their well-being is high while they live independently in their own homes. Social robots can help us provide these to older adults. At the same time, integrating social robots into the lives of older adults might alleviate the burden on caretakers. The current study investigates older adults' and caretakers' attitudes toward three social robots (Aibo, Paro, Pepper) with different appearances and abilities. We conducted semi-structured interviews with older adults (n=18) and caretakers (n=12). In these interviews, we showed participants photos and videos of the three robots and asked them to answer some questions. These questions were created to examine how older adults and caretakers feel about the robots, whether they need them, and what they want from them. Data were analyzed using two methods. First, we used sentiment analysis on the language data to understand the positivity and negativity of the attitudes. We analyzed the scores with 2 (Group: Elderly, Caretaker) x 3 (Robot type: Aibo, Paro, Pepper) mixed ANOVA. The findings show that older adults have positive approaches toward the three social robots. Additionally, there are no significant differences between their sentiment scores for the three robots. On the other hand, caretakers' sentiment scores for Aibo and Pepper are significantly higher than their score for Paro. To understand the attitudes of participants better, we conducted a thematic analysis with 6 phases following Braun and Clarke (2006). For this analysis, we recruited three experts who work in the human-robot interaction area. They came up with different themes, and the first author combined them and developed a new model. The Delphi method (Dalkey & Helmer, 1963; Okoli & Pawlowski, 2004) was used with surveys to make the experts reach a consensus. When all experts agreed with the model, the authors reviewed the themes and made them ready for reporting. Four overarching themes emerged: I) perceived and expected roles of the robot, II) physical characteristics and design features of the robot, III) factors influencing acceptance of the robot, and

IV) disadvantages of the robot. Themes and sub-themes under those differed partly between the three robots. In future research, delving deeper into the themes identified in this study and conducting further user studies to explore the needs, demands, and expectations of users will contribute to developing social robots to provide maximum benefit to older people and caretakers.



## **Perceptual Fluency and Recognition Memory**

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Previous research has shown that perceptual fluency differentially affects metacognitive judgments and actual recognition performance. In this sense, the perceptual fluency hypothesis asserts that fluent items are considered more memorable and are likely to receive higher metamemory judgments than disfluent items, which is replicated in multiple studies. Despite a demonstrated positive effect of perceptual fluency on metacognitive judgments, the relationship between perceptual fluency and recognition memory performance is less clear. Therefore, in this study, we aimed to further investigate the distinctive effects of perceptual fluency on metacognitive judgments and actual recognition performances for pictures. Respectively, in Experiment 1, participants (N = 30) were presented with blurred or clear pictures and prompted with Judgments of Learning (JOLs) ratings at study, followed by a recognition test. In Experiment 2, our main focus was on the direct association between perceptual fluency and actual recognition performance. Hence, the second experiment was similar to the first one except participants (N = 48) were not asked about JOLs and inversion along with blurriness was used as the source of perceptual manipulation. Results showed that neither metacognitive judgments nor actual recognition performance significantly differed in response to perceptual fluency. Thus, in contrast to many other studies, the current study failed to support the perceptual fluency hypothesis even though our results about actual recognition performance align with past research.

# **The Effect of Acoustic Roughness on Long-term Memory for Emotionally Ambiguous Facial Expressions**

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Acoustic roughness is a percept induced by auditory signals with amplitude modulations within the 30-150 Hz frequency range. Alarming sounds such as human screams and baby cries elicit this perception. Despite the large space it occupies in the modulation power spectrum of acoustic communication signals, it was thought to have no ecological meaning until recently. Research conducted in the last decade indicated that acoustic roughness either has a general attention-grabbing effect or selectively signals aversiveness. Furthermore, the literature suggests that vocalizations with greater acoustic roughness increase the aversiveness of the negative vocalizations and reverse the valence from positive to negative. This effect is seen exclusively when the context in which the sound is presented is ambiguous. Emotional facial expressions are one of the most prominent contextual cues that can be present in daily life along with rough sounds. Despite this daily coupling, the potential effect of acoustic roughness on the long-term memory for emotional facial expressions has not yet been investigated. The present study investigated this effect and tested whether acoustic roughness precisely conveys aversion or whether it is a general attention-grabbing mechanism. We used a recognition memory task comprising three phases: encoding, distraction, and recognition. We presented participants with positive, negative, and ambiguous cues, which were morphed facial expressions with differing emotional content. Happy facial expressions comprised positive cues, while fearful facial expressions comprised negative cues. Stimuli used for morphing were obtained from the FACES Database. According to the group they are allocated, participants viewed facial expressions along with rough sounds (roughness group), non-rough sounds (no-roughness group), or no sound (silence group) in the encoding phase. In each trial, participants were presented with one selected emotional facial expression from every morphed set containing seven different facial expressions of the same individual. There was a total of 28 unique facial expressions to be encoded. After the encoding phase, there was a 5-minute distraction phase, in which participants completed a two-back test. Once the distraction task was completed, participants were asked to complete a recognition phase. In each trial of this recognition phase, participants were presented with the whole morphed stimulus set containing the seven facial expressions of the same individual and they were asked to indicate the specific facial expression that they viewed in the encoding phase. Our initial results from 54 participants (18 per group) indicate that the overall accuracy levels are not different among the three groups, but are generally

very low (28%), providing the opportunity to further examine the positivity vs negativity biases in incorrectly recognized facial expressions. Preliminary analyses of these incorrect trials show a stronger negativity bias in the roughness group compared to the no-roughness and silence groups. These initial findings suggest that acoustic roughness selectively induces a negative affective modulation on long-term memory for ambiguous facial expressions rather than enhancing the attentional process generally during the encoding phase.

# **The Impact of Response Type on Affordance and Spatial Compatibility Effects in Human and Object Interactions**

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Everyday social interactions, such as shaking hands, or goal-directed interactions with objects, such as holding a cup, require facilitation of action plans appropriate to their specific affordances. The spatial compatibility of a stimulus and a response might interfere with the activation of these affordance-compatible action plans. Such interference effects might depend on how one's behavior is represented in a given context. In the present study, we examined how framing of interactions affects the interaction between affordance and spatial compatibility effects towards humans and objects in two separate experiments. In a motor priming task designed to simultaneously assess affordance and spatial compatibility effects, participants were presented with human interactive hand gestures and single handled everyday objects. The spatial compatibility was manipulated by presenting the stimulus on left or right side of the screen. Therefore, in each trial, participants' responses were either compatible or incompatible in terms of affordance and spatial compatibility. Participants responded either with their left or right hand according to the color mask of the stimulus, regardless of the spatial position or the affordance-related orientation of the stimulus. In Experiment 1, the responses were given by keypresses and in Experiment 2, participants responded with key releases followed by performing a grasping gesture. When responding with simple keypresses, we found independent and strong affordance and spatial compatibility effects towards objects. Surprisingly, interactive hand gesture stimuli induced a reversed affordance effect, that is, mirror-compatible responses, while the effect of spatial compatibility was preserved. Changing the framing from a simple keypress task to an interactive one drastically altered these findings, resulting in enhancement of affordance and complete elimination of spatial compatibility effects for both human and object interactions. These findings indicate that affordance-related responses for social signals are strongly facilitated by contextual framing of interactions, rather than fixed action representations. These results might provide a potential standpoint for further investigation of neural processes underlying the interplay between imitative and complementary actions in social interactions.

**Keywords:** Perception-Action, Affordances, Spatial Compatibility, Motor Priming, Interactive Gestures

## **A Computational Study on Accusativity and Ergativity**

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English is defined as an accusative language with Subject-Verb-Object (SVO) syntactic order. In this study, if children were exposed to hypothetical English, i.e. ergative English, rather than accusative English in the language acquisition process, what would happen was investigated by using the linguistic annotations of a child-directed speech data set taken from the Eve fragment (Brown, 1973) of the Child Language Data Exchange System (CHILDES) database (MacWhinney, 2000). Based on the data set, the standard English grammar was constructed with the syntactic and semantic representations of the words. According to this grammar, correct pairs of sentences and their corresponding logical forms were generated. Subsequently, several models were developed to derive accusative sentences from the grammar. After training, the best model that prioritizes the correct pairs of sentences in the derivation results was obtained. Three experiments were conducted with this model: one exclusively employing accusative grammar, another incorporating accusative grammar alongside ergative forms of transitive verbs, and the last focusing only on ergative grammar. In these experiments, the trained model corresponded to the child acquiring the language, and the rank success indicated whether the child successfully acquired the target language. The results of these experiments demonstrated that children acquired accusative English when they were exposed to accusative English, and similarly, they acquired ergative English when they were exposed to ergative English. These results indicated that each grammatical relation (accusative or ergative) system is equally likely for children in the language acquisition process. We observed that the exposure to particular linguistic experiences decided which system takes precedence and which falls behind.

## **Understanding Politics from Neuro-Philosophical Basis: Neuro-Politics and Two Types of Cognitive Reasoning**

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This paper aims to understand the neural mechanism behind political behavior and decision-making in reference to current studies in neuro-politics. Accordingly, these studies mainly show that in most of political action processes, people tend to use their normative judgment under the influence of “motivated reasoning” because of emotional and cognitive constraints, which block the possibility of an objective evaluation process (Westen et al., 2006; Knutson et al., 2006). Motivated reasoning refers to a type of cognitive bias where an individual tends to focus on the parts of given facts which are in line with their motivation, and not putting specific emphasis upon the information that contradict their opinion. In the context of politics, this motivation may be related to behavior of political actor one supports, theoretical discussion about their ideology or historical examples of their political view. “Cognitive constraints”, in this regard, means the maximization of goodness to the fitness of data whereas “emotional constraints” is the minimization of negative impact upon one’s idea (Westen et al., 2006. p. 1947). The studies within the literature of neuro-politics, in that sense, can be divided into three main categories. First group of study examines the differences between neural activation in those who are interested in political subjects and those who are not, through which depicting active brain parts that are in more relation to political reasoning. Here, the common result for these studies is that more interest in politics is positively correlated with more emotional intensity (Gozzi et al., 2010; Jost & Amodio, 2012; Kanai et al., 2011; Schreiber, 2012). Second group of studies analyzes how opposite ideologies or representatives of these ideological positions are cognitively perceived. These studies provide vital examples of motivated reasoning in practice and offer possible explanations of how such neural mechanisms come into practice, together with what they could mean (Kaplan et al., 2007; Westen et al., 2006; Cunningham et al., 2004). The last category of research puts emphasis on specific ideological positions and how their neural mechanisms differ from one another. For instance, the studies provided by Jost & Amodio (2012), Amodio et al. (2007) and Kanai et al. (2011) attempt to understand cognitive differences between liberal and conservative ways of thinking while Zamboni et al. (2009) widen ideological definitions by categorizing political views into three: individualism, conservatism, and radicalism. When the general picture of neuro-politics is observed, several crucial consequences for debates in political philosophy is seen. First, unlike the traditional enlightenment view, individuals do not rationally calculate their benefits in social realm. Type – I of reasoning, which is more emotive,

reactive, and automatic, is more active in contrast to Type – II, which is more cognitive and rational (Greene et al., 2001; Greene, 2014). Therefore, the idea of homo economicus cannot be given as a legitimization point for political theory. Yet, this relatively new field indicates that theorist needs to be aware of the impact of motivated reasoning which shows itself different aspects of political thinking. Therefore, it is necessary to be cautious whether such cognitive bias shows itself within different steps of philosophical argumentation when a political issue is presented.

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# **Transformer Models for Translating Natural Language Sentences into Formal Logical Expressions**

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Translating natural language sentences into logical expressions has been challenging due to contextual information and the variational complexity of sentences. The task is not a straightforward process to be handled by rule-based and statistical methods in artificial intelligence since it requires an ability to understand the variational complexity of natural language sentences and an ability to interpret how different expressions can play the same roles and how the same expressions can play various roles in different contexts. While translating a natural language sentence into its logical expression, one must rely on their sense of natural language; one must understand what the sentence is meant to convey and judge whether any suggested expression captures the meaning of the original sentence (Goldfarb, 2003). In recent years, a new deep learning architecture, namely the Transformer architecture, has provided new ways to handle what was hard or seemed impossible in natural language processing tasks. The Transformer architecture and language models that are based on it revolutionized the artificial intelligence field of research and changed how we approach natural language processing tasks (Vaswani et al., 2017; Phuong & Hutter, 2022). Transformer architectures' ability to handle long dependencies, their self-attention mechanisms that provide relational and contextual information, and their versatility and generalization capabilities make them powerful candidates for translating natural language sentences into logical expressions. In this work, we conduct experiments to see whether successful results can be achieved using Transformer-based language models in translating sentences into first-order logic expressions, a task considered under semantic parsing (Kamath and Das, 2019). These experiments aim to answer two main questions: 1) Can transformer-based language models be successful and beneficial for semantic parsing tasks, and 2) Can transformer-based language models learn and generalize the formal and compositional aspects of language simply by fine-tuning? To conduct the experiments, we fine-tune two Transformer-based language models and evaluate their performances. Then, we conduct an additional experiment to see whether these models' knowledge can be generalizable over sentences that require more complex logical expressions. The reason we are conducting experiments for generalization capacity is that if a model is fine-tuned with data and can translate various natural language sentences into first-order logic expressions, it would be possible to integrate this model into a larger pipeline that can extract argumentative structures from texts that are written in the scientific domain and translate each



sentence in the argumentative structure to first-order logic expressions. Such a system can be used for several tasks, including natural language reasoning in machines, evaluation of logical aspects of argumentations, making inferences to possible implications that logically follow from the existing sentences, and finding enthymemes or possible grounders of existing sentences to provide a complete argumentation structure if there are missing premises or conclusions. We developed a new WillowNLtoFOL dataset, consisting of 16014 pairs of natural language sentences and first-order logic expressions with diverse logical forms to focus on and train the models for predicting correct logical forms. We evaluate the models' performances for predicting correct logical forms using four metrics: well-formedness, exact match, formal match, and equivalence. With the results we gain, we discuss the effectiveness of Transformer-based language models in the translation task, whether these models are generalizable without additional methods than fine-tuning, and what procedures and methods are needed to produce a logical argumentation evaluation pipeline.

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**Mental Visualization of a Color Spreading Within a Shape:  
Eye Movements, Memory Performance, And Subjective Vividness**  
**Eda Melin Develiođlu<sup>1</sup>, İrem Kűsműş<sup>1</sup>, Yađmur Őimsek<sup>2</sup>, Olesya Blazhenkova<sup>1</sup>**

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Using two types of stimuli, labyrinths and abstract outlines, our study examined eye movements during the mental spreading of a color within an enclosed shape, in relation to its' recall and subjective vividness visualization. The data was collected from 35 participants using a Tobii TX300 Eye Tracker. In the 'route' task, we presented 5 long and 5 short black-and-white routes within square-shaped labyrinths. In each trial, participants were shown a round color marker placed in a new location and were instructed to mentally visualize a given color being spread through the path. Afterwards, they had to mentally visualize the same route within the empty square of the same size as the original labyrinth, and to click at the ending point of the imagined route. Then, participants rated the vividness of their mental imagery on a 5-point scale. Finally, they had to select the correct shape of the route from among the four options, all presented in black color. We recorded accuracy and response time for identification of ending point location and for route shape, the vividness of imagery, eye-tracking data, and self-reported strategies. In the 'outline' task, we presented 6 complex and 6 simple abstract outlines. Participants were shown a round color marker placed on the right of the outline and were instructed to mentally visualize a given color being spread within the empty outline for 10 seconds. The location of the outline and color marker did not change. Then, participants rated the vividness of their mental imagery on a 5-point scale. Finally, they had to select the correctly color-filled outline from among the four options, all presented within the same outline but different in color tint. We recorded accuracy and response time for identification of the color-filled outline, the vividness of imagery, eye-tracking data, and self-reported strategies. Additionally, participants completed measures assessing individual differences that included vividness of visual imagery questionnaire, working memory capacity task, and mental rotation task. In the analyses, we examined the gaze patterns during the mental visualization of color spreading, and memory performance. We also explored the relationships between performance on our tasks, judgments of task-related imagery vividness, and other individual differences assessments.

# **The Vulnerability of Working and Long-Term Memories While Manipulated**

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Visual working memory temporarily stores and manipulates information. A recent study showed that visual working memory items are open to interference by perceptual distractors while actively in use. Here, we propose a study with two aims. First, we want to test the replicability of this novel effect. Second, we aim to compare the vulnerability of working memory and long-term memory while in use. The study consists of three phases: learning, test, and experimentation. During the learning phase, participants learn the orientations of colored bars. In the test phase, participants are given a fixation cross in a studied color and are asked to report the studied orientation. Participants must indicate the orientation with less than 10 degrees four times consecutively to progress to the experimental phase. In the experimental phase, participants are given a memory item, which is either a colored bar shown in a random orientation or a fixation cross in a studied color. Then, they are instructed to mentally rotate the memory orientation using two sequential rotation cues indicating the degree and direction of rotation. On some trials, a colorful distractor is presented during rotation. The critical manipulation involves varying the timing of the distractor's appearance—either during the target's active manipulation or after the manipulation is over. By comparing the vulnerability of working and long-term memory representations against perceptual distraction during different stages of memory processing, this study will contribute to our understanding of how each memory type handles perceptual interference.

**Object Or Cake? The Behavioral Validation of a Task  
To Investigate the Recently Discovered Specialized Food Area  
In the Visual Ventral Stream**

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The human brain has a category-selective organization in the fusiform gyrus to recognize and discriminate between different kinds of visual information of ecological importance, such as faces, scenes, bodies, words, numerals, tools, and landmarks. Food - of major ecological importance and a primary reinforcer of eating behavior - evokes responses in the fusiform gyrus, too. Recent data-driven methods on high-resolution neural responses to a variety of natural scenes have confirmed a selective brain region for food images. Food image selective responses have been observed in the bilateral ventral visual stream in the fusiform cortex. Considering the importance of the differential activation of high-calorie and low-calorie food pictures on food-related behavior like weight loss), it is important to understand the functional properties of the food-image selective region. The principal objective of this research is to investigate the recently discovered food-image selective brain region using a novel method that we call food-object illusion. Illusions that use perceptual switches between categories allow for the dissociation of category-selective responses. Rubin's face-vase illusion has been used to investigate face selectivity. Here, we propose to use a dynamic food-object illusion to characterize perceptual and neural responses to foods in the food-selective regions. We use "hyper-realistic cake videos," in which a video starts with a non-edible object view, for example, a Rubik's cube, and gradually the object is revealed to be an edible cake after the knife slices the object. These videos will help us to test whether there is an increase in neural activation in the food-selective areas after the initial non-edible object is revealed to be a cake. We will compare the neural activation to these videos with control videos in which the initial object will remain as an object even after a failed attempt to cut it with the knife. In addition to the ventral food stream, we will analyze the neural activation in two other control regions: the lateral occipital cortex and the primary visual cortex. Before conducting the fMRI study, we aimed to confirm differences in perception and behavior in response to the hyper-realistic cake videos compared to the control videos. We conducted behavioral experiments with 30 participants (16 women) to determine when the categorical switch from object to cake happens and collected ratings of various attributes of objects. Participants were able to decide faster whether the object is cuttable or not when they viewed hyper-realistic cake videos than control videos ( $p < .001$ ). As expected, participants found objects in the hyper-realistic cake videos more edible than in the control videos

( $p < .001$ ), and they found some objects more disgusting than others. In conclusion, we developed a task and selected a subset of object identities that are appropriate for a food-object selective fMRI task. In our future fMRI study, we will perform mass univariate and multivariate pattern analyses to find food-object selective responses in the fusiform food area.

# **EEG Theta and N400 Responses to Visual Mental Imagery During Semantic Incongruency**

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The relationship between semantic processing and imagery is essential for the debates about forms of mental representations and the explanation and mechanism of the aphantasia phenomenon. The present study aimed to compare semantic processing and visual object imagery by means of N400 component of event related oscillation and event related theta frequency band (4-8 Hz) during semantic incongruency. The brain activations of 24 participants (15 females, 9 males) were recorded via electroencephalogram (EEG) during two different tasks. The N400 mean amplitude values and power differences of theta band of semantically congruent and incongruent target words were analysed. It was found that N400 responses of incongruent stimulus were significantly larger than that of congruent stimulus in the electrode locations of C3, C4, and Cz for the semantic processing task and F4 and Fz for the imagery task. The theta frequency band mean power values after incongruent target stimulus were significantly higher than that of congruent target stimulus in the electrode locations of Cz, P3, Pz, O1, and Oz poststimulus 400-700 millisecond time window and Cz and O2 poststimulus 1400-1700 millisecond time window for the semantic processing task and nonsignificantly Cz poststimulus 550-700 and 1700-2000 millisecond time window for the imagery task despite of approximate  $p=0.05$  and Cohen's effect size value  $d=0.34$ . These results revealed that imagery and semantic processing give responses of N400 and theta band power increase that overlapped in time and brain locations in semantic incongruency. Therefore, imagery contains sensory amodal and symbolic neural processes in contrast to embodied cognition theories.

## **The Visual Cortex in The Blind Responds to Motor Control Demands**

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Studying what happens to the visual cortex in the brain when they are deprived of their normal visual inputs is a key question in neuroscience. This is also critical for understanding mechanism of change and adaptation in the brain. Further, these kinds of studies can help us to understand to what extent can experience change existing structures in the brain. There is a plethora of fMRI research with regard to the visual cortices of the blind in the literature. They have been found to activate various task-related stimuli involving tactile, auditory, and olfactory modalities. Additionally, the visual cortices in the blind also activate during more complex tasks, like language comprehension, language production and working-memory tasks. In this study, we aimed to investigate whether the blind's visual cortex also responds to speeded-motor acts. We had 19 congenital and early blind participants execute a motor task in fMRI. The task was structured in a block-design and had 10 easy and 10 hard blocks in total. Each block separated by a rest period jittered between 5-15 seconds. Blind participants had executed them in an alternating sequences of easy and hard blocks. In a trial, participants listened to one of four numbers: 1,2,3 or 4. Numbers presented in a random sequence across trials. When participant heard a number, they had to press the corresponding button in the button box. In easy trials, participants had 1.5 seconds to respond, while in hard trials, participants had 0.5 seconds to respond. Additionally, inter-trial interval was reduced from 1.5 seconds to 0.5 in hard trials. Whole-brain contrast (hard > easy) had shown that almost the visual cortex in the blind, along with fronto-parietal regions, becomes robustly active during more demanding hard blocks of the tasks that required more rapid execution of motor sequence ( FDR corrected < 0.05). To our knowledge, this is the first study demonstrating that visual cortex in the blind responds to motor control demands. Previous reports have shown that these regions activate to several kinds of task-related stimuli involving various modalities. Coupling this with our present finding, we surmise that visual cortex when deprived of its typical inputs, may have taken some domain-general role activating across multiple tasks similar to fronto-parietal regions.

## **Investigating the Contiguity Effect in Probed Recall Task: Influence of Enhanced Encoding**

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Recall literature has revealed that when an item is recalled during a test phase, the next item that will be recalled is likely to come from a neighboring study position to the just recalled item, meaning that successive items are most likely to be recalled together. This effect is named the contiguity effect. The contiguity effect in the free recall is generally observed with an asymmetry in favor of the forward neighbors called forward-asymmetry. Kılıç et al. (2013) have made a distinction between models that aim to explain the contiguity effect. The first group of models is called the causal models. According to the causal models, the contiguity effect is the result of the recall of one item being used as a cue to recall a neighboring item, as close items are associated during the study phase either due to interitem associations (e.g., SAM Model) or due to shared temporal context (e.g., TCM). On the other hand, the non-causal models suggest that the recall of one item is not the cause of the recall of another neighboring item. Instead, the reason for the contiguity effect is the replay of the random study context during the test context, prompting a similar recall order. To test the suggestions of causal and non-causal models, Kılıç et al. (2013) devised the probed-recall task in which they aimed to impede the replay of random context suggested by non-causal models. Thus, if there is still a contiguity effect is observed, this would support the causal models. In the probed-recall task, participants study lists of words in the study phase. In the test phase, they are given probe words and asked to recall another word from the list of the probe words. Kılıç et al. (2013) have found a contiguity effect but not the asymmetry. It is suggested that this could be due to the low recall performance of the participants. In the current experiment, the probed recall task is developed to increase the performance of participants by using overt rehearsal and generation tasks. In this version of the probed recall task, participants overtly rehearsed and generated sentences with the words during the study phase. The conditional-response probability (CRP) analysis revealed both a within-list contiguity effect and a between-list contiguity effect to a smaller extent which indicates a trend in favor of the causal models. However, even though a forward asymmetry is also expected, it was not observed, which prevents the full support of the causal models yet.

**Keywords:** the contiguity effect, probed recall, forward-asymmetry



## **Developmental Affordances: How Do We Learn to Perceive as Agents?**

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The term affordance has both philosophical and practical implications. Ecological theory of perception makes up a foundation for direct perception and direct realism and the theory of affordances proposes an explanation how the perceived information is specialized according to the organism, opening new discussions for the issue of agency. As a practical implication one of the main developments is in the field of robotics. It is used as a learning model which proposes alternative solutions for the problems of classical models such as mapping, localization, and navigation. It also bridges the gap between perception and action for AI agents. Nonetheless, being a recently hot-debated theory, affordance discussion has many questions to be answered and explained especially related to developmental psychology, such as “How does one learn affordances in the beginning? How do affordances be affected by aging and new experiences? In what ways does affordance learning change the structure of perception? What kind of role does social interaction play in affordance learning?” etc. The aim of the presentation is to discuss the answers to these questions which, I propose, will provide a basis for the issue of agency, and guide the further developments in robotics in affordance learning. First, to set the philosophical ground, I will defend a dynamic and relational approach to affordance. Second I will argue the answers to aforementioned questions holding an exploration-observation based learning approach. And finally, I will open a discussion asking what these can offer to the issue of agency.

## **Neural Basis of Movement Direction Invariance in Action Perception**

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Recognizing and understanding others' actions is vital to make sense of the events in our environment and take the appropriate action. Cognitive neuroscience research to date has revealed the Action Observation Network, which consists of visual regions (V1) and the middle temporal cortex (MT+) at earlier levels, and the posterior superior temporal sulcus (pSTS), parietal and premotor cortices, at higher levels. One question that has remained unknown in the literature is what regions of this network code the direction of body movements (x-axis: left-right, y-axis: up-down, z-axis: front-back) and what regions are invariant to the direction of movements. To this end, video stimuli were created that included four different action classes. These classes were: (i) object manipulation: stretching and shaking, (ii) object manipulation with a tool: wiping and painting, (iii) self-directed actions: scratching and rubbing, (iv) self-directed actions with a tool: brushing and drying. Each of the eight actions was created using two actors, three axes, and two versions, which yielded 96 videos. These stimuli were presented in event-related fMRI paradigm that consisted of 8 runs (lasting around an hour). One pilot data was collected and analyzed for the experiment. The task was to report on which axis the actions were performed (left-right, up-down, or front-back). The results of the General Linear Model (GLM) analysis revealed that the video stimuli activated the action observation network as expected. Moreover, whole-brain multi-voxel pattern analysis (MVPA) showed that the axis of performed actions (x, y, or z) were decoded mostly in somatosensory and premotor cortices in the right hemisphere, and pSTS and V1 in the left hemisphere. Future analyses will utilize model-based representational similarity analysis (RSA) which will enable us to examine the direction of body movements by regressing out the other types of low-level information such as shape and motion.

# **Detecting Discourse Connectives Using a Lightweight Machine Learning System**

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In this work, we introduce a novel lightweight discourse connective detection system which is specifically developed to facilitate the annotation of discourse relations in resource-constrained environments, with minimal compromise on performance. This work was previously presented at the LREC-COLING 2024 Joint ACL - ISO Workshop on Interoperable Semantic Annotation. This system employs gradient boosting algorithm trained on straightforward, low-complexity features to avoid the computational burdens commonly associated with deep neural network-based approaches. Despite its simplicity, our system delivers competitive results and demonstrates substantial improvements in processing time, even on CPU configurations. We reached 83.58% and 82.38% f1-score for detecting discourse connectives in English and Turkish respectively. Our system's consistent performance across two distinct languages highlights the robustness of our approach in multilingual settings.

# **Top-Down Effects of Attention on The Neural Responses in The Action Observation Network**

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Perceiving others' actions is a crucial skill for survival and social interactions. Cognitive neuroscience research identifies a network of brain regions involved in visual action perception, known as the Action Observation Network (AON), which includes the posterior superior temporal cortex (pSTS), posterior parietal cortex (PPC), and premotor cortex (PMC). The pSTS integrates visual information and plays a role in social cognition, the PPC encodes action context and purpose, and the PMC is crucial for action planning and execution. Recent research emphasizes integrating top-down processes to enhance understanding of real-life perception. This project examines how attention affects the AON during human action perception. We conducted a two-session fMRI experiment with 27 participants, recording eight videos of pushing actions with different actors (female vs male), effectors (hand vs foot), and targets (human vs. object). In the first session, participants performed three tasks focusing on the action videos' actor, effector, and target. In the second session, participants watched the videos without any task. From passive sessions group level analysis, we extracted ROIs: pSTS, parietal, and premotor region for both hemispheres. Then, we performed Representational Similarity Analysis (RSA) and Decoding Analysis on these ROIs. For RSA, we created model Representational Dissimilarity Matrices (RDMs) to compare with neural RDMs for each ROI. The models included a task model, three feature models including actor, effector, and target models, and a low-level visual model. In the Decoding Analysis, we conduct binary discriminations of features across tasks. This resulted in 54 decoding analyses (2 hemispheres x 3 ROIs x 3 tasks x 3 features). RSA results showed that for all ROIs, only the task model showed a significant correlation with neural RDMs at a  $p < 0.05$  level (FDR corrected), while other models did not correlate significantly. In the decoding analysis, the pSTS decoded the target feature in the left hemisphere during the target task and in the right hemisphere during the actor task but did not decode other features. In the parietal cortex, the actor was decoded accurately during the actor task, and the effector was decoded across all tasks. The target was decoded in the left hemisphere during the target and actor tasks, and in the right hemisphere during the target and effector tasks. In the premotor cortex, the effector was decoded during the effector task in both hemispheres and during the actor task in the right hemisphere. The target was decoded in both hemispheres during the target task, but the actor could not be decoded under any task condition. In conclusion, we observed that the task impacted all levels of the AON, resulting in changes in the

activity patterns in all ROIs. Also, we examined the interaction between tasks and action features, highlighting task-specific impacts. Our results emphasize that top-down attentional modulation alters the neural representation of action features within AON nodes. Notably, these effects are observed uniquely across regions, each reflecting its original encoding scheme and hierarchical position in the AON.

# **The Role of Perceptual Load in the Interference Effect of Attractive Distractors**

**Özlem Ertan-Kaya<sup>1</sup>**

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According to the Perceptual Load (PL) theory proposed by Lavie & Tsal (1994), the distractor interference effect decreases as PL increases. In the literature, the PL is also the subject of studies to reveal the processing type of stimuli. For example, Yates et al.'s (2010) study highlighted that angry faces have an interference effect on low PL (LPL) but no effect at high PL (HPL). In the study of Soares et al. (2015), angry faces diminished performance at HPL only for participants with high social anxiety. On the other hand, no study is known to have investigated the interaction of perceptual load and facial attractiveness. Attractive faces have repeatedly been shown to be very strong distractors. (e.g., İyilikci & Ertan, 2012; Maner et al., 2003, 2007). The present study investigated whether attractive distractor faces would impair performance despite HPL. Participants performed the letter-discrimination task between homogeneous (LPL) and heterogeneous (HPL) non-target letters. A task-irrelevant face is presented in the centre of the screen as a distractor. In half of the trials, the distractors were very attractive, and in the other half, they were averagely attractive models. Similarly, half of the models were male and half were female. For 2(Perceptual Load: Low, High) x 2(Model Attractiveness: Attractive, Average) x 2(Model Gender: Female, Male) x 2 (Participant Gender: Female, Male) mixed model experimental design, relationship status and relationship duration were determined as covariates, so ANCOVA analysis was conducted for the data of 116 heterosexual participants (%50 female). As a result, after controlling relationship status and duration, there were significant main effects of PL ( $F(1,112)=338.49$ ,  $p<.001$ ,  $\eta^2=.75$ ) and model attractiveness ( $F(1,112)=5.05$ ,  $p=.027$ ,  $\eta^2=.04$ ). There was also interaction effect between PL and model attractiveness,  $F(1,112)=4.73$ ,  $p=.032$ ,  $\eta^2=.04$ . No other main effects or interactions were significant. Post-hoc analysis (with Bonferroni) revealed that slower overall RTs at HPL than at LPL conditions, thus confirming the effectiveness of the PL manipulation. Besides, RTs were slower for attractive models than average models. For interaction effects, the analysis showed that RTs were slower for attractive models than average models for only HPL conditions. There was no difference between the average and attractive model conditions in LPL conditions. The current study interestingly showed that when the task is easy, the distractor face has no effect, whereas when the task becomes difficult, the attractive distractor accelerates performance. This result contradicts the assumption that the distractor would not be processed at HPL. It also seems that participants showed selective inattention to attractive faces at

HPL. This is in line with the study by Maner et al. (2008) in which people in long-term relationships specifically avoided attractive distractors. This is because, in that study, this interaction effect would disappear if relationship status and duration were not controlled for.

## Sex Differences in the Comparison of Perceptual Load and Dilution

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The perceptual load theory (Lavie, 1995; Lavie & Tsal, 1994) and the dilution approach (Benoni & Tsal, 2010; Tsal & Benoni, 2010) are two important explanations for the distractor interference effect on selective attention. Although there are studies in the literature supporting both theories, it is noteworthy that almost all of them do not take into account the sex of the participants. Indeed, it has been demonstrated that distractors have a greater inhibitory effect on females in go/no-go (e.g., Stoet, 2010) and flanker (e.g., Judge & Taylor, 2012) tasks. On the other hand, most perceptual load and dilution studies do not include information on the sex of the participants (e.g., Benoni et al., 2014; Biggs & Gibson, 2014; Chen & Cave, 2013; Lavie, 1995), although very few studies have included predominantly female participants (e.g., Eltiti et al., 2005; Weissman et al., 2018). This study aims to focus on sex differences when comparing perceptual load and dilution approaches. The data from 33 females (M=20.18, SD=.23) and 33 males (M=20.79, SD=.18) were analyzed in the study. There was no difference between the depression, anxiety and stress levels of female and male participants based on the Turkish version of Depression Anxiety Stress Scale - Short Form (Yilmaz et al., 2017). In this study, a task similar to that used by Benoni and Tsal (2010, 2012) was preferred. Accordingly, participants were asked to identify the target among homogeneous letters in the low perceptual load condition (LPL), the target among heterogeneous letters in the high perceptual load condition (HPL), and the coloured target among heterogeneous letters in the dilution condition. The 2 (Participant Sex: Female, Male) x 3 (Condition: Low PL, High PL, Dilution) x 2 (Congruency: Congruent, Incongruent) mixed ANOVA analysis showed that there were significant main effects of condition ( $F(2,128)=92.11, p<.001, \eta^2=.59$ ), congruency ( $F(1,64)=37.05, p<.001, \eta^2=.37$ ), and participant sex ( $F(1,64)=10.33, p<.01, \eta^2=.14$ ). Besides, there were significant interaction effects of congruency\*sex ( $F(1,64)=7.97, p<.01, \eta^2=.11$ ), condition\*sex ( $F(2,128)=4.49, p<.05, \eta^2=.07$ ), and condition\*congruency\*sex ( $F(2,128)=3.90, p<.01, \eta^2=.06$ ). Overall, the slowest overall RTs were shown in HPL condition, on incongruent trials, and for females. The congruency effect was generally observed to be highest in the low PL and lowest in the dilution conditions. Tsal and Benoni (2010) proposed to compare the dilution condition with the high perceptual load condition to represent the real perceptual load effect correctly. On this basis, the current study revealed that the congruency effect increases in the high PL. This finding supports the dilution approach. On the other hand, all these effects are only valid for female participants. This suggests that participant sex may have a confounding effect on the findings in the literature.



## **Playing with Cognition: Investigating Working Memory and Clock Reading within a Large-Scale Online Learning Environment**

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Studying cognitive abilities in children through educational games offers a realistic context for testing established theories and exploring new research inquiries. This study investigates working memory (WM) and clock reading, two essential cognitive skills for educational outcomes, using data from a large online adaptive learning environment used by thousands of Dutch primary school children. Students between grades 3 and 7 played verbal WM serial recall, visuospatial WM serial recall, and clock reading games, providing tens of millions of responses and a means for studying children's cognition in students' regular practice environments. Using psychometric modeling and Bayesian multilevel modeling on item difficulty and response accuracy, we replicated key WM benchmark findings identified by Oberauer and colleagues (2018), such as set size effect, primacy and recency effect, spatial grouping, and error-related effects across the full age range. Additionally, our findings indicated that students' abilities reflect both developmental and practice effects. Our investigation on item difficulty in clock reading provided novel insights into the complexity of developing clock reading skills, for instance, the effect of day-time information on digital clock reading and the numeral effect within analog clock reading. Moreover, we identified common misconceptions in clock reading to better understand the developmental learning processes. Finally, our analysis showed a strong correlation between students' performance on WM and clock reading tasks. Our findings provide an understanding of the dynamic development of WM and clock reading skills in children and highlight the robustness of classical WM findings in a realistic setting.

## **Interactivism for Social Cognition: Exploring the Relationship Between Implicit and Explicit Theory of Mind**

**Yağmur Esendemir<sup>1</sup>, Hasan Deniz Baran<sup>1</sup>, Jedediah Wilfred Papas Allen<sup>1</sup>**

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The current literature on social understanding mainly focuses on the developmental trajectory of Theory of Mind (ToM). While False-Belief (FB) understanding was previously thought to develop around four years of age, more recent studies have suggested that FB is present even in 15-month-olds. Such an empirical discrepancy initiated the debate of early developing ToM (i.e., implicit ToM) and later developing ToM (i.e., explicit ToM). How various accounts interpret empirical findings regarding implicit and explicit ToM, as well as developmental explanations about their relationship, depends on the underlying assumptions of those accounts. Accordingly, the various accounts were critically analyzed based on the distinction between lean and rich interpretations of the empirical findings. Lean interpretation accounts generally argue that behavior-reading is enough to explain implicit ToM results, while rich interpretation accounts generally argue that some amount of mind-reading is involved (in addition to the behavior-reading). By differing in the amount of mindreading that is assumed to be involved, rich interpretations also differ in the degree of development that they postulate. On the lean interpretation side of the distinction, there are accounts that argue implicit ToM does not involve any mindreading. However, these accounts seem to miss something about the social meaning of early interactions and have difficulty explaining how mindreading does eventually take place around age 4. On the rich interpretation side of the distinction, the accounts all incorporate some amount of mindreading into implicit ToM, but they vary dramatically in terms of how much development is involved (i.e., they range from nativism to empiricism to socio-cultural constructivism). However, both camps have problems accounting for the emergence of the mental states involved in mindreading due to their shared assumption about a split between cognition and behavior. Solving the “empirical” puzzle of ToM requires rejecting this split and moving towards an understanding of others that is constituted by the interactions with them. Action-based emergent constructivist accounts adopt the latter perspective. They address the issue of emergence and consider our socio-cultural situatedness as constitutive for such emergence. The specific approach adopted here is interactivism. For interactivism, all knowing is constituted by anticipations for interactive potentialities. However, a qualitative distinction is drawn between two forms of knowing: interactive (i.e., implicit) and reflective (i.e., explicit). Interactive knowing is the first level of knowing and is what constitutes implicit ToM in early childhood. The emergence of epistemic reflection around age 4 enables children to reflect on their interactive knowing and

constitutes a second level of knowing. This developmental process results in reflective knowing as the origins of explicit ToM. From this perspective, language is an interactive tool for reflective knowing. It guides reflection to abstract various implicit properties of the interactively shared practices involving others, and this facilitates the process of enculturation. This also means that both language and culture contribute universally to the development of ToM but with variations resulting from different interactive and linguistic practices across cultures and communities. A footnote: The first and second author contributed to this work equally.

## **Mood and social influence: the role of metacognitive ability**

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Others not only influence our behavior, but also our metacognitive evaluations of those behavior (i.e. decision confidence), even when feedback is random and uninformative. Here we ask if metacognitive ability to monitor reliability of one's decisions predicts social susceptibility. We also ask if mood (anxiety and depression) further modulates this effect. We gave 46 healthy participants a perceptual task and presented them with random social feedback (positive, negative, neutral). Participants rated their confidence in their decisions before and after feedback, and lastly had an opportunity to change their initial decisions. In a separate task we also measured their metacognitive abilities, as well as their anxiety and depression scores. Results showed metacognitive ability to increase susceptibility to random social feedback. Surprisingly for those with high levels of metacognitive ability anxiety exacerbates this effect, whereas depression suppresses it.

## **Decision formation during naturalistic action perception in the perceptual decision-making framework: An ERP study**

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One of the fundamental stages of perceptual decision-making, decision formation, includes the temporal integration of the accumulated sensory evidence, and this formation is executed by decision variables. A neural signature, namely the centroparietal positivity (CPP), showing the characteristics of a decision variable has been observed to track the decision process in perceptual decision-making tasks such as discrimination of motion direction facilitating artificial stimuli (e.g., random dot motion (Kelly & O'Connell, 2013), biological motion animated by point-light displays (Oguz et al., 2024)). It remains unexplored whether the decision-formation stage that is active in the perception of naturalistic action stimuli in the perceptual decision-making framework shares similarities with the studies that used artificial stimuli. In the current study, human participants (N=17) participated in three EEG experiments where the task was to discriminate between two action exemplars of an action class (i.e., locomotion, self-directed actions, and manipulation). We created four coherence levels for each action exemplar to manipulate the available sensory evidence. Our behavioral data analysis revealed that response times and miss-rates declined as the coherence level increased. Furthermore, our ERP results showed that CPP was elicited in all action-class conditions, with its peak amplitude following the coherence level of the visual stimuli. A repeated measures ANOVA on the mean amplitude of the CPP showed significant main effects of action class and coherence level. Our results suggest that the decision-making stages that are involved in the visual perception of artificial motion stimuli can be generalized to the stages active in the perception of naturalistic and more complex action stimuli, with the emphasis that the decision formation is affected by the identity of the action that the decision variable tracks.

# **Investigating the Relationship Between the Activation of Individuals' Honor-Related Cognitive Schemas and Their Formation of False Memories for Gender Related Fake News Using Experimental Methods**

**Dilan Gönül<sup>1</sup>, Sezin Öner-Yaman<sup>1</sup>**

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In the current study, we aimed to investigate individuals' honor-related cognitive schemas and subsequent information processing, particularly in forming false memories concerning gender-related fake news. Previous studies have shown how easy it is for individuals to form rich false memories and beliefs for events that never happened, often as a result of exposure to fake news, and have shown that these memories can be biased (one of the individual differences) in line with our political views, preexisting beliefs knowledge (Greene et al., 2021; Greene & Murphy, 2020; Murphy et al., 2019). The current data was collected as a part of a more extensive study; thus, the study will encompass three distinct sub-studies, each designed to examine the effectiveness of different types of manipulations on honor-related cognitive schemas. We recruited 600 participants, with each sub-study comprising 200 participants. Accordingly, we used the honor priming manipulation method with the thought trimming technique on the word completion task that involves honor and non-honor-related words (S1a). Secondly, we used the word activation method with a lexical decision task on the word completion task (S1b). Finally, we used the mindset activation method with a rating scale on the Word Completion Task (S1c). We argued that the experimental groups completed more honor-related words on the word completion task than the control groups for all three sub-studies. As expected, the results revealed that the experimental groups completed more honor-related words than the control groups across the three sub-studies. The effect sizes are used to measure the effectiveness of these three manipulation methods. The most significant effect size was used to determine the manipulation method for other parts of the more extensive study. The word activation method with the lexical decision task had the most significant effect size: Cohen's  $d = 0.66$ . The results emphasize the effectiveness of different types of cognitive schema activation methods. They will discuss the role of honor-related cognitive schema in forming false memory. Key Words: Misinformation, false memory, cognitive schema activation, gender, honor.

## **Thinking Creatively in Two Languages: The effects of imagery vividness, foreign language proficiency, and hand gestures**

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The positive effects of bilingualism on overall executive functioning have recently been a topic of great inquiry. Several studies showed that bilinguals outperform monolinguals on measures of creativity. However, there has hardly been any research investigating whether people differ in their creative thinking when in a native (L1) versus a foreign/second language (L2) context and the cognitive and linguistic factors that might impact these effects. Previous studies suggest that some of those factors could be related to vividness of imagery, L2 proficiency, and the use of hand gestures. For example, recent research shows that vividness of imagery is lower in one's L2 compared to their L1, and L2 proficiency predicts L2 vividness. Moreover, hand gestures have been linked to the activation and maintenance of visuospatial imagery and research has shown that high imagery skills enhance the positive effects of gestures on verbal convergent thinking in L1. This, however, has not been studied in L2. Based on those findings, the current study investigates (1) whether types of verbal creative thinking (divergent and convergent) are expressed differently in one's L1 vs. L2, (2) if so, whether this differentiation is due to reduced vividness of imagery in L2 and how that is affected by L2 proficiency, and (3) whether spontaneous gestures play a differential role in L1 and L2 creativity and vividness of imagery. To study these questions, we tested 40 Turkish-English bilingual speakers' verbal creativity in Turkish and English. They self-reported their vividness of imagery during creative thinking and their gesture frequency was analyzed. We found that people were more verbally creative in their L1 compared to L2 on both measures of creativity. Also, their vividness of imagery was higher during creative problem-solving in L1 than in L2. There were main effects of both L2 proficiency and vividness of imagery on L1 and L2 divergent thinking performance. In contrast, there were no effects of vividness of imagery on convergent thinking performance either in L1 or in L2. It was L2 proficiency that had a positive effect on L2 convergent thinking. Moreover, vividness in L2 creativity was not related to L2 proficiency. Finally, people used more representational gestures in their L2 compared to L1 during convergent but not divergent thinking. However, overall gesture frequency did not affect creativity or vividness of imagery. It also did not interact with L2 proficiency or mental imagery skills. These findings suggest that people are more verbally creative in their native language and that could be due to reduced vividness of imagery in their foreign language, especially during divergent thinking. While high L2 proficiency was beneficial for divergent thinking in both languages it was only

advantageous for L2 convergent thinking. This finding also implies that bilingual proficiency not only enhances L2 creativity but could also benefit some aspects of L1 creativity. Lastly, even though people produced more gestures in their L2 during convergent thinking, that did not necessarily help them do better. Future research should examine the role of multimodal language and vividness of imagery in non-verbal creativity.



## **Examining the Structural and Aesthetic Elements of Poetry from a Cognitive Poetics Perspective: Can Gestalt Theory Help?**

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Cognitive Poetics is an interdisciplinary approach to the study of poetry, utilizing tools offered by cognitive sciences. In the late 1950s and early 1960s, with the rise of computer science and a growing curiosity in understanding human cognition, a step by step modeling of the human mind as a computer became almost a norm. Although this cognitivist theory of the human mind has offered important insights in fields such as learning and memory, it has limitations and is sometimes considered methodologically reductionist because it possibly oversimplifies the complex nature of human emotions and unique experiences (cf. Mungan, 2023). Through two experimental setups, this research aims to explore the human experience when reading poetry from a Gestalt theoretic perspective by looking into how grouping dynamics may influence semantic and aesthetic responses to poetry. In the first experiment, Nazım Hikmet's poem "Memleketimden İnsan Manzaraları" is used to investigate how individuals interpret and organize a text presented in prose format without punctuation marks. Participants are first asked to read the text silently and structure it into lines, then the same task is repeated while listening also to the poem. This approach seeks to explore how grouping of rhythmic patterns, reliance on semantic comprehension, and person-related aspects influence one's poetry experience. The engagement and involvement of participants in poetry will be assessed using the Tellegen Absorption Scale, which measures the depth of their emotional and cognitive engagement during the tasks. In the second experiment, inspired by a similar study by Tsur, we will modify the rhyming scheme of a quatrain in a manner that changes its original rhyme pattern to ABAB or AAAA formats, instead of using a specific existing poem (Tsur et al., 1991). This setup investigates how the Gestalt principles "law of return" and "law of good continuation" modified in the ABAB scheme, and "similarity" in the AAAA scheme may affect participants' aesthetic enjoyment. These tasks are designed to illuminate how different poetic forms and structural elements influence psychological grouping processes and aesthetic experience. It aims to develop our understanding of where the meaning of poetry is derived from, what is seen as beautiful, and the cognitive processes involved through the lens of Gestalt theory.

## **Spiking Neural Networks Involving a New Learning Paradigm**

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As research in neuroscience improves, knowledge of how memory and learning are formed is beginning to be better understood, leading to improvements in our understanding of cognition. This progress in neuroscience affects the studies on artificial intelligence. Thus, studies in artificial intelligence have been more versatile since Artificial Neural Networks (ANNs) inspired by the human brain began to be used efficiently to solve difficult problems with increasing computational power. Based on the success of ANNs, ANN-like structures are not only becoming more efficient than the current von Neumann architecture but also aim to consume less energy like the brain. Spiking Neural Networks (SNN) are such structures and their implementation on neuromorphic hardware assures energy optimization for intelligent systems. Despite ANN's strengths, they also have disadvantages like parameter optimization and catastrophic forgetting, and they are not entirely inspired by the activity of neurons and the hierarchical organization of the brain. So novel structures that handle cognitive processes realistically as the nervous system are required. SNN, which elucidates the neuronal activity and organization besides the chemical processes that convey information between neurons while using effective learning paradigms and rules, stands as a new approach. Although SNNs haven't replaced ANNs yet, recent studies have shown that SNNs can process complexities and give similar results in noisy environments. The main factor behind learning and data storage in the brain is the adjustability of synaptic weights. One of the methods, by which the weights are thought to be adjusted is the STDP method. However, STDP takes into account the temporal ordering of spikes preventing it from becoming a convenient method of incremental online learning. Training of SNN, which involves neurons with different firing patterns, becomes difficult when weights are updated via STDP. Not only local learning rules affecting the communication between cells but also the hierarchical organization of neural network structure in the brain should be addressed, thus an SNN structure incorporating winner-takes-all (WTA) and predictive coding (PC) methods is proposed in this study to overcome these drawbacks. Neuromorphic hardware consumes much less energy in computationally intensive operations than CPUs. Implementing an SNN on neuromorphic hardware, which performs complex tasks with intertwined methods, will be an important step in overcoming energy consumption. As SNNs inherently have a resemblance to brain structures more than ANNs, having a neuromorphic implementation of them will provide an advantage. Thus, to achieve energy efficient, hierarchical structure resembling the brain, four main objectives are determined: i) Accomplishing an

acceptable performance threshold for pattern recognition with SNN; ii) Integrating PC and WTA mechanisms into the SNN structure; iii) Developing an online updated version of a learning algorithm that is equivalent to the STDP; iv) Simulation of the method on a neuromorphic hardware platform for measurement of its effectiveness and energy efficiency. So, in this study, we will set up a novel SNN structure with a new learning rule, implement it on neuromorphic hardware, and compare our results with ANNs.

## **Imagine The Missing Color: A New Experimental Task for Behavioral and Neuroimaging Studies of Object Visual Imagery**

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Visual mental imagery involves two groups of cognitive processes: object imagery represents pictorial features and semantic categories, while spatial imagery operates on proportions and spatial transformations. Presumably, brain implementation of the object imagery is based on the ventral visual pathway, which plays a major role in object recognition. Spatial imagery involves the dorsal pathway, which supports encoding the spatial structure of objects, their location, and sensorimotor coordination. Although there is a substantial body of indirect evidence, there are no clear neuroimaging results supporting reliance of visual imagery aspects on the ventral vs. dorsal visual pathways. One reason is a lack of tasks addressing object visual imagery which are applicable to neuroimaging research. While spatial imagery has been assessed in neuroimaging studies with mental rotation task for decades, its counterpart task for the object imagery has yet to be developed. We sought to create a set of tasks for color imagery with the procedure closest in structure and complexity to mental rotation. Here we introduce a missing color task. Participants are presented with a row of four colored squares and an analogous set with a “missing” color, represented by an empty frame in the second or third position in the row. All colors in a row share the same hue but differ in brightness or saturation. The arrangement of colors can be either logical (i.e., from the brightest to the darkest) or random. Participants are asked to imagine the missing color according to the rule. At the end of a trial, they make a speeded two-alternative forced choice with color options shown on a screen. Two levels of difficulty are determined by the color difference between the distractor and the correct option within the same shade: 100 (difficult) or 200 points (easy) in the “2014 Material Design color palettes” library. Since the technique is intended to be used in psychophysiological studies, the time for response is limited by 5 seconds (optimized for use in fMRI studies). Behavior pilot study revealed that only 22 out of 40 participants achieved average accuracy above the chance level (50%). While accuracy was affected only by difficulty, but not by sequence predictability, the reaction time was affected by both factors. Also, individual differences had a great influence on the results. A pilot study with fMRI (N=12) also revealed substantial individual differences in the neural correlates of the task performance. While neural correlates of the task include activations along both ventral and dorsal visual pathways in all participants, activations for contrasts among two difficulty levels vary, and include clusters on the ventral visual pathway only in 4 participants who achieved over 0.7 accuracy at the high difficulty level. These

findings prompt further improvement of the missing color task library, including lower difficulty levels, and consideration of possible verbal, non-visual solution strategies of participants. Research is supported by the RSF grant #23-28-01561.

## **Bringing To Light: The Challenges of Representing and Reasoning Common Sense Knowledge in AI Systems**

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While significant advances have been made in machine learning, natural language processing, and computer vision, developing AI systems with true common sense reasoning abilities has proven to be a much more difficult challenge. Common sense in AI refers to the ability of an artificial intelligence system to understand and reason about everyday concepts and situations that are familiar to humans. These concepts include cause-and-effect relationships, social norms, context-dependent meanings of words, and the ability to recognize when something is physically impossible or unlikely. However, developing AI systems with common sense reasoning abilities is still a significant challenge for researchers. Philosophical inquiry can help us clarify what counts as common sense knowledge and how we acquire it. It can also help us understand how we represent common sense beliefs and assumptions that might be requirements for reasoning processes. There are several challenges to achieving common sense reasoning in AI; ambiguity: Natural language is often ambiguous, and it can be challenging for AI systems to interpret the meaning of a sentence or phrase accurately; context: Common sense reasoning often relies on context and background knowledge, which can be difficult for AI systems to acquire and utilize; uncertainty: In real-world situations, there is often uncertainty or incomplete information, and AI systems struggle to reason effectively in such scenarios; complexity: Common sense reasoning often involves complex causal relationships and reasoning about the physical world, which can be difficult for AI systems to understand; knowledge representation: It is challenging to represent and organize the vast amount of common sense knowledge that humans possess in a way that is usable by AI systems. In the paper, firstly, I elaborate on the challenges of representing common sense knowledge in AI and, secondly, compare two different AI models: CYC and Chatgpt, which are very different in how they approach common sense reasoning. It will be essential to provide a clear and detailed analysis of the strengths and limitations of each model, as well as how they compare in terms of their ability to represent and reason with common sense knowledge. This comparison will also compare the positions of two mainstream ideas (computationalism and connectionism) in the philosophy of AI on common sense reasoning and common sense knowledge.

## **Young Learners' Regularization Behavior And The Role of Inhibitory Control Skills**

**Elif Gülben Kara, Mine Nakipoğlu**

Children are sensitive to the distribution of information in the linguistic input and use this ability to discover patterns of language. At a general level, consistent patterns allow for generalizations and foster successful learning. Probabilistic patterns, however, invite the young learner to entertain hypotheses regarding the distributional variation and may push her to impose regularity on the variation. In the past few decades, the field of language acquisition has taken special interest in young learners' regularization behavior and numerous works in naturalistic morphology acquisition and artificial language paradigms has revealed not only that regularization bias is deeply rooted in humans but that young learners regularize more, compared to older ones (Hudson Kam&Newport, 2009; Newport 2019; Austin et al. 2022). Children's regularization tendency also sparked interest in the causes of this behavior and among the hypotheses offered are i. Children expect languages to contain deterministic rules, hence may impose this expectation in the form of regularizations in their productions (Marcus 1992); ii. Young learners' memory capacity and cognitive limitations are the cause of regularizations (Newport 1990); iii. Developmental changes in the inhibitory control(IC) skills are what cause regularizations (Ibbotson& Kearvell-White, 2015; Yuile&Sabbagh, 2020). Acquisition of irregular morphology has served as a platform for an exploration of how children impose regularity on inconsistent variation. In the present study, building on the findings of the regularization behavior the Turkish-speaking children exhibit in the acquisition of the Turkish aorist (Nakipoğlu et al. 2023), we will look into whether the production errors are correlated with children's developing IC-skills. In the acquisition of aorist, children's attempts to use the irregularly behaving 13 sonorant-ending monosyllabic-verbs with the dominant -Ar form give rise to overregularization errors such as \*al-ar 'takes' for al-ır; another attempt to seek consistency results in a further erroneous generalization whereby the child uses -Ar-taking sonorant-ending monosyllabic-verbs with -Ir, resulting in irregularization errors such as \*çal-ır for çal-ar 'plays'. We investigated the possible relationship between IC-skills and the erroneous aorist production using two tasks. To tap into young-learners' IC-skills, we adopted a verbal-production-task(Day/Night), whereby the child is invited to utter the word 'Day' when presented with a night-scene or the word 'Night' when presented with a day-scene; and a pointing-task(Grass/Snow), where the child is invited to point to the green-card upon hearing the word 'Snow' and to the white-card upon hearing the word 'Grass' as in (Carlson&Moses 2001;Carlson 2005). To test the aorist, we used a smaller version of the production-test used in Nakipoğlu et al.(2023). Out of the 10

children (age-range:3;6-5;11) tested so far, 4 passed both IC-tests, and produced errors with a rate of 12,5%; 3 children failed both IC-tests and produced production errors with a rate of 29%. The remaining 3 passed one of the IC-tasks and displayed an error rate of 9%. These preliminary results suggest a potential link between more advanced IC-skills and less erroneous production, however, that IC-achievers still produce regularization errors begs an explanation. We conjecture that though IC skills may play some role in children's regularization behavior, in line with what is proposed in Nakipoğlu et al. (2023), regularization bias is best viewed as an attempt to tap into the systematic patterns to discover the relevant rules as they pertain to the distribution of the aorist.

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## **An Assessment of the Major Paradigms of Modelling Intelligence in Terms of Matter-Life-Mind Continuity**

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Several paradigms of modeling living and intelligent systems in Biology, Philosophy and Cognitive Science have tried not only to produce artificial systems with practical uses, but also to explain various aspects of cognitive agents. Yet, many explanatory gaps still exist in the way of a unified understanding of matter, life, and mind. The Life-Mind Continuity Thesis suggests that the living organization and intelligent systems share the same underlying principles (Kirchoff & Froese, 2017, Varela et al. 1991). For this holistic view to reach the level of concreteness for modelling practices, properties that characterize levels of organization and transitions between them need to be explained. From the perspective of Life-Mind Continuity, important transitions towards human intelligence are a) from non-living matter to the emergence of minimally cognitive living organisms b) From minimal cognition to more complex forms of cognition. Any attempt at addressing these transitions also requires identification of necessary and sufficient parameters that can characterize the phenomena in question (Levins, 1966). In this study we evaluate the following models of life and intelligence as to their claims, definitions, and implications regarding the thesis of continuity of matter, life, and mind as well as their possible contributions to artificial intelligence design: Cybernetics, Autopoiesis, Enactivism, Rule-based AI, Connectionism, Basal Cognition and Free Energy Principle. We assess these paradigms, in feasible combinations, along the dimensions of (a) Representationality, (b) Memory, (c) Goal-directedness, (d) Adaptivity and (e) Prediction, (f) Counterfactuality. We aim to outline the prospects for a unified model for living and sentient beings that takes the matter-life-mind continuity at its center.

## **Effects of Caffeine on Brain Networks During Cognitive Tasks and Resting**

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The area of cognitive science has unique multidisciplinary approaches to research cognition, behavior, and the brain by covering them at once. Although all areas have idiosyncratic limitations regarding the research methods, it is obvious that investigating alive human brain used to be impossible until recently. Thus, the rise in interest in functional magnetic imaging (fMRI) is not surprising. Studies in fMRI showed that the brain has intrinsic networks, such as default mode, salience, or executive control. The discovery of brain networks is a result of observed functional connectivity in brain imaging. However, fMRI is an indirect method to measure neuronal activity and the understanding of neurovascular coupling is crucial. Respiratory volume per time (RVT) affects the CO<sub>2</sub> level in the blood, and heart rate variability (HRV) affects the cerebral blood flow. Therefore, blood-oxygen-level-dependent (BOLD) signals of fMRI are susceptible to autonomic nervous system (ANS) responses (Özbay et al., 2019). In our study, we try to understand the effect of caffeine, one of the most consumed psychoactive drugs and an ANS activator (Corti et al., 2002). Also, the relationship between autonomic responses (RVT and HRV) and BOLD signals is investigated. RETROICOR is used to control the effects of these physiological signals (Glover et al., 2000). In the data analysis, independent component analysis (ICA) is performed to identify spatial maps of the intrinsic networks. The experimental design is that repeated fMRI scans are performed following the immediate intake of caffeine pills (200 mg), the first scan 10 minutes (control), and the second scan 30 minutes (experimental) following the intake to create a time window for digestion. Both scans have one cognitive task (solving algebraic problems) and one resting state, which are 6 minutes long (3T MRI with GRE-EPI (FA = 90, TR = 3 s, TE = 36 ms, in-place resolution = 2.5 mm, number of TRs = 135)). Preliminary results of the task condition, which were partially submitted to the 30th OHBM Annual Meeting to be presented in June 2024 by Karakuzu et al., showed that using RETROICOR was important to obtain clear spatial maps of independent components. Task-related activations were seen in early components and random BOLD fluctuations were less when controlling the physiological signals. Group ICA on three caffeine-affected subjects' cognitive tasks displayed a clearer pattern of the ventricular region in a spatial map, which is an expected effect of caffeine. (Han et al., 2009). Also, the explained variance of insula activation was higher. Finally, inspections of resting state spatial maps indicated that HRV

correlated with BOLD signals in lateral ventricular and sagittal sinus regions. Indeed, when comparing the spatial maps of the caffeine-affected condition with the control, a higher correlation with the same regions was seen. It is plausible to say that autonomic responses affect these regions' BOLD signals. Therefore, the study suggests that even though physiological noise can be reduced with post-processing methods, their intertwined nature proposes that neuronal activity and physiological activity must be evaluated together carefully when interpreting fMRI studies.

# **Classification Of Premise and Conclusion Components in the Decisions of The Constitutional Court of Turkey With A Deep Learning-Based Approach**

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This study presents a new method to classify premise and conclusion sentences in Constitutional Court of Turkey decision summaries using natural language processing techniques. Such a classification is accepted as significant for analyzing the content and structure of court decisions. It provides a clear demonstration of legal conclusions or provisions with legal justifications or supporting evidence. In-depth examination of the Constitutional Court decisions is generally time-consuming; however, by classifying "premise" and "conclusion", it is possible to examine the content of the decisions in a more systematic way. In this way, it is possible for lawyers and researchers to find specific arguments and conclusions more quickly and effectively. Additionally, this classification can be used to determine the similarities and differences between different decisions, i.e., makes it easier to compare and analyze decisions on similar legal issues. Turkish Constitutional Court decision summaries were used in this study, and two annotators were used to annotate 636 sentences as premise and conclusion sentences. In the end, Cohen's Kappa ( $\kappa$ ) value has been calculated as  $\approx 0.975$ . Sentences were tokenized using a BERT tokenizer, and while BERT embeddings were extracted for each sentence, TF-IDF features were also created. A hybrid model has been implemented in which the CNN layer output is fed into a BiLSTM layer. Combining CNN and BiLSTM layers has provided to leverage the strengths of both architectures. While CNN has been used to capture local patterns, BiLSTM has been preferred for capturing long-range dependencies. By incorporating TF-IDF features alongside BERT embeddings, the model has been aimed to show a higher performance in capturing additional lexical and statistical information about the text data. This hybrid approach allows the model to benefit from both the rich contextual representations provided by BERT and the distributional properties captured by TF-IDF. This study has revealed that such a deep learning-based hybrid model demonstrates high performance in classifying premise and conclusion sentences with high accuracy by adapting to the different structures of court decisions. This method has achieved a high success rate by obtaining F1-scores of around 0.90. These results show the effectiveness of the method in analyzing court decisions in Turkish, so this study is expected to contribute to natural language processing research in the field of law.

## **Investigation of The Symmetric Contiguity Effect with Event Segmentation**

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During free recall, there's a tendency for words recalled consecutively to be close together in the study list, known as the contiguity effect, with a bias towards recalling words in forward order. This widely observed phenomenon has been studied extensively and explained by both causal and noncausal models of episodic memory. Causal models, such as SAM or TCM, propose that the retrieval of each word in a sequence serves as a cue for the subsequent recall. In contrast, noncausal models, exemplified by the model proposed by Davelaar et al. (2005), posit that the correlation between the cognitive states during the study and recall phases accounts for the observed contiguity effect. Kılıç et al. (2013) attempted to disrupt this mental state correlation by introducing the probed recall task, where participants recall words from the same list using provided cues after studying multiple lists. Despite disrupting the mental state correlation, their findings still supported the presence of the contiguity effect, albeit in a symmetric manner, and favored causal explanations. This study aimed to enhance performance in the probed recall task by using event segmentation to investigate whether the observed symmetry resulted from the obtained lower memory performance of participants. Participants were exposed to various distractor tasks between each list to enhance their ability to differentiate between the lists. The findings revealed a symmetric yet enduring contiguity effect, even with improved performance, as illustrated by a conditional response probability (CRP) curve. These results support the causal explanations of the contiguity effect.

# **The Memory-Test Probability Is a Driving Factor in Memory-Driven Attentional Capture**

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Information held in working memory guides external attention to stimuli that match the memory content. Such memory-driven attentional capture is often measured by providing participants with a search task while they keep a memory item in mind for a memory test. The cost in reaction time when the memory item is a distractor is taken as evidence for involuntary attentional capture. To prevent participants from revisiting the memory item to refresh their memories, a more suitable alternative is to use either a memory task or a search task in each trial. However, different studies use different ratios of memory and search tasks across trials. The effects of task ratio on memory performance and memory-guided attention are unknown, making comparisons across studies potentially misleading. To overcome these limitations, the present study explored the effects of test probability on memory performance and capture effects. We manipulated the task ratio across blocks. The memory task constituted either %25, %50, and %75 of all trials. In each trial, participants were shown a color to remember. After a blank delay, participants sometimes performed one of the two tasks. In the memory task, they needed to report the memory color on the color wheel. In the search task, participants needed to report the location of a diamond among disks. To measure memory-driven capture, in half of the search trials, the color of the distractor disk matched the memory item whereas in the other half, it was a different color. Memory-guided attention, indexed by slower RT in memory-matching distractor vs irrelevant distractor trials, was present for each task ratio. However, the number of search trials needed to reach  $p = .05$  differed, which were 88 (118 total), 34 (68 total), and 40 (160 total) for 25%, 50%, and 75% memory blocks, respectively. Moreover, when the number of search trials was equated across ratios to match the condition with the minimum number of search trials (ie, the 25% memory blocks), the capture effect was insignificant in the 25% memory blocks. Thus, the 50% ratio was the most trial-efficient condition to obtain an effect. We also explored the effect of task ratio on memory performance. The mean error for color recall was highest in %25 memory and lowest in 75% memory blocks, showing that encountering memory tests more often resulted in better performance. Assuming that the error rate reflects memory precision in our single memory load experiment where forgetting is unlikely, these results reveal that memory precision does not predict attentional guidance, since the error rate and capture both decreased across increasing memory task probabilities. Taken together, our findings offer methodological guidelines regarding the most efficient study design for future

research and theoretical contributions regarding the relationship between precision and attentional guidance by WM.

## **Emotion-Memory Interactions in L1-Turkish and L2-English Bilingual Individuals**

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Memories with intense emotions might be remembered better compared to the ones with less emotional intensity (Kensinger & Corkin, 2003). In our investigation of this phenomenon in bilingual minds, we frame our research within the dual-coding theory (Paivio, 1971), which posits two memory systems: a verbal system and an imagery system. Extending this theory, Paivio and Desrochers (1980) proposed that bilinguals, having two languages, possess two verbal systems and an imagery system, which are independent yet interconnected. Some studies showed that emotionally charged words are recalled better in L1 than in L2 (e.g., Anooshian & Hertel, 1994), while others suggest that the recall does not differ for L1 and L2 (e.g., Ayçiçeği-Dinn & Caldwell-Harris, 2009). In the present study, we asked: (a) Does bilingual individuals' recall of emotionally charged words differ between L1-Turkish and L2-English? (b) How does second language proficiency affect this interaction? Previous studies lacked control for the words used in the experiments: the words were not equivalent to each other in terms of word length, word frequency, emotional valence, and arousal (e.g., Ayçiçeği-Dinn & Caldwell-Harris, 2009). Thus, we created a controlled word list consisting of 36 words for L1-Turkish and L2-English, in which emotional valence (positive, neutral, negative) was the only varying factor, whereas arousal, word frequency, and letter-syllable length were kept constant. We performed two studies. In Study 1, bilingual undergraduate students (N=62, Mage=22, SD=4,17) performed an online memory recall experiment for both L1 and L2. They were asked to rate each word based on its valence to enhance deeper processing for subsequent recall test. We used Turkish Phonemic-Semantic-Fluency Test for L1, and Peabody-Picture-Vocabulary-Test-IV (PPVT 4) for L2 to assess language proficiency. Study 1 was completed online due to Covid-19 restrictions; therefore, we also ran lab-based face-to-face data collection for Study 2. Currently, we are still collecting data for Study 2, with an anticipated number of 65 participants. For Study 1, we ran a mixed-effects logistic regression model taking the recall of presented words as dependent variable. The fixed effects were word type (positive, neutral, negative), language (L1-L2), and L1- and L2-proficiency. We also included the interaction between word type and language. Model estimates indicated that the recall of words changed depending on the word type regardless of the language. The interaction between word type and language was not significant. Word type was a significant predictor; positive and negative



words were remembered better than neutral words, and this difference did not change across L1-L2. Furthermore, the recall of words in both languages increased when L2-proficiency increased. This supports the dual-coding theory. In conclusion, when L2 proficiency is controlled, the recall of emotionally charged words might not differ between L1 and L2. This research underlines that taking individual differences in L2 proficiency into account and using controlled stimuli are important factors to explain the conflicting results in the literature. Upon completion of data collection in Study 2, the findings are going to be presented.

## **Exploring the Evolutionary Aspect of Affordance with Primitive vs. Modern Tools**

**Ceyda Koça<sup>1</sup>, Dicle N. Dövençioğlu<sup>1</sup>**

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The concept of affordance refers to the perceived opportunities for action that an object offers to an individual based on its physical characteristics, functions, and context. It is directly related to visual and haptic perception in the ways in which people perceive and understand how objects can be used or interacted with in their environment. Affordance throughout time is also a crucial representative of tool evolution, material culture, and, hence, human cognitive evolution. In this study, we aim to investigate how humans attribute affordances to modern and primitive tools. To this end, we first conducted a preliminary study, a free naming experiment, to investigate how participants (n=30) perceive the potential uses of modern and primitive objects. Each participant was presented with 20 different objects and was asked to write down the actions associated with each object. These objects included tools, utensils, and household items. We analyzed the variety and frequency of affordance naming across participants. Additionally, we looked at whether certain features of objects, such as shape, material, function, and production period, influenced affordance perception. Results show that there is a diverse range of affordances named for each object, with higher variance for modern objects, suggesting that affordance perception can be acquired and lost. While some affordances were consistently named across participants, others showed variability, pointing towards individual differences in affordance perception. Overall, this study provides valuable insights into how humans perceive affordances in familiar and unfamiliar objects, highlighting the complex interplay between object features and cognitive processes.

**Keywords:** Affordance perception, cognitive evolution, free naming.

## **Action Selection with Continuous and Forced Choice Responses**

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Theory of Event Coding (TEC; Hommel, 2019; Hommel et al., 2001) claims that stimulus-response associations are organized in the form of “action files” that are then used to optimize action selection. Partial repetition cost is the decrease in experimental performance observed when some but not all features in a stimulus-response episode are repeated in the next episode, as opposed to the complete repetition or alternation of features. Though this phenomenon has been replicated in several studies that closely adhered to the methods of the original study (Hommel, 1998) and has been explained within the context of the TEC, experimental designs with metrical - rather than categorical - stimulus features yielded TEC-incongruent results. Recently, we have demonstrated that partial repetition costs can be observed only when both the task-relevant and -irrelevant stimulus features (RF and IF, respectively) are categorical and that categorical features have prevalence over the metrical ones. In the current study, previous experiments have been replicated in a continuous frame of magnitude: participants (N = 31) judged the intensity of a RF (luminance, duration, speed, or wavelength-defined-hue) on a continuous scale while an IF (luminance, duration, speed, wavelength-defined-hue, or shape) varied independently. Our results showed that 1) while RF is directly associated with actions, IF affects responses indirectly only by influencing the perceived magnitude of RF in a magnitude system, 2) that metrical stimulus features are prioritized in the selection of continuous - rather than categorical, alternative-forced actions, and 3) that more consistent interactions are seen when RF and IF are processed within the same cortical processing stream in the brain (either dorsal or ventral), as suggested by the dual-pathway hypothesis.

## **Age-related Differences in Autobiographical Memory:**

### **A Trajectory of Changes**

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Studies investigating age-related differences in autobiographical memory recall mainly focused on the differences between young and elderly adults where people older than 65 provided less detailed memories with more intense phenomenological components than younger individuals. Episodic details and phenomenological experiences in young and middle-aged adults were relatively less studied. However, to obtain a trajectory of changes from young to old adulthood, it is important to depict the changes in episodic and phenomenological details in middle-aged adults. In the present study, we aimed to investigate age-related differences and similarities in episodic details and phenomenological characteristics by comparing young (ages 18 - 30 in Study 1, 20 -30 in Study 2) and middle-aged (ages 30-60 in Study 1, 40 -50 in Study 2) adults on early and recent memories. In two consecutive studies, we collected data from 303 participants (112 in Study 1, 191 in Study 2) and asked questions about their phenomenological experiences (e.g. visual imagery, remembering or knowing, involuntary thinking). We coded episodic details based on the episodic richness scheme (Levine et al.,2002). We found that younger adults recollected more detailed memories than middle-aged adults, but the event period significantly influenced the memories. For phenomenological details, our main finding was that young adults recollected events that were more important to their identity than middle-aged adults. We discussed the findings in the context of retrieval and encoding-related advantages and their change across the lifespan.

**Keywords:** aging, autobiographical memory, episodic richness, phenomenological characteristics

## **Cross-Linguistic Examination of False Memories:**

### **A Study with Turkish-English Bilinguals**

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This study investigates false memories among Turkish-English bilinguals using an experimental task utilizing the post-event misinformation method. Thirty-four healthy volunteers (21 females, 13 males) aged between 18 and 28 years (mean age  $23.21 \pm 2.18$  years) participated in the study. All participants were Turkish-English bilingual, with Turkish as their first language and English as their second language. All participants completed a comprehensive clinical and personality evaluation, language proficiency, and cognitive assessment tests. During the experimental task, participants watched a silent video on a computer screen, followed by reading a narrative containing misleading information about the video's content. Subsequently, they completed a recognition test regarding the video they watched, with questions either containing post-event misinformation or neutral details (control questions). The experimental design of this research is a 2x2x2 mixed factorial design, with narrative language (Turkish/English) and recognition test language (Turkish/English) as within-subject independent variables, and question type in the recognition test (post-event misinformation questions/control questions) as a between-subject independent variable. Analysis of memory accuracy in the recognition test revealed a marginally significant main effect of narrative language ( $p = .055$ ) and a significant main effect of question type ( $p = .000$ ). Participants who read the narrative in English showed lower memory accuracy compared to those reading the narrative in Turkish. Also, memory accuracy was lower for post-event misinformation questions compared to control questions. Additionally, the interaction effect of narrative language and recognition test language indicated that participants performed significantly better on post-event misinformation questions when both narrative and the recognition test were in their first language (Turkish-Turkish condition) compared to when they were in their second language (English-English condition). Analyses of the confidence ratings in the recognition test indicated a significant main effect of question type ( $p = .000$ ). Participants showed greater confidence in their answers for post-event misinformation questions compared to control questions. These findings suggest that false memories can occur regardless of the language used during encoding and recognition. Furthermore, participants may be more susceptible to post-event misinformation when presented in their second language, leading to increased false memories.

## **Interaction of The Nameability and Variability Effects in Category Learning**

**Alexey Kotov<sup>1</sup>, Elizaveta Zvereva<sup>1</sup>, Tatiana Kotova<sup>2</sup>**

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In our study, we examined the interaction between two main effects of category learning: the variability effect (learning is more successful on more diverse examples than on similar ones) and the nameability effect (learning is more successful on objects with easier-to-verbalise parts than on more difficult ones). Previous studies have examined these effects separately. In the case of the variability effect (Raviv et al., 2022), the examples were typically difficult to name. In the case of the nameability effect (Zettersten & Lupyan, 2019), the examples exhibited high variability. According to our theoretical hypothesis, the effects are related. High nameability ease will eliminate the variability effect. The variability effect will only occur when parts are difficult to name. An experiment was conducted in which the levels of nameability and variability between examples were varied for participants performing a category learning task on new rules. The experiment was conducted on a sample of 97 people aged 24 to 54 years. The participants were asked to learn how to categorise examples of two artificial categories. The stimuli were black and white figures, each of which consisted of four parts – circles connected by lines to form a single object. Each circle contained a tangram shape. The nameability level was determined through the orientation of the tangram shapes: in the low nameability condition, each shape was rotated by an angle multiple of 45°, while in the high nameability condition, they were presented in basic orientation. The variability level was determined through the sequence of stimuli presentation. In the high variability condition, the probability of switching between two categories in the sequence (that is, after a stimulus from category A, a stimulus from category B will be presented) was 75%, whereas in the condition with low variability it was 25%. The experiment utilised a mixed factorial design of 2x2x4. The first independent between-subjects variable was the level of nameability (easy or difficult to name features). The second independent between-subjects variable was the variability of the sequence of category examples within a block (high or low). The learning block was the within-subjects variable. Thus, there were four experimental conditions in total. The dependent variable was the proportion of correct responses across the four learning blocks and the test. Our hypothesis was confirmed on analyses of learning success. We found a significant relationship between nameability and variability,  $F(1,52)=12.474$ ,  $p<0.001$ . Additionally, we found that the diversity effect of examples with hard-to-name parts was stronger in the early stages of learning. At the same time, we were unable to detect this interaction on the success of transferring the learned

rule to new material: the success of the test task did not differ depending on part nameability and variability between examples. These results indicate not only an interaction between the basic effects of category learning, but also their limitations (transfer of the rule). Possible explanations for the observed interaction and its limitations are discussed with respect to the relationship between selective attention and long-term memory.

## **The phenomenal experience when listening to ambiguous rhythmic structures: Figure-ground and grouping dynamics?**

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Rhythm is a phenomenon deeply connected with time and anticipation. Out of the temporally unfolding events that can be grouped in a meaningful way, there emerges a predictive plane for what might follow next. We believe that rhythm has tertiary qualities (Bianchi, 2018, p. 345) in the sense that rhythmic experience results from the emergent characteristics of temporally unfolding stimuli in interconnection with the listeners' phenomenal sense-making of these. Hence, we expect phenomenal experience of metrically identical stimuli to differ depending on the structure they are embedded in and how the listeners group them. Research on rhythm perception investigated beat perception, reproduction, and neural correlates so far, focusing more on the accuracy of recognizing the rhythmic structures or the tendencies and preferences towards certain structures. In this study, we aim to explore the underlying dynamics that give rise to the experience of rhythm. From a Gestalt theoretical point of view, a rhythm is an audio-temporal gestalt, and its parts interact with both each other and the whole, which is different than the sum of those parts. We know of the optical illusions such as Müller-Lyer and Ebbinghaus illusions. Illusions like these may arise from the macroscopic layout of the whole stimulus where the whole-configuration influences how parts of it are perceived. We also know that these illusions are not universal as there coming about is also influenced by the perceivers grouping attitude (Luria, 1976). Complex, unusual manifold rhythms may constitute a good candidate to understand unique ways of experiencing them depending on temporal characteristics of the unfolding stimuli as well as the listeners' intentional or unintentional ways of sense-making. To explore this, we designed a tapping experiment where a 2-sec isochronous base pulse is presented and participants are asked to tap along to it while, from time to time, different rhythmic structures are superimposed on it. These rhythmic structures consist of different levels of complexities: polyrhythms, polymeters, polytempos and rhythmic displacements. Their pulses sometimes comply with the base pulse, sometimes not. We expect to see slight timing differences in participants' taps, due to the warps that we expect to arise with the dynamic interactions that happen when the base pulse is placed within different rhythmic structures. The differences among tapping responses will be a direct measure of how participants' estimations get affected by the manifold structures and will be an indirect measure of how their phenomenal experience differ. To gain further insight, we will conduct short interviews with the participants after the experiment, to get possible clues about their experience and their possible reasons. Based



on a Gestalt theoretical perspective, we expect that exploring the dynamics and the process that constitute the phenomenal experience will lead us to a more fine-tuned understanding of the coming about of psychological phenomena such as rhythmic grouping and figure-ground dynamics. We hope that integrating experiment and experience into psychological science will enrich our understanding of and hopefully inspire new ways of scrutinizing psychological phenomena.

## **Visual Cortical Activation in Blind Individuals During Auditory Working Memory Tasks**

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Examining how the visual cortices can change when they are deprived of their visual inputs, as in the case of congenital blindness is a significant inquiry in neuroscience. What is the nature of this change and to what extent it changes still remains unexplored. Prior research has found that these visual areas are activated during tasks that involve auditory, tactile, and olfactory modalities. This requires investigation because activating across multiple task modalities is also a key sign of multiple-demands (MD) regions. Like MD regions, visual cortices of the blind have been seen to activate to complex tasks like Working Memory (WM) tasks. We tested if the visual cortex in the blind activates to another WM task of different sort like judging the duration of pure tones in fMRI. The task was structured as a block-design. It consisted of 20 blocks of 10 trials each, alternating between easy and hard blocks. Each block was separated by a rest period. In a trial, participants were presented with two pure tones different in duration. One was always longer than the other. Participants were asked to decide which out of the two was longer in duration. Hard trials were made more difficult by decreasing the time difference between the two tones, in easy trials, difference in duration between two pure tones was between 200–350 milliseconds, whereas in hard trials 60-150 milliseconds. Whole-brain contrast (hard > easy) have shown that the visual cortex in blind individuals shows robust activation during hard blocks compared to easy blocks (FDR <0.05). Visual cortices of the blind activated to judging the length of sound duration along with canonical fronto-parietal MD regions. In sum, we suggest that visual cortices of the blind behave similar to MD regions and further studies needs be conducted about this issue.

## **The Effect of Distinctiveness on Visual False Memories**

**İrem Küsmüş<sup>1</sup>, Olesya Blazhenkova<sup>1</sup>**

<sup>1</sup> Sabancı University

Our research investigated the effect of distinctiveness on false visual memories. We utilized the Category Associates Procedure, where participants learn lists of items from various categories, and subsequently recognize learned items, unrelated items, as well as critical lures, the most representative but not presented items from each category. The false recognition of lure items indicates false memory formation. Previous studies suggested that distinctiveness decreases false memories; however, whether this effect occurs due to encoding-based or retrieval-based processes, or their combination, is debated. The operational definition of distinctiveness varies considerably, and we manipulated semantic and visual distinctiveness of the studied objects by placing them on more vs. less predictable backgrounds. In Study 1, participants learned objects from 14 categories, and as a within-subject factor, half of the category lists presented on semantically congruent (a pear in a garden) and half on incongruent (a pear on an iceberg) backgrounds. For each stimulus, participants rated how matching the object and background was. We expected that incongruent condition, compared to congruent, would require more distinctive encoding, leading to a decreased false recognition of critical lures. After encoding, participants performed a recognition test for studied, critical lure and unrelated items. The results revealed a false memory effect, with critical lures compared to unrelated items yielding higher rates of ‘yes’ responses, which were given faster and more confidently. Participants were also the fastest and the most confident when correctly recognizing studied items. There was no difference between congruent and incongruent conditions in terms of false memory rates, and related confidence ratings or response times. Moreover, contrary to our predictions, when using a subset of lists with the highest and the lowest congruence ratings, we found higher false memory rates for incongruent lists. In Study 2, participants learned the same objects, but items were presented on either neutral gray or colored backgrounds as a within-subject factor. As a between-subject factor, in the homogeneous condition, the objects from the same category were presented on the same background color, while in the heterogeneous condition, each object within a category was presented on a new background color. We expected that the uniqueness of each item’s background in the heterogeneous condition would have a distinctiveness effect as it is less predictable, and therefore decrease false memory. Again, we observed a false memory effect. Critical lures compared to unrelated items had higher ‘yes’ response rates, which were given more confidently, but not differently in terms of response times. The correct recognition of studied items was the fastest and the most confident. We did not find the effect of distinctiveness manipulation; no differences between homogeneous vs. heterogeneous and

neutral vs. colored background conditions were observed for accuracy of recognition, confidence ratings and response times. Overall, we found that distinctiveness, manipulated via adding an unpredictable vs. predictable objects' background, did not have a reducing effect on false memory. Instead, we observed somewhat increased false memory for incongruent backgrounds. The results are discussed in the light of encoding-based and retrieval-based accounts and signal detection theory.

# **Preliminary Experiments in Cross-Lingual Transfer Learning: Bridging Language Barriers in NLP Tasks with Multilingual Models and Fine-Tuning Techniques**

**Ferhat Kutlu<sup>1</sup>, Deniz Zeyrek<sup>2</sup>, Murathan Kurfalı<sup>3</sup>, Amalia Mendes<sup>4</sup>**

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Pre-trained language models, especially the latest large language models, have made significant progress in text representation for down-stream tasks. Yet, these models require a significant amount of computational power where the researchers are forced to gain access to expensive hardwares to train a new model. This issue became particularly acute with the growth of the complexity of models and the tasks they were meant to solve. The approach of transferring knowledge from one model to another created the Transfer Learning concept as yet another remedy. It allowed the use of knowledge and experience gained in solving one task to be applied to another related task. This not only reduced the time and resources needed to train a new model but also enabled models to generalize knowledge across different domains and tasks. The concept became a fundamental breakthrough in machine learning, as it opened new paths and training methods and allowed researchers and engineers to create more complex and powerful systems. Multilingual models are artificial intelligence models, often based on deep learning techniques, designed to understand, and work with multiple languages. These models are trained on diverse, multilingual datasets. They can process text or speech in various languages, making them versatile and useful for numerous natural language processing (NLP) tasks. By the rehearsals of domain and language specific transfer learning solutions, leaning on multilingual models, Cross-lingual Transfer Learning has been experimented widely. Transfer learning refers to the data and models available for one language for which ample resources are available (e.g., English) to solve tasks in another, commonly more low-resource, language. The outcome, namely, cross-lingual embeddings are a valuable tool in bridging language barriers in NLP tasks, enabling the development of multilingual and cross-lingual applications with reduced data requirements. As one of the latest works in this area, [1] targets improving the quality and applicability of these embeddings for automatic discourse analysis. The study leans on the advantage of encoding text with the BERT multilingual base model, with experiments on Turkish (Turkish Discourse Bank 1.2) and English (Penn Discourse Tree Bank 3.0) datasets. The findings of the work are important both in providing insights regarding the enhancement of modern language models in Turkish and in the low-resource scenario. Trustworthy results of the work and the release of Portuguese Discourse Bank in [2] has

motivated the current work in order to produce a new model for identification of discourse relation realization types in all three (Turkish, Portuguese and English) languages by fine-tuning BERT multilingual base model. We are currently experimenting with Portuguese Discourse Bank, a broad dataset with 224.278 tokens extracted mostly from formal writings of newspapers and scientific writings. The corpus offers 14.436 discourse relations (DRs), annotated according to the PDTB scheme [3], which are relations that ensure coherence and hold between two arguments that have properties of abstract objects. In our ongoing work we have so far (i) extracted 13.905 annotated tokens of DR realization types from the dataset, (ii) constructed the neural network architecture, (iii) planned the work of fine-tuning in order to involve updating the pre-trained model's top layers (classification head) while keeping the lower layers frozen. The main purpose is to allow the model developed in [1] to adapt to the task while retaining its cross-lingual knowledge. So, the model is expected to perform reasonably well in a new language, namely Portuguese, due to its cross-lingual understanding.

**Keywords:** Discourse Relation, The Penn Discourse Treebank, Pre-trained Language Model, Encoding, Fine-Tuning, Cross-lingual Transfer Learning

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## **Multimodal grammaticalization in Turkish Sign Language (TİD):**

### **Is Route III possible?**

**Bahtiyar Makaroğlu<sup>1</sup>**

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The mouth activity observed in signers, which can be divided into mouthings, which are derived from the surrounding spoken language, and mouthing gestures, which are not (Boyes Braem & Sutton-Spence, 2001). In most cases, mouthings are temporally and semantically aligned with manual sign and serve a redundant function in sign language (SL) production (Mohr, 2014). With regard to the grammaticalization of gestures, as proposed by Wilcox (2004, 2007), there appear to be two distinct routes through which gestures enter the SL system: (1) Route I: gesture → lexical morpheme → grammatical morpheme Route II: gesture → prosody/intonation → grammatical morpheme This corpus-based study investigates various aspects of mouth actions in existential constructions of native TİD signers, and provides new insights into the grammaticalization of mouthings and the origin of mouth gestures in the signed modality. The analysis of the TİD corpus (Dikyuva et al., 2015) indicates that the Turkish full mouthing /var/ (2), the reduced mouthing /va/ (3) and the biting-lips (bl) gesture (4) encode an existential/possessive function by combining other lexical units without the existential sign VAR. (please see pdf document) To analyze this linguistic phenomenon, a multimodal grammaticalization scheme of the construction [SIGN + mouthing/biting-lips] was examined in terms of Construction Grammar. The findings indicate that the construction [SIGN + mouthing /var/] gains an existential/possessive function through morphosyntactic development. Furthermore, the phonological structure of the mouthing /var/ is reduced (/va/, /vɪ/) in the subsequent stage. Finally, /var/ undergoes further development into the biting-lips mouth gesture to represent the initial sound of /var/, 'v', which is a labiodental fricative (see Figure 1). (please see pdf document) Based on the multimodal constructional development of the mouthing /var/ into the biting-lips gesture, the present study offers an additional route named as a Route III to Wilcox binary classification. This route differs from Wilcox's Route I and II in that the ultimate goal is to have reached the stage of "gesturalization", as illustrated in (2). (2) Route III: congruent mouthings → grammatical mouthings → grammatical mouth gestures

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# **Effective Connectivity in Cortical Regions During Bottom-Up Perception of Biological Motion Under Attentional Load: An fMRI-DCM study**

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Selective attention enables the elimination of irrelevant information from the environment to focus on task-related information. However, the processing level of the attentional effects has long been debated in the literature. Early selection proponents argue that attentional filtering occurs at the early stages of the perception, where the low-level features are processed. Meanwhile, the late selection theories suggest a later elimination of features at higher-level areas. Attentional load theory reconciles these by suggesting selection timing and level depend on task perceptual load. In other words, peripheral distractors are removed early when task demands are high due to a lack of perceptual capacity after processing task-related information. When the task is easy, removal happens after the distractors are perceived. We examined how varying attentional loads in central task impact the processing of peripheral biological motion distractors using dynamic causal modeling (DCM) on fMRI data from 28 participants. In that study, the attentional load was manipulated to be high or low without altering visual input, just task descriptions. Concurrently, participants viewed either intact or scrambled point-light walkers to gauge attentional effects on biological motion perception. Our model space included bidirectionally connected V1, MT, and the Parietal cortex as regions of interest. V1 is included as an input area for the visual stimulus shown in the experiment. MT is included as it was shown in the multivariate analyses that under low attentional load, the peripheral distractor conditions can be decoded from this region. Lastly, the Parietal cortex is included as it is shown to be activated distinctively for the high-load condition in the univariate analyses. We assumed that the peripheral distractors will always modulate the bottom-up connections in a hierarchical order (from V1 to MT and from MT to Parietal) and constructed five models based on literature hypotheses. Early selection theories suggested that both high- and low-load conditions are expected to modulate the top-down connection from the Parietal to V1, reflecting early attention effects. Late selection theories proposed both load conditions modulate the connectivity between the Parietal and MT, indicating later processing stages. Attentional load theory posited that low-load conditions would modulate later Parietal to MT connections, while high-load conditions would impact early Parietal to V1 connections. We also included two models to have a complete model space, one suggesting all top-down connections were modulated by both load conditions (Full Model) and another with Parietal to MT and V1

connections influenced by both load conditions. As a result of the Bayesian Model Selection process, we observed that the Full Model has the highest model exceedance and expected probability. This result indicates that both of the attentional load conditions modulate all of the top-down connections. While this result does not confirm any of the mainstream hypotheses in the literature, the modulation strengths should also be investigated to understand better the differences in modulation strengths of load conditions for different top-down connections and that of the biological motion conditions for different bottom-up connections.

## A Continuation-Based Compositional Account for

### Turkish Past Participle -mİş

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Building over Demirok and Sağ (2023), we propose a continuation-based compositional account for the Turkish past participle -mİş, within the quantificational event semantics of Champollion (2015). Turkish -mİş has been analyzed as a perfective and evidential marker (Kornfilt, 1997; Göksel & Kerslake, 2005; Jendraschek, 2011), and attributed resultant state, perfect aspect, and inferential/hearsay interpretations (Slobin & Aksu, 1982; Aksu-Koç, 1988; Cinque, 2001). The temporal/aspectual interpretation of a Turkish sentence depends on the relations between Aktionsart, temporal/aspectual adverbials and verbal inflection (Erguvanlı Taylan, 2001; Arslan-Kechriotis, 2006). Based upon these previous works, we argue that -mİş participle form encodes the consequent state of the underlying eventuality. Following Kelepir's (2001) analysis of the Turkish aspecto-temporal projection, Demirok and Sağ (2023) propose a functional head Temp that attaches to the verb (an event predicate) and exposes the time of the event for further projections by mapping it to a set of times (a time predicate). The rationale for a TempP is that in its absence it is impossible for a verbal projection (an event predicate) to combine with a tense head (a function from time predicates) without the intervention of a null aspectual head (a function from event predicates to time predicates), which has a rather slim empirical backing in Turkish. This allows for a straight-forward semantic composition for two different syntactic structures proposed by Kelepir (2001), namely [[VP TempP] TP] and [[[VP TempP] AspP] TP], where the intervention of Temp is due to Demirok and Sağ. Furthermore, this analysis brings about two projection levels, TempP and AspP, that denote event times and reference times respectively, providing two possible landing sites for temporal adverbials. Although this predicts the temporal ambiguities in expressions like Saat 3'te düğmeye basmıştı (She had pushed the button at 3 o'clock), it cannot capture interpretive possibilities that result from the interactions between temporal adverbials, Aktionsart, and TAM markers, as in Saat 3 ile 4 arasında mektubu yazmıştı ('She had written the letter between 3 and 4 o'clock', R1: letter completed btw. 3 and 4, R2: writing of the letter took place btw. 3 and 4). Such interpretations require that we take into consideration the relation between the Perfect meaning and consequent states, which has been extensively studied (Moens and Steedman, 1988; Parsons, 1990; Kamp and Reyle, 1993; Giorgi and Pianesi, 1997). Our strategy differs from Demirok and Sağ in that Asp and T heads are not construed as functions from predicates of times, but as functions from sets of event predicates via Champollion (2015). This

has two advantages. First, T head and Asp head can directly combine with the VP without postulating another projection level above it. Secondly, the temporal order of Reichenbachian times emerge from the compositional semantics of temporal adverbials, Aktionsart and tense/aspect markers.

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## **Through the Rabbit's Burrow: Beyond the Carrots - Exploring Language and Moral Development in Children**

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Psycho-development theories and examines narrative self-definition's impact on moral and emotional growth in 24-48-month-olds (Anderson et al., 2018; Ibbotson & Tomasello, 2009). The study involved 10 middle-class 25-50-month-olds from Yuva-Middle East Technical University creche in Ankara (5M:5F). Results showed that age and gender significantly influence children's mental and emotional responses. 50% of children under 36 months deemed the rabbit's actions in the story as correct, in contrast to 75% of older children who viewed them as incorrect. Gender differences were also notable; more girls than boys judged the rabbit's actions as wrong. These findings support and emphasize the research on children's emotional and moral development. Moral judgment and emotion depend on age and gender. We found no compelling evidence that narrative self-description affects morale and emotions. Gender-specific and age-related differences show that social norms and cultural practices influence children's morality. This study helps explain the intricate relationship between language, emotional, and moral development, underlining the need for more research. The study highlights the intricate relationship between language, emotional, and moral development, emphasizing the need for further research.

## **Young Children's Color Preferences and Color Emotion Association During a Storytelling and Drawing Task**

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The research of color-theory uncovers the underlying factors of color perception and preference. Color preferences and color-emotion association is a topic widely studied with adults. However, there are not many studies examining this topic with young children. In order to address this gap in the literature, this study examined whether children between the ages of 4-7 can associate colors with emotions and whether there are age- and gender-related differences in color-emotion matching. In addition, we examined the environmental influences on children's color preferences and color emotion associations. We hypothesized that children will associate positive emotions with their most-preferred colors and negative emotions with their less-preferred ones. Additionally, it was hypothesized that girls will prefer pink and purple more than boys and therefore, they will perceive these colors more positively compared to boys. We have also aimed to observe the influences of environmental factors such as the color of rooms and toys, on children's perception of color. Our intended research encompasses preschool children in Istanbul and is based on two main research questions: (1) With which colors do preschool children match 6 emotions (3 basic and 3 complex)? (2) Is there an interaction between children's matching of colors and their exposure to colors in their immediate family environments? For these purposes, we recruited a total of 30 young children, aged between 4 and 7 years old. First, we collected informed consent forms and demographics questionnaires from parents asking them about their children's color preferences and home environment to determine which colors children were exposed to at homes. Then we tested children individually in their preschools to administer storytelling, color-emotion matching and coloring, and color preference tasks. Descriptive analysis showed that red and blue were the most frequently selected colors as favorite by children at all age groups. In the color-emotion association task, we found that green was mainly associated with disgust and red was associated with happiness as well as anger and black was associated with sadness. Parents reported that white and light blue colors are the most common colors used in children's rooms. However, we did not find any associations between children's exposure to colors at home and color preferences individually. It was also observed that pink and purple are more frequently preferred colors by girls than boys. We discuss these findings within the framework of color theory and earlier findings in the literature with older age groups.

## **Gesture Presentation Perspective Relates Differently to Children's Spatial Performance**

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The presence of gestures and visuospatial materials enhances the children's spatial performance. While describing route descriptions to children via tangible visuospatial maps, using multimodal (i.e., speech-gesture combinations) description strategies enhance their recall compared to speech-only descriptions. Although it is an emergent context in online educational tools, no study so far investigated whether and how the perspective of a speaker's gesture presented to children relates to differences in spatial performance. Here, we investigate whether the perspective of multimodal input relates differently to 5-year-old children's spatial performance by varying the perspective of gesture presentation in virtual visuospatial maps. 5-year-old monolingual Turkish children (N = 52(29 girls), Mage=69 months, SD=9.2 months) were engaged in the Directions Task on a tablet screen. The task included visuospatial maps and videos of speakers describing routes in the map by three conditions: Speech-Gesture combination with a front-facing view, Speech-Gesture combination with an upper back angle, and Speech-only conditions with a front-facing view for control. Children were asked to verbally recall the route described to them in the videos after each trial. Children's verbal responses were coded for the total correct recall of target information in the route descriptions for spatial (e.g., behind) and location (e.g., house) information. After the Directions task, children engaged tasks to measure their perspective-taking (Frick et al., 2014), mental rotation (Frick et al., 2013), and relational thinking (Christie & Gentner, 2013) abilities. We used linear mixed-effect modelling regression analysis (lmer) to test the effect of presentation perspective and visuo-spatial abilities on children's recall of spatial and location information. Results showed a better recall of (1) spatial information as a function of perspective-taking ability when children received multimodal directions in front-facing perspective compared to upper-back perspective ( $\beta = 0.29$ , SE = 0.14,  $p = 0.04$ ); (2) location information as a function of an increase in both perspective taking and RMTS abilities and when children received multimodal directions in either perspective compared to speech only ( $\beta = 0.32$ , SE = 0.14,  $p = 0.02$ ). No other effects and interactions were significant ( $ps > 0.05$ ). Summarizing, the results show that children benefit from multimodal directions and their spatial abilities in their recall of visual-spatial maps. Yet, the effect of their spatial abilities varies based on the type of information they recall (spatial vs location). The results of this study underline the importance of multimodal input and presentation perspective in enhancing children's spatial performance.

## **Examining Life Scripts and Life Stories: University, Marriage, and Retirement Sub-Events in Turkish Culture**

**Melike B. Örs<sup>1</sup>, Aleyna Temizel<sup>1</sup>**

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Cultural life script theory proposes that people within the same culture have similar expectations regarding the life of a typical person from their own culture as to what kind of important events he or she is going to experience and the time that those events occur (Berntsen & Rubin, 2004). To investigate particular periods of life (e.g. university, marriage, and retirement life), in terms of culturally shared expectations, the present study examines whether life script provides a scheme for recalling processes of important events from those specific life chapter periods as well. Data were collected from Turkish undergraduate students (N = 245) for event-based life scripts of three different event periods (university, marriage, and retirement) and from individuals who experienced these life stages (N = 216) for event-based life stories. In the life script questionnaire, participants listed the 5 most important events that a typical person from their culture is expected to experience in their university, marriage, and retirement life separately while for the life story questionnaire, they listed the 5 most important events that they had personally experienced in that life stage. Additionally, questionnaires included event importance, expected age of event, emotional valence, and prevalence measures. The overlap and discrepancies between life scripts and life stories are investigated on the event-based level. Moreover, the characteristics of the event-based life scripts and life stories are examined in terms of the temporal distribution (within the age range of the event period) and emotional valence so that it is possible to investigate whether the event-based distributions show similar patterns with general life script and life story distributions. This study contributes to the literature by providing support for chronological remembering and not for the cultural-life script as a remembering guide in the case that a similar temporal distribution appears. Furthermore, the relationship between the typicality of the life story, meaning the amount that participants' event-based life stories resemble event-based life scripts, for three event periods and life satisfaction is also examined. Considering that the cultural life script is independent of the personally experienced events and is semantic knowledge, although overlaps between life stories and life scripts are expected, some deviations are also expected. In addition, regarding emotional valence, because the life script is the idealized version of life, more positive events can be observed in life scripts than in life stories. The present study will contribute to the literature by comparing life scripts and life story events for important sub-events (university, marriage, retirement) in



Turkish culture. It will provide a better understanding of the effect of autobiographical memories on the formation of cultural life scripts for sub-event periods.

## **The Role of Material Perception in Associative Recognition Memory**

**Öykü Göze Özdemir<sup>1</sup>, Aslı Kılıç<sup>1</sup>, Dicle N. Dövençioğlu<sup>1</sup>**

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The Role of Material Perception in Associative Recognition Memory Öykü Göze Özdemir, Aslı Kılıç, Dicle Dövençioğlu Department of Psychology, Middle East Technical University, Ankara, Turkey Material is a crucial feature of objects since recognizing it aids our interaction with the world, such as picking ripe fruits, appropriate clothes, or solid ground to step on. Previous research has shown that salient object features such as color or shape enhance memory processes, but none of them seem to specifically focus on the materials of objects. This study seeks to understand how the different material characteristics influence the encoding and retrieval of objects in associative memory. Specifically, we used an associative recognition task to understand the nature of associations formed when processing different material information. The experimental stimuli in this study contained images of everyday objects (3D models rendered in Blender) under four object categories (jug, goblet, water glass, mug) and four material categories (wood, metal, glass, stone). After training, these stimuli were used in an associative recognition task as items with four item pair conditions: material-congruent, material-incongruent, object-congruent, and object-incongruent conditions. The findings revealed a significant congruency effect in which the recognition sensitivity ( $d'$ ) for both material and object congruent conditions were higher than the material and object incongruent conditions. In the post hoc comparisons, a significant material effect was found; the congruent pairs rendered as wood material were better remembered than the metal, stone, and glass materials. There was no significant congruency difference between the material or object pairs. Our findings point to the crucial role of the material features of objects in associative recognition performance. Hence, they shed light, for the first time, on how individuals use object material categories while forming associations between different objects. Overall, this study opens up new research questions about the type of information that predominates creating object memory associations.

**The Predictive Processing Framework for  
Visual Perception of Human and Robot Actions:  
The Interplay of Short-Term and Long-Term Priors  
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In recent years, the predictive processing framework has emerged as a central theoretical construct in demonstrating the mechanisms underlying the visual perception of others' actions (Friston & Kiebel, 2009; Clark, 2013; Howhy, 2013; Rauss et al., 2011). With the increasing integration of robots into human environments, it has become essential to apply analogous principles to the investigation of visual perception concerning robots. Although a growing body of research shows that we extend our predictive abilities to the perception of robots, these studies did not distinguish the source of predictions (Saygin et al., 2012; Urgan et al., 2018; Urgan & Saygin, 2020). In principle, predictions can stem from our long-term knowledge (Bar, 2004; Oliva & Torralba, 2007) or can be induced by experimental stimuli that stand as short-term priors (Hsieh et al., 2010). In the present study, we investigate the relationship between short-term and long-term priors in visual perception of human and robot actions. The experiment included two animated characters, a human and a robot, that move either expectedly or unexpectedly based on our life-long experiences (long-term prior). We used these stimuli in a probabilistic-cueing paradigm (%75 validity) in which two types of short-term priors (cue) were introduced, one being visual and the other being kinematic, followed by animations of human or robot characters (target). Participants were engaged in a motion identification task, trying to decide between biological and mechanical motion. The target videos were introduced with different noise levels to disrupt the clarity of the visual stimuli. By making the reliability of the long-term prior weak, we lead participants to use short-term priors on the task (de Lange et al., 2018). By measuring reaction time and accuracy, we aimed to see the relationship between the short-term priors and the long-term knowledge. Our results show that when target videos comply with our long-term knowledge, short-term priors are not utilized. On the other hand, when target videos are unexpected, short-term priors come into play. More specifically, when participants watched a human agent moving biologically or a robot agent moving mechanically, it did not matter what cue (human or robot) they were shown beforehand; the measurements didn't significantly differ from each other. This suggests that short-term priors do not play much role when the target itself is expected but rather long-term prior knowledge overrides. On the other hand, when target video didn't comply with our long-term knowledge, type of cue did matter. For instance, when participants were presented with a human moving

mechanically, they responded faster and more accurately if preceding cue was a robot than if it was a human. This suggests the utilization of short-term kinematic prior when target was incongruent, which in turn implies the interaction of long-term prior knowledge and the short-term kinematic prior knowledge. As for the other incongruent condition, i.e., a robot moving biologically, a similar pattern was observed for accuracy but response times were not affected by the cue type. Overall, our results highlight the interplay of short-term and long-term priors in visual perception of others' actions.

## **Neural Integration of Speech and Co-Speech Iconic Gestures across L1-Turkish and L2-English: An ERP Study**

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Listeners integrate various communicative signals during face-to-face communication, such as speech and speech accompanying iconic gestures that represent object attributes, actions, and events. Earlier ERP studies with native listeners showed modulations of N400 amplitude in gesture-speech mismatch paradigms with more negative N400 amplitudes to gestures that convey mismatching than matching information to the accompanying speech (e.g., Kelly et al., 2007; Özyürek et al., 2007). Behavioral evidence also suggests that listeners might benefit more from gestures in their non-native than native languages (e.g., Dahl & Ludvigsen, 2014). However, how listeners neurally integrate speech and gesture in their L2, where they might process visual cues differently than L1, is yet to be explored (Drijvers & Özyürek, 2018). In this study, we recorded EEG activity from 24 participants (18 females, between 18 - 26 years of age) during a mismatch task where L1-Turkish and L2-English listeners watched a 1-second video of an action prime (e.g., a man chopping vegetables with a knife) followed by a 1-second video of another actress describing the action in the preceding action prime by uttering a word and making a gesture across 4 major conditions: (1) both-match (e.g., saying “chop” and gesturing “chop”), (2) gesture-mismatch (e.g., saying “chop” and gesturing “twist”), (3) speech-mismatch (e.g., saying “twist” and gesturing “chop”), (4) both-mismatch. The both-mismatch condition was further divided into two sub-conditions: (4.1) local match (e.g., saying “twist” and gesturing “twist”) and (4.2) local mismatch (e.g., saying “twist” and gesturing “shake”) to investigate the effect of the mismatch between concurrent speech and gestures independently. Participants were asked to detect whether the gesture (gesture-focused task) or the speech (speech-focused task) in the second video was related to the preceding action prime. Speech was presented in Turkish or English in separate blocks. The N400 amplitude was computed as the average voltage within the 390-517 ms in the Cz electrode and analyzed via a 2 language (L1-Turkish vs. L2-English) x 2 task (speech-focused vs. gesture-focused) x 2 gesture (match vs. mismatch) x 2 speech (match vs. mismatch) repeated-measures ANOVA. In the L1-Turkish speech-focused block, N400 amplitudes were more negative in the speech-mismatch and gesture-mismatch conditions compared to the both-match and both-mismatch conditions, indicating that mismatching semantic information from verbal and visual modalities interfered with semantic processing. However, no such N400 modulation was observed

in the L2-English speech-focused task. In the gesture-focused task, observing mismatching gestures yielded more negative N400 amplitudes compared to matching gestures both for L1-Turkish and L2-English, but only in the context of matching speech. Our results revealed that listeners are sensitive to semantic information conveyed through speech and gesture in L1, particularly when they attend to the spoken channel. During L2 comprehension, on the other hand, processing speech might be already cognitively taxing due to lower verbal proficiency, which possibly may have caused limited processing of the visual semantic cues. Overall, listeners differ in their processing of verbal and visual semantic context across their first and second language at a neural level.

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## The Effect of Self-Construal on Visual Mandela Effect with A Metacognitive Perspective

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The Visual Mandela Effect (VME) refers to collegial misremembering of popular images. For now, it is still not entirely clear why this phenomenon occurs. Visual memory has been given as a possible cause, but visual attention, which may affect this phenomenon, has not been studied. In this context, the effect of self-construal, which is related to visual attention, has been investigated on the VME. The study sample is based on voluntary participation and consists of adults between the ages of 18-35. The data of 221 participants were evaluated by considering the exclusion criteria. Participants were primed with either interdependent, independent self-construal, or control conditions. Participants were presented with focally and globally manipulated and original popular images and asked to choose the correct image. In addition, the reaction time, confidence rating about the answers, and the reaction time of confidence rating were measured. Visual manipulations differed significantly from each other in four separate measures: in local manipulations, participants made more mistakes than holistic manipulations, and the degree of confidence in the answers was higher. On the other hand, participants examined holistic manipulations longer than local manipulations and spent more time answering their confidence rating. The effect of the self-construal was only in the reaction time in the confidence ratings: the independent self-construal group spent more time on the confidence rating of the local manipulations, while the interdependent self-construal group spent significantly more time on both visual manipulations. Six images of VME, five local and one holistic, were found. The study showed the effect of visual manipulations on VME and gave information about the relationship of metacognitive structures with self-construal based on visual manipulations. The strengths, limitations, and contributions of the research are discussed together with the literature.

**Keywords:** Visual Mandela Effect, self-construal, visual attention, metacognitive functions

**The Role of Observing Co-Speech Hand Gestures on  
Retrieval of Spatial vs. Non-Spatial Information:  
Evidence from Narrative Retellings**

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Research shows that seeing gestures along with speech benefits language comprehension and learning, particularly for visual-spatial information (Dargue et al., 2019). Gestures also play a facilitating role in the encoding and retrieval of information in memory, with information presented bimodally was remembered better compared to unimodal presentations (e.g., Cook et al., 2008). Moreover, both iconic (i.e., gestures that represent object attributes, actions, and events) and beat (i.e., rhythmical gestures that bear no semantic meaning) gestures support encoding and recall processes (e.g., So et al., 2012). However, the role of observing different types of gestures with different semiotic functions (iconic vs. beat) in the encoding of information across different contexts (spatial vs. non-spatial) is yet to be explored. This ongoing research aims to examine how seeing iconic vs. beat gestures affects listeners' encoding of information in their subsequent narrative retellings across spatial vs. non-spatial contexts. Based on power analysis, we plan to recruit a total of 72 native-Turkish speakers (22 recruited so far). In the study, there are two different narratives: one spatial and one non-spatial. Each narrative is recorded in three conditions: (1) iconic gestures, (2) beat gestures, and (3) no gesture, yielding six different narrative videos in total. Each narrative contains twenty-three critical information units and gestures are produced along with these units. This is a mixed-design study with context type (2: spatial vs. non-spatial) as the within-subjects factor and gesture type (3: iconic vs. beat vs. no-gesture) as the between-subjects factor. All participants watch both narratives (in counterbalanced order) only in one of the gesture conditions. Participants are instructed to watch the video carefully by informing them that they will be asked to retell the story in detail. After watching the video, they are given a distractor task of basic calculation for three minutes. Following this, participants are asked to retell the story in as much detail as possible. The same procedure is applied for the second narrative. At the end, participants complete the Object-Spatial Imagery and Verbal Questionnaire to assess individual differences in spatial imagery and verbal cognitive styles (Blazhenkova & Kozhevnikov, 2009). We will assess (1) the number of critical information units mentioned in retellings, (2) the channel in which the critical information is conveyed (in speech, in gesture, or bimodally in both speech and gesture), (3) the number of overall iconic and beat gesture use in narrative retellings. We hypothesize that (1) participants in the iconic gesture condition will mention more critical



information units compared to ones in the beat and no-gesture conditions, (2) in the iconic gesture condition, participants will mention more critical information units in the spatial than non-spatial narrative, and (3) participants will tend to mention critical information units in the corresponding channel through which the information is presented (e.g., participants in the iconic gesture condition will use more gestures that convey the critical information compared to ones in the beat and no-gesture condition). We will present preliminary results in the symposium and discuss them considering the role of gestures in learning and memory across different contexts.

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## Timing of Footstep Sounds Alters Perceived Speed of Biological Motion

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Humans and many other species interact with the external environment through the integration of sensory information from different modalities. In line with this ecological observation, it has been shown that multisensory integration and crossmodal interactions play important roles in perception and behavior. In particular, motion perception stands out as a multisensory process, as moving objects typically stimulate multiple senses simultaneously, such as sight and sound, forming a unified percept. Previous research revealed that audiovisual interactions and binding of information in the temporal domain significantly affect various aspects of motion perception. For instance, Kafaligonul and Stoner (2010) found that the timing of brief static sounds (i.e., auditory time intervals) significantly modulates the perceived speed of apparent motion elicited by brief visual flashes (see also Ogulmus et al., 2018). Notably, prior studies have primarily utilized simple stimuli, such as visual flashes and auditory clicks, to investigate the multisensory nature of motion perception. In the present study, we aimed to evaluate and test these findings under more ecologically relevant scenarios. We examined whether the effects of auditory time intervals and audiovisual interactions exist in the perception of biological motion. In our design, we utilized step sounds and point-light walkers (PLWs) and measured the perceived speed under different time interval conditions. We initially evaluated the participants' ability to discriminate the speed of two consecutively presented unisensory PLWs with varying visual time intervals. Subsequently, we paired two consecutive PLWs having the same visual time intervals with step sounds of varying temporal intervals to test whether the timing of these sounds affects the perceived speed of biological motion. Our results confirmed that the participants are able to discriminate the speed of PLWs for varying visual time intervals. More importantly, the behavioral findings indicated that the perceived speed of PLWs is modulated by auditory time intervals demarcated by footstep sounds. Overall, these findings demonstrated that audiovisual temporal processing extends to ecological motion perception and provide supporting evidence that the binding of sensory information and crossmodal interactions are essential components of perception and cognition. Support: The Scientific and Technological Research Council of Türkiye (BIDEB 2211 Program). **Keywords:** crossmodal interactions, multisensory integration, motion perception, biological motion, temporal processing

## **Investigating The Effects of Several Factors on Audiovisual Saliency in Omnidirectional Panoramic Dynamic Scenes**

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Many techniques have been developed to estimate salient areas from visual or audio-visual stimuli, progressing from images to videos, mono and multi-channel audio, 2D to 360° content, and VR devices. Current 360° video models with spatial audio do not match human performance. Saliency, linked with low-level signal features, drives attention, but separating it from top-down effects is difficult. To improve saliency modeling, high-level factors, as well as the low-level features should be considered. In this study, we explore how observer behavior changes over time with respect to the effects of color and audio modalities, and how semantic audio and place categories influence observer saliency through conducting a controlled experiment and creating a novel dataset. Wearing an HTC Vive VR headset with an in-built eye-tracker, participants watched a curated set of panoramic videos of 30 seconds each with spatial audio. The videos were chosen to denote equal samples of several place and audio categories. The place categories included (i) indoors, (ii) outdoors human-made, (iii) outdoors natural. The audio categories included (a) human speech, (b) music-instrument sounds, (c) vehicle sounds. Each video was modulated to present them in grayscale/colored color modes and spatial/mono/mute audio modes. A total of 102 participants watched 81 videos (9 from each category combination) in random color/audio modes in a free-view task. Eye fixation locations of each participant per stimuli were used to compute inter-subject congruency scores through several similarity measurement formulas. Then were analyzed the effects of time, color mode, audio mode, place categories, and audio categories over these scores. The results demonstrated that congruency scores significantly increased over time, indicating convergence in user observation behavior over time. Whereas color modulation didn't yield any significant effect, audio modulation yielded a strong effect on congruency scores, suggesting that audiovisual saliency is mainly regulated by audio content but does not depend much on color. The audio category showed both a medium main effect by itself, and a significant interaction effect with audio modulation on congruency scores. Moreover, the main effect of place category was not significant but its interaction with the audio categories and its interaction with time yielded significant effects. Overall, these findings hint that although effects arising from audio and place category combinations might be due to the correlation with other semantic content of the videos, the interaction of audio category and audio modulation results suggest that the semantic content of the audio itself is important in determining saliency.

# **Prediction Errors About Perceptual Load Delay Behavioral Responses in the Presence of Salient and Less Salient Distractors**

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Our attentional resources are allocated to the various aspects of the environment based on the context, and predictive coding has been used as a model to explain the interaction between sensory-based information and top-down expectations in visual attention (Spratling, 2008; Rauss et al., 2011). When presented with a task, our cognitive resources are distributed based on various factors, which include task difficulty, playing a significant role in determining the cognitive workload that may be allocated to the other features of the environment. On the other hand, the saliency of the environmental stimuli is also hypothesized to be capturing the attentional resources of the individuals involuntarily, and thus, it is thought to be playing a crucial role in attentional resource allocation. The current study investigates the role of predictive processing of a particular task and the task's difficulty in selective visual attention in the presence of various distractors. Utilizing a letter search task, we provided brief cues about the upcoming task's difficulty, and participants were asked to detect the target letters regardless of the cue congruency and presence of distractors, which made the distractors task-irrelevant. We aimed to control for low-level features of distractors across experiments and investigated whether predictive processing about task demands may cause a difference in behavioral measures in the presence of semantically salient distractors in Experiment 1 (faces) and semantically less salient distractors in Experiment 2 (Gabor patches). Results of these two experiments showed that prediction errors about the task demands delayed behavioral responses in both studies. We observed that all independent variables, which are task difficulty, cue congruency, and distractor presence, affected reaction times in both experiments, but cue congruency interacted with distractor presence only in Experiment 1. Here, we argue that though predictive processing plays a role in attentional resource allocation in the presence of both semantically salient and semantically less salient distractors, the underlying processes may be different from each other as the saliency level interacts with the cue congruency.

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## **Mice Monitor the Magnitude and Direction of Their Temporal Errors**

**Tutku Öztel, Fuat Balci**

Animals often engage in representationally guided goal-directed behaviors. These behaviors are thus also subjected to representational uncertainty (e.g., timing uncertainty during waiting), previously shown to adaptively guide behaviors normatively. These observations raise the question of whether non-human animals can track the direction and magnitude of their timing errors (i.e., temporal error monitoring). Only a few studies have investigated this question without addressing the key components of temporal error monitoring (e.g., due to differential reinforcement of metacognitive judgments and primary task representation). We conducted the critical test of temporal error monitoring in mice by developing a novel temporal reproduction task that exponentially favored temporal accuracy and minimized the contribution of sensorimotor noise. The response rate for an upcoming probabilistic reward following the timing performance was used as a proxy for confidence. We found that mice exhibited high reward expectancy after accurate and low reward expectancy after inaccurate timing performance. The reward expectancy decreased symmetrically as a function of deviations from the target interval for the short and long reproductions; pointing to the ability of mice to monitor the direction of their temporal errors. These findings suggest a complete temporal error monitoring ability for mice with human-like metacognitive features.

## **Causal structures in Couple Dialogues:**

### **Relations with Paralinguistic features**

**Pınar Öztürk Atlı<sup>1</sup>, Aslı Aktan-Erciyes<sup>1</sup>**

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Causal structures in Couple Dialogues: Relations with Paralinguistic features Pınar Öztürk Atlı & Aslı Aktan-Erciyes Kadir Has University Causal reasoning facilitates learning and categorization across various domains of human interest (Rehder & Hastie, 2001), enabling us to understand the past, anticipate the future, and exert control over the present (Weiner, 1985), and contributing to making consistent decisions (Pennington & Hastie, 1992; Read, 1987). Our ability to reason about the causes and effects of events plays a pivotal role in these cognitive processes. Languages differ in their use of syntactic structures for expressing causality. For instance, for verbs, Turkish encodes two types of causatives: lexical causatives, which are words that inherently mean causality (e.g., topla-mak,), and morphological causatives, which are formed by adding a transparent causative morpheme to the verb stem (e.g., yapTIRmak, to get something done). Although causality has been extensively studied in the literature, its frequency of use in naturalistic dialogues has not yet been investigated. In order to fill this gap, we asked: Is there any association between the use of causal structures and paralinguistic features in dialogues such as gaps (Two people remaining silent and then the other taking the floor.), turn-taking (Number of speaking turns), turn-taking duration (Speaking turn duration) and overlaps (Conversations at the same time)? Seventy-two couples participated in the study. To examine the frequency of causality, we analyzed 24 couple dialogues (Mean age of females: 22.5; Mean age of males: 24). The data is currently undergoing coding, and the preliminary results are derived from these 24 couple dialogues. Couples were instructed to discuss negative events for 15 minutes. We coded 24 dialogues based on their linguistic complexity, categorizing them as either complex or simple (clause). In line with the study's objectives, we categorized causality into three types: lexical, morphological, and conjunctions (e.g., because). To determine the proportion of causal structure usage, we divided the total number of causal structures by the total number of clauses used. The paralinguistic features were derived from audio recordings by two research assistants focusing on selected paralinguistic features in speech, considering indicators such as gaps, overlap count, turn-taking count, and duration. We ran zero-order Pearson correlation analyses for 24 couples. The results indicated that there was no significant relation between the causal word proportion used either by women or men and paralinguistic features in these dialogues. This suggests that the use of causal language might not be associated with paralinguistic features in this context. Nonetheless, there was a significant relation observed

between the causal word proportion and overlaps in the dialogues that approached significance  $r(23) = .38, p = .090$ . These preliminary results might be expanded when all data is coded. The present study might yield important insights that clarify the relationship between paralinguistic elements and causal language in communication.

## **Goed or Went? Interference Between Regular and Irregular Verbs in L1 and L2**

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Language is complicated. Grammatical rules entail both regularity (e.g., English present tense, “going”), and irregularity (e.g., English past tense, “go-went”, Turkish Aorist “al-alır”). One possibility is that a single mechanism is responsible for regulars and irregulars with a similar-sounding lexicon of overregularized forms interfering with production (e.g., “goed” vs. “road”; Maslen et al., 2004). The other possibility is that two distinctive processes with regular as the default interfere with irregular production (Pinker & Ullman, 2002). Adults can easily switch between regulars and irregulars in their native language (L1; e.g., Ferreira et al., 2020), hinting at a single processing, but second language (L2) studies found a switching cost (e.g., Jiang et al., 2021), possibly indicating distinct processing. We thus examined whether and how regular and irregular morphology involves different production processes in L1 and L2 and asked whether language relies on a unitary system or involves multiple mechanisms in L1 and L2. We also tested the contributions of Executive Functions (EFs; verbal and visual Working Memory, and Inhibitory Control). Forty-seven Turkish adults verbally produced the Turkish (L1) Aorist and English (L2) past tense. Switching costs between regulars and irregulars were examined as the response times to irregular-irregular-regular (IIR), regular-irregular-regular (RIR), regular-regular-irregular (RRI), and irregular-regular-irregular (IRI) sequences. In L1, but not in L2, switching from repeating two irregular verbs and then to a regular (IIR) took longer than switching between the two (RIR;  $B = -.04$ ,  $SE = .02$ ,  $p = .006$ ), regardless of participants’ L2 proficiencies. Yet, there was no cost between switching from two regular verbs to an irregular (RRI) and switching between the two (IRI) in either language ( $B = -.002$ ,  $SE = .02$ ,  $p = .890$ ). The higher cost in IIR compared to RIR suggests the difficulty of switching back to the regular form when initially inhibited, possibly indicating a regular default mode in L1. Mere task repetition in IIR cannot explain our results as there was no cost between RRI and IRI. We also found that verbal Working Memory predicts the overall switching performance ( $B = -.03$ ,  $SE = .01$ ,  $p = .017$ ). Our findings, however, contrast with previous studies as Jiang et al. (2021) found switching costs in L2. One possibility is that, unlike the comprehension task by Jiang et al. (2021), we administered a production task, which might have increased the processing demand, especially in L2. In fact, the response times in L2 were overall slower. Future research may consider demanding participants to respond as fast as possible and/or testing more proficient L2 speakers. Overall, this study was among the first to test (late) bilingual



adults on regular and irregular linguistic processing on a switch cost task in both L1 and L2 while also considering the unique contributions of EFs. The results support the idea of distinct processings for regular and irregular production, with regulars being more of a default mode in L1. In L2, a higher cognitive cost of irregulars was not caused by regulars, possibly implicating a more uniform system.

## **Depends on Who Does What! Real-time Implicit and Explicit Measurements of Agent and Action Effects on Mind Perception**

**Tuğçe Nur Pekçetin<sup>1</sup>, Şeyda Evsen<sup>2</sup>, Serkan Pekçetin<sup>1</sup>, Burcu A. Urgan<sup>2</sup>**

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The interest in cognitive science about the cognitive abilities of agents, including artificial ones like social robots and chatbots, has grown as these agents become more integrated into everyday social interactions. Research in human-robot interaction (HRI) has provided insights into mind perception triggered by robots, yet improvements are needed in two key areas. First, the reliance on explicit measurement methods such as surveys has led to inconsistent findings that fall short of clarifying the processes behind mind perception. Second, the extensive use of indirect stimuli like sentences, pictures, or videos in laboratory settings calls for research with higher ecological and external validity. In this study, we systematically explore mind perception within the HRI context, using real-life action stimuli in a lab environment and employing both implicit and explicit measurement methods. Our investigation focuses on understanding mind perception from two angles: the participants as perceivers and the perceptions formed about a humanoid robot and a human as the perceived agents. On the perceiver side, we examine the influence of generational and individual differences on attributing mental capacities to social robots. To these ends, we recruited participants from four age groups and administered seven scales to assess factors related to mind attribution capabilities, such as loneliness and body consciousness. Regarding the perceived agents, we manipulated the agent type and the nature of their actions, presenting four communicative (e.g., salute) and four non-communicative actions (e.g., drinking) validated in our previous research. We collected data from 160 participants, ensuring equal representation from each generation—young, adult, middle-aged, and elderly. After completing the scales and training sessions, participants proceeded to the Real-World Implicit Association Task (RW-IAT) we developed for this study, followed by a counterpart explicit assessment. In the RW-IAT, participants observed live actions performed by the Pepper robot and a human, then selected the level of Agency and Experience—two dimensions of mind perception—that they attributed to each action, using a special OLED screen. The screen operated in dual modes: transparent for action viewing and opaque for evaluations. We recorded participants' responses, response times, and mouse movements. The explicit task involved evaluating Agency- and Experience-related concepts through statements on a 1-7 Likert scale. We have analyzed the results from the RW-IAT and found significant effects of both action and actor type on behavioral metrics and participant responses. Specifically, action type predominantly influenced Agency capacity evaluations, while actor type

had a more noticeable impact on Experience capacity evaluations. Generally, communicative actions and the robot actor tended to elicit longer response times and more hesitations. However, these behavioral indicators are often not apparent or may even appear reversed when only verbal responses are considered. This discrepancy highlights the importance of integrating behavioral data with verbal feedback to understand the underlying processes of mind perception. As the next steps, we will compare implicit and explicit task results and examine the impact of individual and generational differences. Our study, with its innovative experimental setup and methodology, aims to enrich the discourse on the factors influencing mind perception.

## Neural Responses to Different Fat-Content Drinks In Healthy Weight Versus Overweight

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Motivation The modern lifestyle promotes overeating and obesity. Environmental, behavioral, social, and emotional factors influence obesity. High-fat food consumption particularly contributes to obesity. Fat provokes responses in gustatory, somatosensory, olfactory, and food reward systems, however, few studies show different neural responses by fat content. According to the reward deficit theory, there may be decreased responses to fat stimuli in obesity and this perpetuates the drive to eat high-fat foods. To curb obesity and develop treatments, it's important to assess the impact of fat content in the brain and to investigate differences in neural responses to fat between participants with healthy weight and overweight. Method and materials 19 participants with healthy weight (14 women and 5 men) with an average BMI of 22.12 (+/- 1.56 SD), and an average age of 25.05 (+/- 6.22 SD), and 9 participants with overweight (5 women and 4 men) with an average BMI of 27.17 (+/- 1.96 SD), and an average age of 25.33 (+/- 5.34) were recruited for the study. Participants laid down inside the MR bore and received high-fat, low-fat, water, or tasteless drinks from pumps. A Siemens 32-channel 3.0T, Trio TIM scanner was used for fMRI scans. For EPI images PAT mode of GRAPPA and multiband acceleration factor PE = 2 are used. For analyzing data: MATLAB (R2019b), SPM 12 toolbox, and TOPUP from FSL (for distortion correction) are applied. Results In participants with healthy weight, both low-fat and high-fat drinks triggered neural responses in the mid-dorsal insula/frontal operculum, precentral gyrus, thalamus, and cerebellum. There were no significant differences between low-fat and high-fat neural responses. Neural responses in the mid-dorsal insula of participants with healthy weight increased with a higher fat content of the drink relative to the participants with overweight, who displayed lower responses. This pattern of neural responses supports the hypothesis of reward deficit to fat stimuli in the insular cortex.

**Keywords:** fMRI, food reward system, insula, thalamus, precentral gyrus, cerebellum

## **Characterization of Gaze Patterns in Cerebral Visual Impairment through a Visual Search Task**

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Cerebral visual impairment (CVI) is a brain-based visual dysfunction resulting from damage to retrochiasmatic pathways and cerebral structures. Individuals with CVI exhibit various higher-order visual deficits, particularly in visual-spatial processing. In a previous study, visual search performance was investigated in this group using a virtual-reality-based task with eye tracking (Manley et al. 2022). Participants were asked to locate a target toy in a toybox, with task demand levels manipulated by varying the number of distractor toys. Results demonstrated that participants with CVI exhibited lower accuracy and longer reaction times compared to neurotypical controls. In the current study, we aimed to further characterize gaze patterns and impaired visual search behavior in this dataset by analyzing the number of fixations on objects and the duration of these fixations in the CVI group. We found that CVI participants fixated on more objects within a trial than controls. Even when they fixated on the target, they returned to distractors more frequently than controls. Additionally, the target was usually not the most fixated object for the CVI group in a trial. These results suggest that the longer reaction times observed in the CVI group may not be due to slower visual scanning but rather difficulties in suppressing distractor information.

## **Cognitive Modeling of Prospective Interval Timing with ACT-R**

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Attention is an important cognitive process in prospective interval timing. According to the Attentional Gate Model (AGM), which aims to explain the effect of attention on time perception, in situations involving temporal awareness, we direct our attention toward time more and perceive time as longer than it is actually. On the other hand, in complex and relatively more difficult tasks, we pay less attention to time and perceive the time interval as shorter than it is (Block & Zakay, 2006). In this study, this prediction of the Attentional Gate Model was tested on both human and cognitive architecture. Cognitive architectures are tools that help explain the processes underlying cognitive functions such as time perception. The ACT-R is one of the most widely used psychologically oriented cognitive architectures and it provides a theory about how human cognition works. (van Rijn & Taatgen, 2008). ACT-R was used in this study to understand prospective time perception. The study aims to examine prospective interval timing performance and to test the model's fit with human participant performances. In the study, the task difficulty was used as a variable to understand the effect of attention on prospective interval timing. For this, a dual-task timing task was used and participants were asked to perform easy and difficult tasks that were not related to time simultaneously with the interval timing task. To evaluate human and model interval timing performance, the experimental setup of Taatgen, Anderson, and van Rijn's study was reconstructed (Taatgen, Anderson and van Rijn, 2007). In the experiment, a dual-task timing task was applied to the participants. In this task, there were two different levels of difficulty, easy and difficult. In addition, a learning effect was expected in the form of gradual improvement in the time estimation performance of the participants and the model. These two expectations were evaluated in terms of both participant performance and model performance, and the agreement between participant and model performance was tested. In summary, this study examines the effect of attention on prospective time perception and evaluates the performance of the temporal module of the ACT-R in modeling this effect. As a result of the analyses conducted to investigate the effect of learning on model and human interval timing performance, the time interval learning effect was observed in the model but not in the participants. Investigating the participant data, task difficulty was not found to affect time estimation. In model data, it was concluded that task difficulty caused a change in time estimation. For goodness of fit between the model and behavioral data, R-square and RMSE statistics were examined. The model did not yield a good fit to the behavioral data. It is thought that the difficulty of the task, the small number of participants, and inadequacy of the temporal module parameters may account for this poor goodness of fit. The current study may

represent an attempt to contribute to the understanding of time perception by using cognitive models implemented in a cognitive architecture.

# **Radicalizing The Radical: Towards A Radically Externalist Biology of Cognition**

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Villalobos and Silverman (2018) claims that even the most radical accounts of radically embodied cognition (REC) are open to internalism which they construe as “the idea that the material realisers (or vehicles) of cognitive states and processes reside, always and entirely, inside the organism’s boundaries (paradigmatically inside the head).” In contrast, externalism is the opposite view. Authors state that, even the most radical approaches in externalism distinguish between what constitutes cognition – even though constituents might be ‘external’ - and what does not. This creates a systemic asymmetry in which cognitively constitutive parts carry the explanatory burden and become primary against the non-constitutive external causes, hence opens up a space for possible internalist interpretations where only the boundary shifts but the division itself remains. They identify this as an important problem for the coherence and revolutionary claims of externalist approaches and argue that Maturana’s Autopoietic Theory (Maturana and Varela, 1980) might provide foundations for a ‘secure’ externalist theory since it rejects any kind of concept that would lead to such asymmetry, e.g. representation, agency, intentionality, etc. From this point of view, one should focus on structural couplings between organism and environment and should not prioritize neither organism nor environment in our explanations. However, they do not develop Autopoietic Theory into a working framework for further empirical research. In this presentation, drawing inspiration from Autopoietic Theory and debates in the philosophy of science, I will outline the foundations of a normative framework that answers the questions of why and how we should approach biology and cognitive science for a complete externalism. In doing that, I will try to show why it is important and required to integrate an anti-realist conception of science and knowledge (Rorty, 1979; Stengers, 2023; van Fraassen, 1980) with mechanistic explanation (Craver, 2015; Craver and Kaplan, 2020; Colombo, Hartmann, and van Iersel, 2015). I will further argue that the integration can provide tools for evaluating conceptual toolkits of different research traditions such as versions of enactivism or cognitivism, and even for a method of creating new concepts when needed. The project outlined here may also have implications for the unity of science, the concept of naturalization and emergence. Lastly, I will highlight the primary implications of the framework proposed here for biology and cognitive science.



## **Why Do Dogs Follow Human Pointing Gestures: Referential Communication or Attentional Bias?**

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Humans use pointing gestures to communicate with dogs. However, efforts to study of how dogs receive this communicative signal have produced ambiguous results. Large-sample studies that present dogs with a choice between two locations have shown that dogs choose an option that a human point to above chance levels, but just barely. One problem with such studies is inherent in presenting only two options: a too-high probability of choosing correctly by chance weakens the signal. After replicating the 2-option task, this study changed the task's parameters by presenting dogs with six options, while pointing to one. This should reduce the number of correct choices made by chance, but not affect instances of genuine point following. We find that dogs chose the location pointed to a barely above chance rates in both the 2-choice and 6-choice versions of the task. This pattern is discouraging of the belief that dogs interpret human pointing as a communicative act. Rather, these results are more consistent with an attentional bias by which something about the act of pointing draws the dogs' attention subtly to one side of the arena. Additional patterns that become visible with more than two options bolster this interpretation. Dogs chose the correct side of the arena and succeeded on second choices more often than expected by chance. All considered, dogs appear not to interpret human pointing as referring to a specific location, supporting the view that dogs lack the capacity for referential communication.

## **Mental Workload and Time Estimation: Combining Predictive Models, Performance, and Survey Data Using Bayesian Models**

**Aysun Saydam<sup>1</sup>, Barbaros Yet<sup>1</sup>**

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Mental workload measurement is one of the most common usability testing methods as it aims to optimize mental workload to maximize usability. Performance measures such as error rates, task completion time, and response time are also crucial metrics to test the usability. Mental workload and task completion time can be estimated prospectively using cognitive predictive models. Cognitive predictive models such as GOMS study the sequence of atomic cognitive and motor operations required for completing different tasks on an interface and combines the workload and time estimations of these operations. These models can provide reasonable estimates for a wide variety of user interface tasks when the atomic tasks are rigorously measured. However, these models only make estimation for an average expert user without capturing the differences between groups and individuals. Self-report measures ask the user their personalized assessment of the workload hence, they can be helpful in assessing group and individual differences. But the subjective nature of surveys makes them prone to errors due to response style biases and they can also be laborious and time-consuming since they require considerable human effort. This study aims to make personalized estimations of mental workload and task completion time by combining cognitive predictive models, self-report measures, and execution time data. We use Bayesian models to revise the estimates of a cognitive predictive model with execution time, and the subjective data collected from a workload survey. We tested our approach with the participation of 20 people on two user interfaces in the defense industry domain which are tank driver interface and torpedo counter measure system. We chose Cogulator as a predictive cognitive model that provides a time estimate in seconds and a workload estimates in 1 - 10 rating scale for a modelled task, and adapted Bedford scale for subjective workload assessment. While the workload model updates the workload estimations obtained from Cogulator based on the Bedford scale, the time model updates task completion time estimates obtained from Cogulator based on recorded task execution time. According to the analysis results of models' predictive performance, our models estimated at least two times better than the Cogulator. The results show that the proposed approach can capture the differences between both tasks and users, and it can make personalized performance and workload assessments based on limited amount of data.

## **Comparing The Effect of Single Outliers and Outlier Clusters on Trend Estimation in Scatter Plots**

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Scatterplots are commonly used data visualizations to depict relationships between variables. There are inconsistent findings in the literature regarding how outliers in scatter plots affect trendline estimates. Correll & Heer (2017) found no difference for trendline estimations between the no-outlier and the outlier conditions consisting of a separate group of items creating an outlier cluster. However, Ciccione et al. (2022) showed that single outlier points might be included in trendline estimations. To investigate whether an outlier cluster was perceived as a salient and separate unit and thus excluded from the remaining data points, we directly compared the effects of single and multiple outliers on trendline estimations, controlling for correlation strength, outlier position, and trend direction. Before the task, participants were given short texts about how to interpret scatter plots in general and how they are used in daily contexts. The existence of outliers and whether to include or exclude them was not mentioned in these texts. After the information part, participants were asked to complete a short practice task in which they received feedback regarding whether their trend lines were statistically accurate or not. None of the graphs in the practice phase have included any type of outliers. After the practice phase, participants have completed the main phase of the experiment. In both the practice and main phases, participants were exposed to each scatter plot for 200 ms. After each scatter plot, they were asked to draw a trend line for the graph they had seen on a blank screen. We found that participants included single outliers more than they've included outlier clusters into the trend lines; this pattern was similar across all other control variables; suggesting grouping might play a role in this process.

## **The Role of Visual Imagery Level and Gesture Production on Single-Time and Repeated Past and Future Events**

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Visual imagery is one of the essential elements in autobiographical remembering since it is strongly associated with episodic details and phenomenological characteristics of autobiographical memories, such as the feelings of reliving and vividness (Rubin et al., 2003). Individuals with lower visual imagery ability recall fewer details about the events and rate them as less vivid (D'Argembeau & Van der Linden, 2006). Moreover, due to the involvement of similar neural and cognitive networks, future thinking holds similar properties to episodic remembering. Thus, visual imagery ability is significantly correlated with both recalling details about past events and details in future thinking. On the other hand, the relationship among gestures, autobiographical memories, and future thinking still needs more research. The association between episodic details of autobiographical memories and representational gesture use was significant. However, no significant results related to future thinking were revealed. In this study, we investigated the associations between individual differences in visual imagery and gesture use in repeated and single-occurrence memories and future event narratives. Moreover, we expected to find the role of gesture production in the relationship between visual imagery and episodic event details. In this study, 36 participants will be tested in a  $2 \times 2$  within-subjects design (single occurrence and repeated events  $\times$  past and future). We used Event Questions, Vividness of Visual Imagery Questionnaire (Marks, 1973), the Mental Imagery Test (Di Nuovo et al., 2014), and the Autobiographical Memory Questionnaire (Rubin et al., 2003). This study will contribute to our understanding of gesture production in different event types (single and repeated) events and future thinking as well as their relationship to visual imagery skills. We are currently collecting and coding the data.

**Keywords:** Autobiographical memory, single-time events, repeated events, visual imagery, future thinking, gesture production

## **Recipient Design in Human-Robot Interaction**

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Recipient design refers to tailoring the information in one's message to an interlocutor's characteristics and relevant requirements, based on knowledge, assumptions, and beliefs shared with the interlocutor. Human-robot interaction (HRI) provides a testbed for understanding recipient design in highly uncertain and unpredictable contexts, given the limited knowledge people have of robots. People then have to discover how to interact with a robot by relying more on the information that will potentially emerge throughout their interaction with the robot. Most studies investigating recipient design in HRI used free interaction paradigms where a social robot with limited sensory capacities was introduced to participants. A common observation is that people indeed adapt their speech based on the inferred capabilities of the robot. Yet, the extent and nature of this adaptation is not fully understood. The present study employs an experimental approach to investigate speech design to a robot vs. human recipient. In a computerized experiment, participants are asked to describe words (nouns only) either to a robot or to a human recipient that will guess the target word. The game is played through an interface where participants see the target words and pre-recorded videos of the recipient. While participants describe a word, the video shows the recipient as listening to them. When the description is complete, the video shows the recipient as guessing the word. The videos are continuously displayed to create the impression of a real-time interaction. Half of the target words refer to concrete objects whereas the other half to abstract concepts. The recipient makes incorrect guesses in half of the trials to avoid bias due to competence. Participants' descriptions will be coded for linguistic complexity and word frequency. We expect to find less complex utterances with decreased number of different words in descriptions produced for the robot recipient compared to those for the human recipient. Given the well-reported differences in people's initial inferences regarding the capabilities of social robots in HRI literature, we will code the word descriptions of the first five trials for linguistic complexity and word frequency for each participant and use this variable to control for individual variation in our analyses. Last, an exploratory analysis will be conducted to seek real-time changes in recipient design. The descriptions produced for the trials following a correct trial (i.e., after-correct trials) and for the trials following an incorrect trial (i.e., after-error trials) will be compared in terms of linguistic complexity and word frequency. Our study will contribute to the experimental investigations of recipient design in HRI with its novel experimental design that simulates real-life interaction between a human and a robot. We argue that shifting the focus from investigating the influence of

specific changes in robot characteristics on interaction to taking human-robot dyads as a social unit of interaction will prove useful for understanding recipient design in HRI.

## **Multitasking Among Informal Caregivers:**

### **Example from the Netherlands**

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Background: As the population worldwide ages, more people will be diagnosed with dementia in the coming years. Most of these people are cared for, certainly in the early stages after diagnosis, by their spouse or other family members, so-called Informal Caregivers (ICs). ICs have many roles and responsibilities in patients' lives, including keeping track of medications, appointments, housekeeping, etc. This is often in addition to other demands, including work, grandparenting, and more. Many ICs struggle to find a balance and have a higher likelihood than non-caregivers of experiencing caregiver burden (CB), depression, and anxiety. There is a gap in the literature regarding how (and if) a combination of different caregivers' responsibilities affects CB. This study investigates caregiver burden in multiple dimensions, including employment, social support, and cohabitation with the patient. Methods: 201 ICs living in the Netherlands were tested on a battery of questionnaires, including the CRA and HADS, and a variety of background variables, including employment, social support, financial status, and cohabitation with the patient. A composite score to assess what we refer to as 'multitasking' was created per IC, including cohabitation (living with the patient or not), work status (working full-time, working part-time, not working), and social support (high support, low support). Results: A regression analysis will explore the relationships between this composite score and the dependent variables (depression, anxiety, caregiver burden). Discussion: We expect that ICs who score on the composite score will be more likely to have caregiver burden, anxiety, and depression. We also expect women's composite scores to be higher than men's.

## **Boundedness is Represented in Visual and Auditory Event Cognition**

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Humans divide their continuous experience of the world into discrete events with a beginning and an end (Zacks & Tversky, 2001). Events can be classified into two categories based on whether they have predictable boundaries. Bounded events have predictable endpoints or “built-in terminal points” (Comrie, 1976) marking the event boundary. By contrast, unbounded events have no predictable endpoints and may terminate at any moment. Humans can distinguish between bounded and unbounded events based on visual information (Ji & Papafragou, 2020a; 2020b). The principles and constraints that apply to the basic units of human experience in the visual modality may have counterparts in the auditory modality. This relationship is evident in the domain of objects that share critical similarities with events (Papafragou & Ji, 2023). Here, we tested whether the auditory information would be sufficient to distinguish between bounded and unbounded events. Our sample consisted of adult native speakers of Turkish ( $n = 45$ ,  $Mage = 21.10$  years). The stimuli consisted of eight pairs of audio and video recordings depicting bounded and unbounded events. We manipulated two aspects of event categorization in a category identification task: (i) the modality and (ii) the (un)boundedness categories. Half of the participants were assigned to the visual condition, and the other half to the auditory condition. Within each modality group, we marked bounded events for half of the participants and unbounded events for the other half. In the training phase, participants watched or listened to four pairs of bounded and unbounded events. After playing both events, we told them the bounded or unbounded event would receive stars. In the testing phase, participants watched or listened to two bounded and two unbounded events across four trials. After each event, we asked them whether the video would receive stars. If participants extracted the (un)categories during the category identification task, they should be able to extend these categories to new examples in both modalities. To test this prediction, we tested to what extent the accuracy of category identification differed across visual and auditory modalities, as well as based on (un)boundedness categories. A glmer model revealed a significant intercept, indicating that overall, participants were more likely to respond correctly than incorrectly ( $\beta = 1.315$ ,  $SE = 0.222$ ,  $z = 5.926$ ,  $p < .001$ ). However, there were no significant differences in categorization accuracy for Bounded and Unbounded events ( $\beta = -0.407$ ,  $SE = 0.424$ ,  $z = -0.960$ ,  $p = .337$ ) and across Auditory and Visual modalities ( $\beta = 0.160$ ,  $SE = 0.423$ ,  $z = 0.378$ ,  $p = .706$ ; Figure 1). Participants extracted bounded and unbounded categories equally accurately in visual and auditory modalities. Summarizing, our participants could categorize bounded and unbounded events equally well in both auditory and visual modalities. Therefore, they could interpret the abstract internal



temporal pattern of events with only visual and auditory information. This finding extends the evidence in the spatial domain, indicating that auditory objects can be represented similarly to visual objects to another essential unit of human representation in the temporal domain, events.

# The Relationship Between Maladaptive Daydreaming and Episodic Memory

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The Relationship Between Maladaptive Daydreaming and Episodic Memory Maladaptive daydreaming is defined as a behavioral addiction characterized with prolonged, excessive daydreaming sessions of elaborated plots and vivid imaginary, often accompanied with kinesthetic stereotypic movements and/or a musical stimulus (Schimmenti et al., 2019,). Its distressing aspects such as time consumption, stigmatization and addiction make it qualitatively different from mind wandering (Soffer-Dudek & Somer, 2022). It has high rates of comorbidity with psychopathologies including mood disorders, anxiety disorders, attention deficit and hyperactivity disorder, obsessive compulsive disorders, and dissociative disorders (Somer et al., 2017). Since maladaptive daydreaming has recently become a topic of research as a potential new mental health disorder, there are no studies focusing on its cognitive aspects. In the present study, we aimed to study the relationship between maladaptive daydreaming and episodic memory. One hundred and ninety-eight participants (Mage=22,39, SDage =3.39, 72.2% female) recruited through snowball sampling completed the Beck Depression Inventory (BDI), the Maladaptive Daydreaming Scale (MDS-16 TR), the Positivity and Negativity Affect Scale (PANAS) and the episodic memory task (Soylu, 2014) online via Qualtrics. The episodic memory task consisted of three phases. In the encoding phase, participants were presented with 44 pairs of words and asked to learn them. In the recall phase, each pair was presented with one missing word in a random order. Participants were expected to remember the missing word and write it. In the following recognition phase, four choices including the correct word were presented for each word pair which could not be correctly recalled by participants in the recall phase and participants were expected to select the correct choice. Consistent with previous studies (e.g. Somer et al., 2017, Soffer-Dudek & Somer, 2018), maladaptive daydreaming score was found to correlate positively with depression score,  $r(198) = .31, p = .00$ . Partial Pearson's correlation analyses with the depression score as a covariate demonstrated no significant correlation between maladaptive daydreaming score, and recall and recognition performance,  $r(195) = .09, p = .206$ ;  $r(195) = .01, p = .790$  respectively. The findings would be discussed in terms of the regularity of daydreaming, and the new acknowledgement of maladaptive daydreaming as a clinical condition.

**Keywords:** maladaptive daydreaming, episodic memory, depression

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## **Effects of Agent and Motion Type on Attention Under Perceptual Load**

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Enhancements of social robots and innumerable motion capabilities of robot designs increased our interactions with robots and the likelihood of questions arising with these interactions, such as their effects on our cognitive processing. The process we explore in this study is selective attention, with questions of how robots capture and affect our attention. Additionally, we integrated motion type as an independent variable to explore cognitive influences of motion type and its relationship with agent type under perceptual load. Motion here refers to two: Biological and mechanical. Biological motion is the often smooth 'natural' movements of animated living and is likely processed automatically (Nizamoglu, 2024). In contrast, mechanical motion refers to disrupted biological movements wherein the cognitive aspects need further exploration (Ozen, 2023). Here, we are trying to uncover how robots differ in distracting our attention and how motion type interacts with agent type, uncovering the human expectation of biological and mechanical motion. To tackle these questions, we utilized Lavie's visual letter search task paradigm (1995). This task includes six letters in a circular sequence and a target letter, either 'X' or 'N.' The task consists of two conditions of difficulty. In low perceptual load (easy) condition, participants search for the target letter from the same letters. In the high perceptual load (hard) condition, all letters are different. During the experiment, participants conducted the visual search task under easy and hard conditions, with either irrelevant distractors or no distractors. Our distractors consist of 1-second action videos of two agent types -human and robot- executing the walking action from Ozen & Urgan's (2023) stimuli set. In the distractor present condition, our animated agents execute this walking action naturally (biological motion condition) and unnaturally (mechanical motion condition). We did not include any cues on our independent variables to eliminate predictive mechanisms as much as possible. Preliminary results of 13 participants indicated a significant effect of agent type. Participants took a longer time to react when the robot agent was present. Notably, preliminary data did not show a significant effect of motion type. We aim to validate these effects with further data collection.

## **Predictive Processing in The Cortical Network of Biological Motion Perception**

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While the cortical network that supports biological motion perception is well-established and includes occipitotemporal, parietal, and frontal regions, it remains unknown how it is affected by expectations. In light of the influential models of predictive processing in visual perception, it is time to re-evaluate the feedforward models of biological motion perception that usually ignore the effect of expectations. To this end, in the present study, participants (N=27) went under fMRI while they were shown two point-light displays (in noise) on two sides of the screen. One of the displays depicted a biological motion stimulus (walking or kicking) whereas the other was its scrambled version. The task of the participants was to indicate the location of the biological motion. Before the task screen, they were shown a cue of an action (either walking or kicking) and informed that the cue correctly predicts the action of the biological motion in the task screen 75% of the time (congruent) and violates the prediction 25% of the time (incongruent). There were also two additional conditions in which the cue was uninformative about the action of the biological motion stimulus (neutral condition) or there were no motion stimuli after the cue at all. As expected, univariate and multivariate analysis on the fMRI data showed a clear activation of the action observation network consisting of pSTS, parietal cortex and IFG throughout the conditions in which a stimulus is present. On the other hand, these regions have failed to significantly discriminate between congruent and incongruent conditions. However, it is highly possible that this result can be explained by the low number of trials. In order to better investigate the connections within the action observation network, a DCM analysis was conducted. The results have successfully shown the presence of feedback connections in predictive processing. The winning model of DCM argues that feedforward and feedback modulatory connections are present during congruent, incongruent, and neutral conditions. In sum, our results highlight the importance of incorporating top-down signals such as expectations in the computational models of biological motion perception.

## **To What Extend Do Turkish Onomatopoeic Words Mimic Natural Material Sounds?**

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To what extend do Turkish onomatopoeic words mimic natural material sounds? İrem Tuncel, Defne Akkuş, Dicle Dövençioğlu Department of Psychology, Middle East Technical University, Ankara Sound symbolism refers to the phenomenon where the phonetic characteristics of certain words or linguistic elements evoke sensory percepts associated with their meaning. Onomatopoeic words, such as "buzz" or "click," are examples of sound symbolism where the phonetics of the word imitates the sound it represents. These words provide strong counterevidence to the arbitrariness hypothesis in linguistics, indicating a natural and distinctive connection between certain phonemes in words and corresponding materials in the environment. Here, we aim to analyze the level of mimicry in Turkish onomatopoeic words that describe the sensory qualities of materials. To this end, we first extract distinctive sound characteristics in Turkish onomatopoeic words and establish their semantic relationship with perceived materials. Next, we use sound effects of materials to determine mutual distinctive sounds in language. In the first experiment, participants (n=93) listened to 83 Turkish onomatopoeic word recordings and rated these words from 1 to 7 according to 18 adjectives (e.g., rough, airy, wet, granular, silky, metallic). A principal component analysis revealed 5 semantic factors describing the perceived material space: lightness (relating to adjectives airy, silky, bright, and smooth), wetness (wet, silky, and bright), granularity (dry, mat, rough, and bumpy), wholeness (whole, flat, smooth, and matte), and metal (metallic and bright). In the second experiment, participants (n=34) listened to 60 natural sound effects corresponding to material dimensions in the previous experiment, and they were instructed to transcribe what they had heard. After analyzing the phonetic characteristics of these written responses, we identified recurring sound symbolic relationships. For instance, we observed that the /ş/ sound is associated with fine granular and viscous materials, the /ç/ sound with coarse granular materials, and the /c/ sound is linked to sticky materials. These recurring sounds (e.g., /ş/ for water sound effects) can be deemed distinctive since we observed similar characteristics in the Turkish onomatopoeic words, which were rated highest for the corresponding material dimensions (e.g., şakır şakır, wetness). Overall, our results reveal distinctive phonetic patterns in Turkish and open up new pathways to study how natural materials are represented in sound symbolism.

## Effects of Shape Cues on Animacy Perception

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Animacy perception, classifying visually perceived objects as "animate" or "inanimate", has an essential role in survival and interactions with other entities, such as identification of social partners and recognizing dangerous situations. This ability allows humans and animals to recognize living beings and understand their intentions or purposes. In this study, we aim to investigate the role of shape on perceived animacy by using distorted images. We use five different animate-inanimate pairs and images in between obtained by morphing the animate silhouette (e.g., bird) into the inanimate silhouette (e.g., airplane). For each pair, we created 7 different images at equal distortion steps (20, 30, 40, 50, 60, 70, and 80 percent, 35 different stimuli in total). To create these morph stimuli, we used the Image Processing Toolbox and Computer Vision Toolbox (MATLAB Add-Ons). In a 2AFC psychophysics experiment, participants were asked to classify the stimulus they saw as "animate" or "inanimate" without any time restriction. In each trial, the image was displayed on screen for 150 milliseconds. Each stimulus was shown 20 times in one experimental block, and participants performed 700 trials in total. Psychometric curves were fitted to the percentage of "animate" responses for each pair. As the distortion steps reached inanimate images, participants' responses changed accordingly. Overall, this study provides evidence for the role of image distortions in the perceived animacy of shapes.

**Keywords:** animacy perception, shape cues, image distortion.

# **Food For Thought: Fusiform Responses to Food Objects Support a New Cardinal Category in Human Perception**

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Food detection and identification are necessary for survival. But, despite its importance in daily life, food has not been considered an object category worthy of scientific study. Recently various independent research groups<sup>1–3\*</sup> have conducted data-driven studies of the ventral visual areas in the human brain using natural photographs. To their mutual surprise, there was a newcomer among the expected categories of faces, places, bodies, and text: foods. These studies herald a paradigm shift in the cognitive sciences from food as a research tool to food as a perceptual category of interest. We will discuss these recent findings and evaluate them in the light of the following questions: Do these recent findings really stand up to closer scrutiny? Is this really new and why has such an intuitive category been overlooked? What's next for selective food category processing? These findings will be contextualized by what is known about neural processing of selective categories in the fusiform cortex, and by what is already known about food recognition. We will also address what relevance this may have to clinical perspectives and what future studies should focus on. \*Note that these original data studies are by independent research groups and that the co-authors of this abstract have a funded project on this subject for which data collection is just starting.

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**Relationship Between Spatial and Number Development:  
Mental Rotation and Spatial Location Knowledge  
Relates to Numerical Skills of Preschoolers**

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Spatial skills have the potential to disambiguate the symbols used in mathematics and understand mathematical concepts, including complex structures used in geometry (Mix et al., 2016). Early spatial skills, measured by mental rotation, have been argued to predict number knowledge development of young children, especially for number estimation and calculation (Casey et al., 2015; Gunderson et al., 2012). Specifically, children's early mental rotation skills predicted better scores on non-symbolic and symbolic calculation tasks (Gunderson et al., 2012) and better counting abilities (Liu & Zhang, 2022). However, less is known about the relationship between spatial location knowledge and different mathematical abilities despite a strong emphasis on how our mental representation of numbers relies on left-right body space (Dehaene et al., 1993). In other words, while small numbers are mentally encoded on the left side of the body, large numbers are encoded on the right. In this study, we investigate the relationship between mental rotation and spatial location development with different numerical skills (e.g., symbolic, non-symbolic, and counting) of preschoolers. To do so, we are collecting data from children aged between 3;10-5;8 on tasks measuring their mental rotation, spatial location, symbolic, non-symbolic and counting skills. We are using Ghost task to measure the mental rotation skills (Frick et al., 2013). In this task, children are asked to find a fitting picture by mentally rotating the target object. In the spatial location task, children are shown different objects standing in various locations (e.g., on, in, next to, behind, in front of), and they are asked to produce and comprehend the location of objects. Finally, children are engaged in simple calculations (symbolic) (Gilmore et al., 2007), estimated dot collections (non-symbolic) (Barth et al., 2006), and counted beads into the stick (counting skills) (Gibson et al., 2018). Preliminary analyses based on 30 participants (Mage = 4;6) showed significant relationships between mental rotation and spatial location knowledge with symbolic and counting skills (all ps <.05) but not with non-symbolic ability (all ps > .05). Specifically, the relationship between spatial location knowledge and symbolic calculation ability ( $r = .51$ ;  $p = .004$ ) and counting skills ( $r = .57$ ;  $p < .001$ ) seems to be stronger than the relationship between mental rotation and symbolic ( $r = .41$ ;  $p = .02$ ) and counting skills ( $r = .47$ ;  $p = .009$ ). In summary, our data provides more evidence to previous work reporting a close relationship between space and number (Mix et al., 2016) Mental rotation and spatial location seems to be essential in determining

preschoolers' numerical skills (e.g., symbolic and counting skills) rather than their estimation abilities (e.g., non-symbolic). Finally, these findings support the earlier results that demonstrate our mental architecture for processing numbers is closely related to spatial locations (e.g., left-right) (Dehaene et al., 1993). In conclusion, our results underline the importance of considering children's spatial skills, especially locational knowledge, in understanding and supporting their number development.

**Keywords:** number development; mental rotation; spatial location development; preschoolers

## Exploring Attribution in Turkish Discourse: Annotation-Based Analysis

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Attribution constitutes the foundational procedure of recognizing and crediting original sources within written and spoken discourse. It contains both a cognitive and linguistic process where thoughts and statements are systematically traced back and ascribed to their originators. Prior studies have highlighted the complexity of attribution in text, with the Penn Discourse TreeBank (PDTB) contributing how sources and statements are attributed in written English. Building on that foundation, this current study explores discourse attribution patterns in Turkish texts in the Turkish Discourse Bank version 1.2 (TDB 1.2). The TDB is an annotated dataset involving discourse relations and their components, referred to as Argument1 (Arg1) and Argument2 (Arg2). It contains 3987 discourse relations in total. In this work, attribution annotation is added over discourse relations and their arguments. The main aim of this study is to shed light on the underlying mechanisms of attribution in the TDB 1.2 and to pave the way for advanced text analysis applications that obviate need to involve manual attribution annotation in Turkish. Based on the insights and methodologies drawn from the existing literature, this work developed an attribution annotation scheme tailored to the nuances of Turkish discourse. Two annotators independently annotated the TDB texts, and inter-annotator agreement was evaluated using Cohen's kappa coefficient. For Arg1, the kappa score was 0.83, indicating an almost perfect agreement, while for Arg2, the score was 0.80. The Entire Discourse Relation (Entire DRel) demonstrated a substantial agreement with a kappa score of 0.77. Discrepancies identified from kappa scores were discussed and rectified, ensuring data consistency. The data, annotated on the PDTB Annotator Tool, was converted to Excel for statistical analysis. In total, 366 DRel were annotated for attribution, with 343 annotations on Arg1 and 311 annotations on Arg2. Findings reveal that the Other (Ot) category that refers to individuals or groups specifically mentioned in the text was predominant in the DRel category, with a frequency of 296 instances, followed by Arg1 with 259 instances, and Arg2 with 221 instances, signifying a trend of specific sources. Communicative (Comm) verbs, such as söylemek ('to say') or belirtmek ('to state'), constituted 75.8% of the dataset and were notably the most prevalent, especially in Rel, recorded at 317 occurrences, highlighting the prominence of direct communication verbs. Following this, Belief Proposition (PAtt) verbs, such as inanmak (to believe) or düşünmek ('to think'), accounted for 10.2%, Eventuality (Ctrl) verbs, such as karar vermek ('to decide') or mecbur olmak ('to be obliged'), for 6.9%, and Factive (Ftv) verbs, such as hatırlamak ('to remember') or bilmek ('to know'), for 4.2%. It has been observed that Turkish discourse predominantly uses verbs like dedi ('said') 130 times, dedim ('I said') 62 times, and

söyledi ('told') 49 times. Genres such as novels, with a total relation count of 1365, and news, with a total of 559, have emerged as particularly rich domains for the research of attribution. This dataset has been prepared for computational analysis, and this work has significantly enriched the TDB.

## **Lesions In Consciousness: Is An Intact Consciousness Necessary for The Brain's Recovery?**

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Neuroplasticity, the brain's capacity to adapt and reorganize in response to internal and external stimuli, is fundamental to cognitive development, recovery from neurological insults, and adaptive responses to environmental demands. This paper investigates neuroplasticity dynamics through two paradigms: recuperative neuroplasticity following hemispherectomy and maladaptive neuroplasticity in schizophrenia. Hemispherectomy and schizophrenia offer contrasting perspectives on neuroplasticity dynamics. While hemispherectomy exemplifies robust recuperative neuroplasticity, schizophrenia reveals maladaptive processes despite structural integrity. The role of consciousness appears as a potential factor in neuroplasticity, with intact consciousness favoring adaptive neural changes and compromised consciousness associated with maladaptive plasticity patterns. Our paper underscores the need for further investigation into the determinants of neuroplasticity, emphasizing the interplay between consciousness and brain pathology.

## **Investigation of The Generation Effect on Memory and Metamemory Through Semantic and Perceptual Cues**

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The generation effect is an experimental finding that provides evidence that self-generating information produces higher memory performance than reading it passively. The effect can be obtained through various semantic and perceptual generation manipulations. Despite the numerous studies investigating semantic and perceptual generation tasks, studies do not typically compare the effectiveness of semantic and perceptual generation tasks directly. For Experiment 1, participants read or generated words from rhyming words or highly associated words, comprising a 2 (level of processing: perceptual, semantic) x 2 (generation: generation, read) within-subjects design. The recognition test results showed that participants had higher memory performance for generated words than read ones. Moreover, an interaction revealed that memory performance was higher for the semantic generation task than for the perceptual generation task. Experiment 2 aimed to see how participants' memory predictions changed in regard to their subsequent memory performance under perceptual and semantic generation tasks. Moreover, we investigated whether making predictions modifies memory performance. Experiment 2 incorporated judgments-of-learning (JOL) and no-JOL groups, demonstrating that participants accurately predicted and performed better on memory tasks involving generation and semantic manipulations. Additionally, the cued-recall retrieval phase produced higher memory performance for the JOL-group than the no-JOL group, suggesting that predicting one's memory performance enhances actual memory performance. Experiment 3 aimed to see the importance of the retrieval phase for the metamemory reactivity. Like Experiment 2, the JOL group still had a higher memory performance than the no-JOL group. The group difference was only observable during a semantic cued-recall test, implying the test type's importance.

## **Cool Techniques, but Not Cool Enough to Reveal Neural Correlates of Consciousness**

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Understanding the neural basis of consciousness is the most significant challenge for neuroscience. Identifying neural regions whose activity correlates with consciousness during perception, or the neural correlates of consciousness (NCC), seems to represent a tractable first step to the seemingly insurmountable question of consciousness. The crucial step involves extracting the Neural Correlates of Consciousness (NCC) from the prerequisites of NCC (NCC-pr). The NCC-pr here refers to the correlates of “unconscious” sensory processing, preceding conscious perception. Thus, the assumption is that the stimulus is processed up to a level before conscious perception arises. The prevailing approach in this context has been the application of psychophysical blinding techniques, such as masking and inattention blindness, whereby the processing of stimuli is variously disrupted such that they are rendered unconscious on a fraction of trials and participants report no awareness of them. Trials where participants reported awareness of stimuli are contrasted with trials where they reported no awareness in the hope of eliminating NCC-pr; and delineating brain regions associated with conscious awareness. However, we posit that the application of psychophysical blinding techniques to eliminate NCC-pr is flawed, as it presupposes that the processes or regions disrupted by the blinding technique coincide with, or correspond to, the level at which conscious perception arises. There's a valid chance that a blinding technique targets lower levels or certain specific types of unconscious processing. Therefore, the identified NCC-pr only accounts for a portion of the entire unconscious processing, as it fails to capture higher levels or other types of unconscious processing. Note that the mechanisms underlying psychophysical blinding techniques are not yet fully understood, and no widely accepted theory explains how these techniques function. Furthermore, different psychophysical blinding techniques are likely to result in varying levels of sensory processing preceding conscious awareness. Blinding manipulations that interrupt early as opposed to later sensory regions will result in shallower compared to deeper sensory processing. Inattention blindness resulting from disruptions at higher visual regions may result in deeper processing of the non-conscious stimuli compared to backward masking, which is likely to disrupt processing early on. This phenomenon clearly demonstrates that identifying NCC-pr heavily relies on the type of blinding technique used. Importantly, even if we employ a technique targeting later sensory regions, there's a significant risk of underestimating NCC-pr since we lack knowledge about where those later sensory regions correspond to in terms of levels of unconscious processing.

Employing psychophysical blinding techniques have the potential to encompass regions or processes involved in unconscious processing within the Neural Correlates of Consciousness (NCC). We contend that this drawback stands as one of the foremost challenges hindering the progress of scientific research on consciousness. In conclusion, these techniques are sophisticated , but not successful in completely eliminating processes preceding NCC.



## **Disfluency in Speech and Gestures: Windows into Metacognitive Processes**

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Speech disfluency refers to errors, pauses, or repetitions in speech production (Maclay & Osgood, 1959). Earlier studies suggest that speech disfluencies signal one's certainty such that those with lower confidence in their answers produce more disfluencies (Smith & Clark, 1993; Swerts & Kraemer, 2005). Language is multimodal, involving cues, including hand gestures (Bortfeld et al., 2001; Fröhlich et al., 2019). Co-speech gestures are shown to precede lexical affiliates (Ferré, 2010; Seyfeddinipur, 2006; TerBekke et al., 2024) and increase performance monitoring (Çapan et al., 2023), suggesting a metacognitive involvement. However, up to date no study investigated the relationship between speech disfluencies, hand gestures and metacognitive processes. Furthermore, speech disfluencies and co-speech gestures change as a function of listener visibility: People produce more gestures (Alibali et al., 2001; Cohen & Harrison, 1973; Kraus et al., 1995) and fewer disfluencies (Alibali et al., 2001; Kasl & Mahl, 1965; Oviatt, 1995; Rimé, 1982) when they can see the listener. Here, we ask whether (1) disfluencies and gestures act as metacognitive cues in speech and (2) they serve varying functions in different communicational settings. Fifty participants (32 female, Mage = 21.16, SD = 1.46) responded to trivia questions either with a visible or a non-visible listener, and they audibly elaborated on their answers, during which we measured the frequency and the type of disfluencies and co-speech gestures. Then, participants rated their confidence in their answers (i.e., metacognitive judgment) on a 4-point Likert scale. We predict confidence ratings will change as a function of speech disfluency and co-speech gestures produced by the participants. We also expect the rate of disfluencies and gestures to change depending on the conversational setting. To test these hypotheses, we will analyze the data using linear mixed-effect models to account for the variability resulting from different subjects answering questions with varying difficulties. Preliminary analyses showed that among 40 questions, participants answered 16.9 questions correctly on average (SD = 4.01, Range = 10-27), and the mean confidence ratings were 2.08 (SD = 0.39, Range = 1.25-2.85). Further coding for the rate of speech disfluencies and hand gestures is in progress. Our findings will contribute to understanding the multimodal nature of language and the role of metacognition in speech and gesture production.

## **Production of Conditionals in Turkish and English-Speaking Children**

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This study examines the production of conditional sentences in children, which might provide insights into their acquisition of complex morpho-syntactic and semantic features. Using child language corpora, the present study aims to investigate the developmental trajectory of indicative and subjunctive conditional sentences in English and Turkish-speaking children, providing cross-linguistic perspectives on conditional sentence acquisition. In both English and Turkish, indicative conditionals are used when the events are very likely to happen. Subjunctive conditionals are used when the situations are not actual and less likely to happen, so they require one to imagine what the world would be like, which is referred to as counterfactual reasoning (Lewis, 2013). In addition to this, subjunctive conditionals also necessitate using various complex grammatical structures in different languages. For instance, past tense morphology is needed in forming a subjunctive conditional in English (von Stechow, 2012). On the other hand, Turkish attaches the subjunctive morpheme *-sA* to the bare verb root to form subjunctive conditionals. When the conditional marker *-sA* precedes the past tense marker, the sentence is a subjunctive one. However, when the past tense marker precedes the conditional marker, it is an indicative conditional. Therefore, the morpheme order is a crucial aspect of encoding a conditional sentence in Turkish. Apart from the morpheme order, conditionals in Turkish are considered to be simpler compared to English, since Turkish does not require the use of *if*-complements, auxiliaries, modal verbs or participles (Yarbay-Duman et al., 2015). While Turkish-speaking children need to acquire and differentiate between the complex stacking of morphemes to form subjunctive and indicative conditionals, English-speaking children need to acquire *if*-complements as well as the back-shifting by getting a past tense morphology required by the subjunctive conditional sentences. However, despite these morpho-syntactic differences, semantic, pragmatic, and cognitive mechanisms seem to remain the same. The research questions addressed in this study are as follows: 1. What is the number and frequency of indicative and subjunctive conditional types used by Turkish and English-speaking children? 2. Is there a significant difference between the Turkish and English-speaking children's first production of indicative and subjunctive conditionals? To investigate these, the data are collected on two samples taken from CHILDES. We investigate the corpus of Kuczaj (1973) and Aksu-Koç (1972) for English and Turkish data respectively, using CLAN. These corpora were chosen based on MATTR analysis. The data were collected from the corpora in the ages of 2 years to 5 years and analyzed using KWAL and FREQ programs. Our initial results show that regardless of the structural differences, both English and Turkish-speaking children use indicative conditionals

more frequently than subjunctive conditionals. Even though the subjunctive marker is morphologically simpler than the indicative one (Sezer, 2001), both groups start to use indicative conditional sentences before the subjunctive conditional sentences. Considering these initial findings, we will argue that despite the structural differences, forming subjunctive conditionals is more challenging for both groups of children as they require the same universally complex semantic, pragmatic, and cognitive mechanisms.

## Effect of Music on Sweetness and Saltiness Perception

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The effect of music on flavor perception has grossly focused on music's loudness, genre, language, or bpm. Over the last decade studies have started to move their focus to taste qualities (sweet, salty, sour, bitter, and umami), which can be associated with music's psychoacoustic and musical properties such as pitch and timber. People reliably match music with different taste qualities. For example, Guetta and Loui (2017) asked participants to match the taste words with a novel music piece which was composed in four different ways to reflect different taste qualities (sweet, sour, salty, and bitter). They found that participants correctly matched the taste quality with the congruent music above chance. However, it is unclear if music stimuli that are matched in quality may also enhance taste perception. Here we test the hypothesis that taste quality-congruent music will increase taste intensity relative to taste quality-incongruent music and no music (control condition). The experiment consists of two sessions. In the first session, participants listened to 6 different music samples (3 sweet and 3 salty). Music samples were taken from Taste and Affect Music Database (Guedes et al., 2022). Participants were asked the rate each sample's saltiness, sweetness, bitterness, and sourness. They also rated the affective properties (valence and arousal) of the samples. We selected for each participant two music samples, the sweetest and the saltiest. These samples were used in the second session. In the second session, the participant rated taste solutions in three different blocks: sweet music, salty music, and no music, block order was randomized. In each block, the participant tasted two different concentrations of sucrose (0.32 M and 0.56 M) and sodium chloride (0.18 M and 0.32 M). Every solution was tasted three times in a block, and solution order was pseudo-randomized in a block such that none of the solutions was presented more than two times consecutively. We have collected data from 15 participants (8 women, 7 men) out of a targeted total of 40. We will present a summary of the ongoing data collection and analyses and a preliminary assessment if sweetness and saltiness intensity perception is affected by congruent music and incongruent music.

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