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Abstract Book

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Poster Board Number	Title & Authors
1	Working memory related to different subtasks can be maintained in separate noninterfering stores Aida Rezaei, Ausaf Farooqui
2	Bayesian Modeling of Demonstrative Use in a Joint Problem-Solving Task Alaz Aydin, Murat Perit Cakir
3	Challenges in Measuring Attitudes toward Social Robots Hande Sodacı, Aylin C. Küntay, G. Tarcan Kumkale
4	The nameability effect is limited by the categorical membership of the object's features Alexey Kotov, Tatiana Kotova
5	Meaning, Referentiality and Distribution: German Compounding Ali Eren Çetintaş, Cem H Bozsahin
6	Anticipating Temporal Action-Effects Alperen Doğaner, İnci Ayhan
7	Influences of early and intense L2 exposure on causal verb production: Comparison of 5-, 7 and 9-year-old bilingual and monolingual children Aslı Aktan-Erciyes, Ebru Ger, Büşra Sena Özcan, Songül Kandemir, Pınar Atlı, Tilbe Göksun
8	The iconic meeting of Kichwa communication and the Turkish tongue Austin W. Howard
9	Perception of Built Environments and its Neural Modulation by the Behavioral Goals of the Perceiver Aysu Koç, Yasemin Afacan, Burcu A. Urgan
10	Multiple demand regions in cerebellum Ayşe Betül Varol, hasan duymuş, Ausaf Ahmed Farooqui
11	The Investigation of the Perceived Motion of Biological and Non-Biological Movements Ayşe N. Badakul, Berfin Mısırlı, Efe Soyman
12	Word learning of spatial and temporal metaphors across auditory and visual modalities Bahar Tarakçı, Ercenur Ünal
13	The Effects of Ketamine on Different Phases of Implicit and Explicit Memory Bahar Yüksel, Zeynep Şen, Güneş Ünal
14	The effect of stimulus features on stimulus-response associations Batuhan A. Koçak, İnci Ayhan
15	A preliminary study on older adults' and caretakers' perception of and response to social robots Begüm Çonka
16	Exploring Prosocial Behavior on Video Conference Platforms: The Role of Self-Awareness Begüm Yılmaz, Terry Eskenazi, Derin Eda Derelioğlu

Poster Board Number	Title & Authors
17	Effect of Feedback on Memory and Metamemory Judgments in Eyewitness Memory Berfin Sıla Yalçın, H. O. Serçe, C. Yalçın, A. Elmaslı, M. Irak
18	Holding on to Last Words? Aphasic word-repetitions may have psychological relevance Berfin Gürçan, Tamer Gezici, Mehmet Karaaslan, Ozan Yavuz Tüfek, Çağlar Şahin, Emrah Çeltikçi, Ausaf Ahmed Farooqui
19	Are Emotional Evaluations Influenced by Culture? An IAPS Study Beril Sercem Şengül, Gülin Kaça, Aycan Kapucu
20	Contextual stability, not prediction errors, underlies event segmentation Berna Güler, Fatih Serin, Eren Günseli
21	Biases on Target Representations: The Within- and Across-trial Target Integration Effects in the Attentional Blink Bugay Yıldırım, Yelda Semizer, Ayşecan Boduroğlu
22	Creating Semantically Related and Unrelated Word Lists for Episodic Memory Research using Word Embeddings Burak Büyükyaprak, Barbaros Yet, Aslı Kılıç Özhan
23	Do bilinguals use gestures when they are disfluent? Burcu Arslan, Can Avcı, Ali Yılmaztekin, Fatma Nur Yılmaz, Mine Yürekli, Mehmet Kaya, Tilbe Göksun
24	An Agent-Based Model to Explain the Emergence of Dominant Word Orders Burcu Çınar
25	How Does Gesture Restriction Affect Grammatical Complexity? Individual Differences in Gesture and Speech Production Can Avcı, Burcu Arslan, Süleyman Can Ceylan, Tilbe Göksun
26	Pupil Dilation in Time Perception Cansel Inan, Ausaf Farooqui, Tamer Gezici
27	Interpreting conditionals in a dynamic judgmental logic Ceyhan Temürcü
28	Designing Multimodal Utterances: The Role of Addressees' Perceived Spatial Aptitude Demet Özer, Arda İçen, Tilbe Göksun
29	Children allocate more visual attention when planning informative spatial descriptions in speech-gesture combinations than in speech Dilay Z. Karadöller, Aslı Özyürek, Ercenur Ünal
30	The role of working memory for mental operations on long-term memory Duygu Yücel, Betül Türk, Eren Günseli
31	Role of Estrogen Receptor $\alpha$ (ER $\alpha$ ) on the Antidepressant Effects of Ketamine Ece İdil, Bahar Yüksel, Zeynep Şen, Güneş Ünal

Poster Board Number	Title & Authors
32	Can individuals implement strategies to protect memories during retrieval against divided attention? Eren Günseli, Nursima Ünver, Ece Karagül, Eren Güngör
33	Designing Menus for a Sustainable Future: The Role of Non-Meat Decoys Eda N. Çapkan Altun, Sibel Özilgen, Funda Yildirim
34	Neural and Ocular Correlates of Conceptual Grounding in Verbal Interaction Efecan Yilmaz, Cengiz Acarturk, Murat Perit Cakir
35	The role of spatial words in the spatialization of time Emir Akbuğa, Tilbe Göksun
36	Unified Benchmark for Zero-shot Turkish Text Classification Emrecaan Celik, Tugba Dalyan
37	On the Edge of Cognitive Revolution: The Impact of Neuro-Robotics on Mind and Singularity Fatih Burak Karagöz
38	Internal attention is the only retroactive mechanism for controlling precision in working memory Fatih Serin, Eren Günseli
39	Investigation of the generation effect on memory and metamemory through semantic and perceptual cues Fatih Yavuz, Miri Besken
40	Bidirectional Relationship Between Haptic Exploration and Visual Perception of Materials Fatma Kılıç, Dicle N. Dövençioğlu
41	The Effect of Linearity and Prosody in Children's Processing of Quantifier Ambiguity Fatma Nur Öztürk, Ceyhan Temürcü, Duygu Sarısoy

Poster Board Number	Title & Authors
1	Metalinguistic awareness as an indicator of linguistic giftedness Ferhat Dolaş
2	Towards a Shallow Discourse Parser for Turkish Ferhat Kutlu, Deniz Zeyrek, Murathan Kurfalı
3	Investigation of the Effect of Uncanny Valley Phenomenon on Feelings and Memory Performance of People Familiar and Unfamiliar with Computer-Based Imagery Filiz Yönyüksel, Emre Yorgancıgil, Yunus Emre Balcı, İtir Kaşıkçı
4	Brain-Diffuser: Natural scene reconstruction from fMRI signals using generative latent diffusion Furkan Ozcelik
5	Give Your Ideas a Hand: How Gestures and Creative Thinking Interact Gyulten Hyusein, Tilbe Göksun
6	Investigating metacognitive judgments during eyewitness memory in individuals with subclinical obsessive-compulsive symptoms Halid O Serçe, Özgür Gülen, Esra Tafralı, Gaye Özdemir, Metehan Irak
7	How Scene Attributes and Sound Influence Visual Exploration of Omnidirectional Panoramic Scenes Halit Ozsoy, Mert Cokelek, Inci Ayhan, Erkut Erdem, Aykut Erdem
8	Manipulating Perceived Softness through Sound Symbolism: Evidence from Turkish Onomatopoeic Words Hamza Nalbantoğlu, B. Melis Hazır, Dicle N. Dövençioğlu
9	Machine-Learning Based Automated Mental State Talk Assessment Özgür Özdemir, Emrecan Çelik, Tugba Yıldız, Sibel Halfon, Albert Ali Salah
10	A right-frontal region critical for identifying 3-D objects duymuş, Ausaf Ahmed Farooqui, Emrah Çeltikçi
11	Self-Prioritization Effect: How Seeing Your Own Face Enhances Emotion Recognition İlkay Ari, Burcu Ünlütürk
12	The Effect of Self-Distancing on Emotion Regulation and Autobiographical Remembering Senanur Dilek, Merve Nur Altundal, Emine Şeyma Çağlar, Zeynep Eylül Gül, Sezin Öner
13	Second Language Acquisition and Associative Memory İlmiye Seçer
14	Wavelet Transform Coherence on fNIRS-hypercanning data from Cooperative n-Back task Kerem Alp Usal, Murat Perit Çakır
15	Subjective and physiological imagery strength during the LTM retrieval vs. VWM maintenance Lara Todorova, İrem Küsmüş, Eda Melin Develioğlu, Tugce Yetik, Birsen Beril Bildirici, Olesya Blazhenkova

Poster Board Number	Title & Authors
16	Against representations that do not represent: Reply to Thomson and Piccinini M. Yunus Şahin, İbrahim Ethem Deveci
17	Exploring Phenomenological Differences in Bilinguals' Remembered Past and Imagined Future Events Across Languages Melda Sandıkçı, Hale Ögel Balaban
18	The relative importance of pre-exposure schedule on perceptual learning effect Nihan Ozant, Aydan Aydın
19	Does Simulating Older Self Increase Memory Positivity?: Effects of Self-Enhancement on the Valence of Post-Simulation Memory Nilay Özdemir Haksever, Simay İcier
20	Sensory Constraints and Selective Attention in Food Settings: Examining Food Type Effects Using Visual Crowding Nur F. İnanç, Funda Yildirim, Sibel Z. Ozilgen
21	Individual differences in working memory reactivation of long-term memories predict protection against anticipated interference Nursena Ataseven, Lara Todorova, Duygu Yücel, Berna Güler, Keisuke Fukuda, Eren Günseli
22	Assessing object vs. spatial dimensions of visual play Olesya Blazhenkova, Alexey Kotov, Tatyana Kotova, Yulia Sudorgina, Elisei Abaltusov, Tatiana Shkurenko
23	Biological motion perception in the framework of perceptual decision-making: An eventrelated potential study Osman Çağrı Oğuz, Burcu A. Urgan
24	Indirect Reward Does Not Capture Attention Pelın Akbaş, Tamar Mosulishvili, Mariam Aly, Eren Günseli
25	Perception of Acoustic Roughness in Human, Instrument and Artificial Sounds Pınar Demir, Nazlı Bronz Arıcan, Efe Soyman
26	The Effect of Correlated Color Temperatures of Lighting in Coffee Shops on Attention Load Rabia N. Balcı
27	The flight of time at meal time Robert Bowers
28	Combining Forces for Causal Reasoning: Children's Predictions About Physical Interactions Salih C. Özdemir, Nathan R. George, Tilbe Göksun
29	The Effects of Lie Generation on Memory and Metamemory from a Value-Directed Remembering Perspective Samet Kaya, Miri Besken

Poster Board Number	Title & Authors
30	Gesture Use in Autobiographical Memory Selma Berfin Tanış, Yağmur D. Şentürk, Ege Ötenen, Ece Karagül, Ecem Pamay, Eren Akbaba, Yaren Kaynar, Süleyman Can Ceylan, Tilbe Göksun, Çağla Aydın
31	The Main Problem with Neuroimaging Research in Explaining Cognitive Faculties İbrahim Ethem Deveci, Cihan Başoğlu
32	Future thinking during the COVID-19 pandemic: Effects of health-related worries on valence of future events across 15 countries Simge Sarıççek, Zeynep T. Bozkır, Sezin Öner
33	Assessing Emotions in Animals Through Cognition: Judgement Bias Test as a Promising Model for Behavioral Neuroscience Sinem Gençtürk, Güneş Ünal
34	Listener Judgements of Preverbal and Postverbal Constituents in Western Armenian Tabita Toparlak, Eda N. Çapkan Altun, Gizem Tanseli Kaspar, Mehtap Çakır
35	Influences of L2 exposure on L1 Theory of Mind Talk: Comparison of bilingual vs. monolingual 5-, 7-, and 9-year-olds. Tuğba Güler Ertit, Aslı Aktan-Erciyas
36	Contiguity Effect is Asymmetric Across Pairs, How About Within Tuğba Hato, Aslı Kılıç Özhan
37	Implicit Metacognition Conforms Group Decisions in A Bayesian Fashion Tutku Öztel, Fuat Balcı
38	The Effect of Bilingual Experience and Home Language Environment on Cognitive Control of Bilingual Children Xiaowei Gong, Dilay Karadöller, Aslı Aktan-Erciyas, Başak Şahin-Acar
39	The interdependence of the memory reactivation of items and task rules Yağmur D. Şentürk, Nursima Ünver, Can Demircan, Tobias Egner, Eren Günseli
40	Disentangling Memory Precision and Internal Attention Through Repeated Memory Storage Reveals That Memory-Guided Attention Relies on Internal Attention Yaren Kaynar, Fatih Serin, Pelin Akbaş, Eren Günseli
41	Word frequency cues to word order: A cross-linguistic study in Italian and Turkish adults Zeynep Aydın, Judit Gervain

## Working Memory Related to Different Subtasks Can Be Maintained in Separate Non-Interfering Stores

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How are we able to maintain more information in working memory (WM) than would be predicted from its capacity limits? Perhaps, WM information related to separate subtasks are maintained as parts of separate programs and hence stored and recalled independently of each other, much like how parts of one chunk don't interfere with another.

In experiment 1, participants first saw subtask B pictures. Then, while keeping them in mind, they did a separate subtask A that involved maintaining and updating similar pictures. They then completed subtask B using the subtask B pictures they had maintained in their mind all along. Note, subtasks A and B used pictures from the same pool and so could have potentially interfered with each other. The structure of the task episode can be represented as mB-A-rB, i.e. memorizing subtask B pictures, followed by subtask A, followed by recall of B pictures. We examined whether increased WM load related to subtask B impacted the concurrent execution of subtask A.

We found that increasing the number of subtask B pictures had no effect on subtask A performance, and vice-versa, suggesting that their WM items were maintained in separate, non-interfering stores.

An objection may be that in experiment 1, subtask B pictures were not maintained in a goal-directed WM store but were passively maintained as part of (e.g.) activated long-term memory. To rule this out, in experiment 2, we had participants do a large episode made of four sequential task episodes. Each episode was again made of subtasks A and B, and involved the same maintenance of subtask B pictures while executing subtask A. But crucially, the B pictures kept in WM in one task-episode were to be recalled not in that episode but in the next, e.g. B pictures from episode 1 (or mB1) was recalled not after subtask A of episode (i.e. A1) but after A2. The overall structure thus was:

mB1-A1 – mB2-A2-rB1 – mB3-A3-rB2 – A4-rB3.

This forced participants to keep two sets of B pictures in mind and recall not the immediately preceding B pictures but the one before that. This can only be done if B pictures were goal-directed (and not passively) maintained. This also meant that during subtasks A2 and A3, participants were maintaining two sets of B pictures (B1 & B2 and B2 & B3, respectively). But during A1 and A4 they were only maintaining one set of B pictures (B1 and B3, respectively). We found that even now the increased WM load of B pictures did not interfere with subtask A, even though both A and B were WM tasks and involved pictures drawn from the same pool.



WM capacity limits may be task or subtask specific. It is possible that in certain multitasking situations, WM items related to different tasks or subtasks don't interfere with each other, plausibly because of their maintenance in separate stores.

## **Bayesian Modeling of Demonstrative Use in a Joint Problem-Solving Task**

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Humans are able to reason about other people's mental states, they have a "Theory of Mind" (ToM). This capacity enables us to communicate in contexts where both the speaker and the listener are required to monitor each other's mental states (beliefs, desires, knowledge) in order to maintain a common ground. Generating appropriate referring expressions and resolving intended referents are typical processes which depend on a functioning ToM mechanism. In our work, we focus on Turkish speakers' use of demonstratives in a joint problem-solving task from a previous study. The task of a pair of participants (an operator and an instructor) is to solve a Tangram puzzle on a computer screen. However, the operator can move the pieces but can't see the target shape, whereas the instructor can see the target shape but can't move the pieces. This setting requires information sharing and coordination of actions to reach the goal state, where demonstratives are frequently utilized. The participants consist of a control group and a group of individuals diagnosed with mild autism. In addition to screen recordings, participants' gaze locations are also monitored. In this study, we aim to model demonstrative use by combining contextual information with gaze location data. Our model builds on Bayesian inference with hierarchical embedding, which allows us to parameterize ToM complexity. Our formal approach to processes underlying demonstrative use enables us to represent different levels of context-dependence, implement different demonstrative semantics, control for the level of epistemic (or social) embedding, and link overt (joint) attention monitored by eye-tracking to demonstrative use. We think that our analysis will further our understanding regarding the relation between autism and ToM, and provide evidence for both semantics and pragmatics of Turkish demonstrative system.

### **Challenges in Measuring Attitudes Toward Social Robots**

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Advancements in robotics and artificial intelligence focus on endowing social robots with sociocognitive capacities to act as social partners of humans. However, these efforts can be considered successful and promising as long as humans perceive and think of robots as such. A diverse set of studies measured the attitudes of individuals interacting with social robots in various interaction contexts through implicit and explicit measures. This article describes the attitude construct and relevant concepts from a theoretical perspective, presents a brief summary of attitude measurement in studies, and identifies its methodological shortcomings. We argue that understanding the attitude construct, the inherent relation of attitude to behavior, and moderators of this relation can provide important insights into attitude research in HRI and potentially bring solutions to many theoretical and methodological challenges of the field.

## The Nameability Effect Is Limited by the Categorical Membership of the Object's Features

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The nameability effect (Zettersten and Lupyan, 2020) is that the success of learning a new category is higher if the categorization rule is based on easy-to-name parts than if it is based on hard-to-name parts. In the present study, this effect was replicated on easy or hard to name colors ( $N=100$ ). We studied the nameability effect and its relationship to category expectations. We hypothesized that in everyday life, ease of naming correlates with the fact that objects (and their parts) belong to different categories: people expect that the more easily different names are chosen, the greater will be the categorical difference between what is named with them. If nameability is important as an indication of categorical distinction, then removing categorical distinction between relevant features should reduce the effect of nameability. To test the hypothesis, we constructed an additional experimental condition ( $N = 49$ ) in which we used colors attributed to one more general group as relevant features (blue group: blue and light blue; red group: red and orange). To create material for this condition, we measured on a separate group of participants ( $N = 20$ ) the ease of naming colors and which groups they formed. Analysis of variance showed no interaction of block learning and condition factors ( $p > 0.1$ ). We found an influence of the block learning factor ( $F(2, 295.823) = 46.932, p < .001$ ): learning success increased in each condition. We also found significant differences between all three conditions ( $F(2, 292.058) = 26.928, p < .001$ ): belonging of relevant colors to one general group resulted in a lower success rate in learning to categories than in the condition with hard-to-name colors. Thus, we found an important new limitation of the nameability effect, related not to verbalization, but to the expectation that easy naming should indicate different categories.

## Meaning, Referentiality and Distribution: German Compounding

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Compounding is one of the known ways of word-formation with cross-linguistic variations. It is considered a productive way of word formation in German. Compounds in German are mostly formed with the combination of two stems. It is also possible to form compounds of long sequences with many stems. German compounding uses linking elements that are placed between the two constituents of the compound such as -s in Kapitän-s-münze (Neef 2009), and belong to the modifier, namely the left constituent of the compound, according to Nübling and Szczepaniak (2013). Linking elements also have controversial origins.

Wegener (2008) claims that the linking elements, -e-, -er- and -(e)n-, are homophonous with the plural suffixes, which leads some to believe that these linking elements come from plural suffixes. However, she rejects this origin and argues that their homophony results from the fact that both these linking elements and plural suffixes in German stem from the same origin, namely the stem suffixes in German, with parallel developments over time, which has created two "formally identical" (p. 342) morphs that can still be distinguished. 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.

Studying this problem from the perspective of polysemy versus polysemia of the linking element relating the two parts of the compound is quite common. In the former approach for example the plural is assumed to serve dual function. In the latter approach the linking element is considered to be homophonous with for example the plural.

Here we pursue the research program of categorial grammar, going back to Husserl (1900) and Ajdukiewicz (1935), that it may be a matter of referential distinction that causes the appearance of polysemy. Consequently, because reference makes itself into linguistic categorization in such an approach, we would expect to see distributional differences in the linking elements because of referential differences, with implications for polysemia. Reference determines categorization in such an approach, and categorization in turn causes distributional differences, rather than the other way around.

To exemplify referential thinking, the following distinction is well-known: She played the sonata in an hour/\*for an hour. However, when 'play' refers to 'perform repeatedly', grammaticality is affected: She played the sonata for a year. Similarly, there is the following contrast: She played the violin for an hour/\*in an hour. However, when 'play' refers to 'master by practice',

grammaticality is again affected: She played the violin in a year. Therefore, reference in the narrow sense used here affects grammaticality and meaning. This way of grammaticizing reference stands in contrast with binding theories in distributional theorizing, where the concern is for the referents of the segments already identified in the surface structure. In this way of thinking, reference fragments an expression. In the case of linking elements, it amounts to suggesting that referential properties of the head and modifier identify the linker element and the plural, and misidentification may occur if these are not taken into account.

In current work, we propose that such choices can be evident in word vectors. It will be argued that it should be possible to learn from a computational perspective how to distinguish between these two forms by making use of word embeddings, which are numerical learned representations of text based on the contexts of the words.

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## Anticipating Temporal Action-Effects

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How covert goals in mind exert control over overt bodily movements is a fundamental problem of goal-directed actions. The ideomotor theory offers a parsimonious explanation by suggesting that motor codes that carry out goal-directed actions are activated by anticipating or “imagining” their sensory consequences. Logically, the cognitive system must have associations between representations of action codes and action outcomes to render such an operation possible.

Previous research that focused on how these associations are formed uses a paradigm consisting of an acquisition and a test phase. Here, participants first experience their actions contingently followed by novel action effects. Then these action effects are presented as imperative stimuli that participants are expected to respond congruently or incongruently regarding the previously paired action–effect mapping. The results of action–effect learning studies typically suggest that novel action–effect associations are forged by contingently experiencing effects following actions, so perceiving the effect as a stimulus facilitates the associated actions.

Even though the mechanisms underlying action–effect learning has been extensively studied in recent years, only the static stimulus features have been used to define action effects. Crucially, our actions in the real world usually generate events with distinct temporal features with a high adaptive value in action selection processes, especially when an agent is in a dynamic relationship with its environment. So far, however, whether temporal features can also be associated and anticipated in action selection has never been directly examined.

To this end, we adopted an action–effect learning paradigm and conducted three experiments to investigate whether duration as a temporal feature can be associated with discrete actions and anticipated during effect–based action control. We used free-choice test phase in experiment one and reported an ideomotor effect for duration, but only for a Flicker stimulus that includes duration as the sole salient feature and not for the Drift stimulus that includes randomized movements in addition to duration as a contingent temporal feature. In experiment two, we replicated this finding using a forced-choice design employing a choice reaction time task. Since we didn’t observe the ideomotor effect for drift stimulus, we further investigated the possibility that action-control by proximal action effects emerged as more salient compared to relatively noisy duration information in the Drift condition. Therefore, in experiment three, we reduced the contingency of omnipresent tactile action effects by simultaneously delivering vibrations to the left and right fingertips with each action. We reasoned that this manipulation would make the tactile action effects less useful in the acquisition phase by reducing the

contingency so that the duration will be rendered as the only action contingent effect. Indeed, we found a reliable ideomotor effect for both the flicker and drift stimuli in this experiment. Our results suggest that effect-based action control can happen through a temporal feature like duration, just like the static effect features extensively studied in the literature.



## **Influences of Early and Intense L2 Exposure on Causal Verb Production: Comparison of 5-, 7- and 9-Year-Old Bilingual and Monolingual Children**

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Causal understanding emerges as early as six months of age for contexts including understanding intentional agents and physical contact and extends to social, psychological, and biological causality in time (e.g., Gopnik et al., 2004, Muentener & Bonawitz, 2017). Causal language might be related to causal understanding (Ger et al., 2021). However, children's early utterances rarely show causal structures before four years of age (e.g., Göksun, Hirsh-Pasek, & Golinkoff, 2010; Kanero et al., 2015). Although causal understanding is widely investigated in literature (e.g., Luo, Kaufman, & Baillargeon, 2009), how specific language input affects children's production of causal language is not addressed extensively (see Aktan-Erciyes & Göksun, 2021). Exposure to an L2 that marks causal structures differently might affect L1 production (Hwang, 2021).

The present study investigates the influences of early and intense L2-English exposure on children's L1-Turkish causal verb production as assessed by an experimental causal verb production task. Turkish can mark causality with suffixes that act as transparent cues, whereas English does not.

Five-, seven-, and nine-year-old bilingual ( $n = 80$ ) and monolingual ( $n = 80$ ) children participated in the study in L1-Turkish. Children were instructed to describe 16 video clips they watched on a computer screen to an adult addressee. All video clips depicted an actor's hand performing actions with and without a toy puppet in a playground. Half of the scenes could be expressed with morphological causatives (i.e., make toy-puppet sleep, "uyu-t-mak") and the rest half with lexical causatives (i.e., open the door, "aç-mak"). This constituted our verb category variable (i.e., lexical, morphological). All responses were coded into categories based on their accuracy in describing the scene and the verb used (1=lexical, 2=morphological). Responses were further coded as correct when they were accurate lexical verbs for scenes that could be expressed with lexical causatives or accurate morphological verbs for scenes that could be expressed with morphological causatives.

We performed a linear mixed-effects regression to predict the accuracy of responses. Participants were entered as random effects. Language group (bilingual vs. monolingual), verb category, age group, L1-receptive vocabulary (TIFALDI), and L2-receptive vocabulary (PPVT), and the interaction of the first three were entered as fixed effects. Results yielded a significant effect of language group, age group, verb type, TIFALDI and a significant interaction of age

group and language group. Bonferroni-corrected posthoc comparisons showed that only monolingual 5-year-olds performed better for lexical vs. morphological verbs. The rest of the groups performed equally well for both verb types. Language group differences indicated that 5-year-old bilinguals performed better for morphological causal verbs than monolingual 5-year-olds. Age group differences emerged only for monolinguals: 5-year-olds performed worse than 7- and 9-year olds.

Results indicated that early L2 exposure was associated with gains in the lexicalization of causal verbs for only 5-year-old bilinguals. This age group of bilingual children were attending L2-immersion preschools and thus were exposed to enhanced levels of L2 compared to other age groups. This might have allowed them to be aware of the contrast between the languages and further enhanced their causal verb production. Moreover, the verbs used in the causal verb production task were mostly periphrastic verbs when L2 translations were considered (e.g., make puppet sleep), thus allowing 5-year-old bilinguals to show the advantage.

## The Iconic Meeting of Kichwa Communication and the Turkish Tongue

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In this study, I investigate whether or not ideophones (depictive, iconic utterances) are more likely to be correctly paired with their meanings by speakers of languages with rich ideophone inventories by means of a 4-way forced-choice task whereby native English speakers ( $n = 30$ ) and native Turkish speakers ( $n = 30$ ) choose the correct meaning of an ideophone presented in audiovisual format. Turkish and Kichwa are two such languages. Amazonian Kichwa is a lowland language belonging to the Quechuan family. Turkish is a Turkic language. The languages are in no form of contact and have no 'genetic' affiliation.

Dingemanse et al. (2016) already provides evidence of cross-linguistic ideophone guessability in a 2-way forced choice task using 5 languages and Howard (2021, unpublished) used a four-way forced-choice task using ideophones gathered from a list of Turkish ideophones (Baturay, 2010). 200 native English-speakers completed a 20-question experiment, in which they were told to guess which of four definitions matched the Turkish word with which they were presented. One of the four options was correct, accompanied by three foils. Both studies indicated that ideophones were correctly paired with their meanings above chance.

However, Howard (2021, unpublished), found that certain words in English (the participants' native language) resembled their 'highly guessable' Turkish counterparts. Perhaps both the English and Turkish roots of those words were derived from iconic, form-meaning mappings. If so, one might expect two iconically-derived word-classes, two sets of ideophones, to resemble each other more than at chance level and therefore be more easily paired with their meanings by speakers of another language rich in ideophones. We expect this to be the case with Turkish-speakers scoring higher than English-speakers when presented with multimodal/video recordings of Kichwa narratives edited so that an ideophone will occur with a 1-2 sentence context (taken from larger Kichwa narratives recorded by the author during fieldwork in Ecuador).

The results of previous work indicate some ideophones were highly guessable and others not. This calls into question whether iconicity is a necessary property of ideophones and whether they constitute a defined word-class with a diverse cognitive profile, also questioning whether there are multiple levels of iconicity within and amongst language systems. Overall, ideophones were guessable on average, in line with previous studies.

Ideophones both fit the contours of the language of which they are a part and yet also possess cross-linguistic properties absent in the general lexicon, as evidenced by their role in narratives. I demonstrate the importance of video recordings of language in general for focussing on

greater aspects of human communication as well as the workings of lexical items within the semiotic system of living languages. Further, I show how these approaches can be better combined and how new questions can be posed and answered concerning the nature of language within culturally evolutionary frameworks and the differing emphases on arbitrariness and iconicity can be better refined.

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## **Perception of Built Environments and its Neural Modulation by the Behavioral Goals of the Perceiver**

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A scene refers to a view of an environment with a spatial layout one can act within. Study of scene perception encompasses any cognitive process that takes place in an environment, as is often the case in real life. In the human brain, 3 scene selective regions have been identified: parahippocampal place area (PPA), retrosplenial cortex (RSC), and occipital place area (OPA); and they are suggested to serve scene perception differently while also sharing some common functions. Neuroscience literature has extensively studied scenes, including changes in brain activity patterns in response to low-level features, scene categories, and content across various tasks. However, previous research has mainly focused on outdoor scenes and broad category differences (e.g., natural vs. man-made) or simple differences between otherwise similar scenes (e.g. color, ceiling height), with tasks that are either category-related or irrelevant to the stimuli. Interactions with fields such as environmental psychology or neuroarchitecture, which could inspire an ecologically valid study of scenes, have been limited. In this study, we look specifically at the perception of built environments where we spend most of our time, draw our categorization method from the architecture literature, and use multiple tasks. Our categories were (i) architectural elements that allow our access to and circulation within an environment, such as entrances, stairs, elevators, and corridors; and (ii) functional areas that are not aimed to aid locomotion but to respond human needs such as restrooms, eating areas, and seating areas. Functional magnetic resonance imaging (fMRI) data were collected from 15 participants while they were engaged in 2 different tasks over 8 runs as they viewed the same indoor scenes from the mentioned categories. One was a categorization task where they indicated which category the presented item belongs to, and the other was an approach-avoidance task where the participant decided if they would like to enter the presented environment or not. Regions of interest (ROIs) were determined using a separate localizer experiment. Univariate whole-brain analyses revealed significantly different activation on somatosensory and motor regions for the categorization>approach/avoidance contrast, indicating a task effect when participants are actively engaged in considering the actions that can be performed in an environment. Region of interest (ROI) analyses for the scene selective regions using representational similarity analysis (RSA) revealed significant task effects on all three regions, with varying degrees. Our findings indicate the task-based modulation of neural representations of scenes in these regions.

## Multiple Demand Regions in Cerebellum

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Cerebellum consists of 101 billion neurons, over 5 times more than the rest of the brain. Hence, suggested that the cerebellum may be involved in all matters of cognition in neuroimaging. The neuroimage activation of a common set of frontal and parietal regions in response to diverse control demands is well-known. These have been variously referred to as multiple demands, task-positive, cognitive-control, attentional network.

Cerebellum used to be thought of a motor-related region. Over the past two decades its role in other aspects of cognition has gradually been uncovered. Neuroimaging studies frequently find cerebellar activations during diverse cognitive tasks. However, functional distinctions within cerebellum remain unclear. It is commonly thought that the anterior lobe of cerebellum has motor related functions while the posterior lobe has cognitive functions. Specifically, lobules VI and VII (including crus 1 and 2) are believed to have cognitive functions while lobules I to V are considered to have motor-related functions.

We investigated which parts of cerebellum show increased activity across a diverse set of control demands and thus behave like multiple demand regions. Blind and sighted participants did four different tasks that involved working memory demands, tactile decisions, time-duration judgement and generating complex motor sequences.

Demands related motor-complexity showed increased activation in both anterior as well as posterior lobes. The three non-motor cognitive demands (working memory, tactile decision, and time-duration judgement) activated a region in lobule VI of posterior lobe that was also activated by motor-complexity. Crucially, these three non-motor cognitive demands also activated a locus in the vermis of anterior lobe that spanned lobules II-V.

We show that specific parts of cerebellum also activate in response to diverse set of control demands. These parts include what are accepted as cognitive parts (e.g., lobule VI), but crucially also include parts that are still thought of as purely motor (e.g., vermis of lobules II – V).

## The Investigation of the Perceived Motion of Biological and Non-Biological Movements

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Accurate interpretations of the true meanings of other individuals' expressions or gestures require proper representations of the motion characteristics of their movements. Accordingly, it has been argued that perception of biological motion, such as other individuals' face and hand movements, rely on partially separate mechanisms than those that serve the perception of non-biological motion. Motivated by these discussions, the present study assessed whether the way in which perceived subjective motion relates to objective measurements of motion is different between biological and non-biological movements.

Prior to data collection, a stimulus set consisting of 2-second videos of face movements, hand movements, and computer-generated non-biological pattern movements was created. For face and hand movement videos, a male and a female actor performed 13 unique movements, such as opening and closing the mouth or moving the thumb towards the index finger and back, in a rhythmic fashion such that the same movement was repeated twice in the 2-second video. Non-biological movement consisting of random displacements of many circles or squares were generated using computer algorithms aimed to mimic the motion characteristics of the face and hand videos. Objective motion energy, calculated as the average of the pixel value changes across video frames, greatly varied within each stimulus category set, but did not differ significantly across the sets. Horizontally flipped versions of all videos were also included in the final stimulus set to control for potential lateralization effects.

Forty-one university students (7 males and 34 females) with an age range of 20-34 years ( $M = 22.35$ ,  $SD = 3.03$ ) participated in the present study. Face, hand, and non-biological movement videos were presented in separate blocks, the order of which was randomized across participants. After each video presentation, participants rated the perceived motion level of the movement using a 9-point Likert scale.

As hypothesized, perceived motion ratings were positively correlated with objective motion energy estimations for all three stimulus categories. Interestingly, these correlations were lower for face movements than for hand and non-biological movements, suggesting that factors other than the average motion energy was also affecting perceived motion for faces. Exploratory analyses indicated that videos showing only oral movements were rated to display more motion compared to videos depicting only eye movements, which was in turn explained by the differences in the temporal profiles of motion in these videos. In addition, although the objective motion energies did not differ across the three stimulus categories, perceived motion ratings were significantly higher for non-biological movements compared to face and hand

movements. When ratings in separate blocks were compared, there was no repetition effect for any stimulus category, suggesting that perceived motion was stable.

These results indicate that although the degree of non-biological motion is represented faithfully, biological, especially facial, motion perception shows deviations from objective motion measurements. Whether these differences stem from motion representations in different neural mechanisms or more complex representations for biological motion compared to non-biological motion within the same neural process will be further investigated in future studies.



## Word Learning of Spatial and Temporal Metaphors across Auditory and Visual Modalities

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One of the puzzles of word learning is how children learn polysemous words that have multiple and related meanings in concrete and abstract domains (Srinivasan & Rabagliati, 2015). One proposal for the underlying mechanism is that polysemy facilitates word learning by mapping abstract meanings onto familiar concrete ones (Clark, 1973; Starr et al., 2020). To better understand this mechanism, we investigated word learning of space-to-time metaphors from perceptual experience of spatial and temporal magnitude (i.e., length and duration). Here, we ask to what extent the shared conceptual structures and perceptual processes scaffold learning and extending word meanings across space and time domains.

Our preregistered sample consisted of 160 native Turkish speakers from two age groups: adults ( $n = 80$ ,  $M_{age} = 22.32$  years) and 4- to 5-year-olds ( $n = 80$ ,  $M_{age} = 4.94$ ). Photos of eight objects and videos (or sound recordings) of eight events with short vs. long versions were used to teach a novel word. Participants were randomly assigned to either space-to-time or time-to-space conditions and to either auditory time (i.e., sound recordings of events) or visual time (i.e., videos of events) conditions. In each condition, we first trained participants with the novel word meaning “long” and later tested how they learned in the same domain and extended the meaning of this word to an untrained domain.

For word learning, a glmer model revealed an interaction between Domain (space, auditory time, visual time) and Age (adults, children) on the binary dependent variable (0=not accurate; 1=accurate) at the item level ( $\beta = -3.123$ ,  $SE = 0.919$ ,  $p < .001$ ). Children were more accurate in the space domain than auditory ( $p < .001$ ) and visual time ( $p < .001$ ). In fact, they failed to learn the temporal meaning. Adults were equally accurate in the space domain compared to auditory time ( $p = .866$ ) and visual time ( $p = .901$ ); however, they were more accurate in visual time than auditory time ( $p < .001$ ).

For word extension, a glmer model revealed a three-way interaction between Direction (space-to-time, time-to-space), Modality (auditory time, visual time), and Age (adults, children) on the binary dependent variable (0=not accurate; 1=accurate) at the item level ( $\beta = -4.075$ ,  $SE = 1.941$ ,  $p = .036$ ). For children, there was no difference across directions or modalities. Adults were more accurate in extending the meaning in the time-to-space direction when the modality was visual than auditory ( $p = .013$ ). However, this difference disappeared once the analysis was repeated after excluding participants that failed in word learning.

Summarizing, adults learned the temporal meaning better from the visual modality than the auditory modality. Once they learned the temporal meaning, they could extend to the space domain as easily, regardless of time modality; suggesting a facilitative role of polysemy in overcoming modality differences in word learning. Although children successfully learned the spatial meaning, they failed to extend this meaning to the time domain. This suggests that when acquiring temporal meanings, discovering the mappings between concepts and words that refer to them is not straightforward.

## **The Effects of Ketamine on Different Phases of Implicit and Explicit Memory**

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Ketamine is a non-competitive NMDA receptor antagonist with fast-onset antidepressant properties. The differential effects of ketamine on different types of learning and memory need to be elucidated, as previous studies on cued fear conditioning and spatial memory tasks have yielded mixed results. In this work, we investigate the effects of an antidepressant dose (10 mg/kg) of ketamine on different phases of fear conditioning, an implicit/affective learning model, as well as Morris Water Maze, an explicit/cognitive paradigm. Ketamine will be administered intraperitoneally 30 minutes before the acquisition, retrieval, and extinction phases of fear conditioning in different groups. In another experiment, the same dose of ketamine will be administered 30 minutes before the training, probe trial and reversal training of Morris Water Maze. So far, we have shown that ketamine reduces freezing behavior in the fear renewal phase when administered before the acquisition. These findings indicate that ketamine given before encoding impairs implicit/affective learning, underlining its prophylactic effect. This project will reveal the mechanisms underlying the effects of ketamine on affective and spatial memory; and will guide future studies in the field.

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**Keywords:** Ketamine, fear conditioning, spatial memory, implicit memory.

## The Effect of Stimulus Features on Stimulus-Response Associations

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The theory of event coding is an ideomotor-based theory suggesting that stimulus features and actions are not only associated with each other, but are encoded in the same code within the same “event file.” One line of evidence provided for the theory is partial repetition cost. In these studies participants are instructed to respond based on only one feature of the stimulus (e.g., press right after blue and left after green) but one or more features of stimulus also alternates (e.g., horizontal line vs vertical line). The participants react faster and more accurately if both the task-relevant and task-irrelevant features are the same as the trial before (complete repetition) and when all features are different from the trial before (complete alternation). However, if some features repeat and some features change (partial repetition), participants react slower and make more errors. According to the theory of event coding, this difference is due to a clash between the repeated feature which reactivates the previous event file and the previous action, and the alternated feature which triggers the formation of a new event file and alternation of the action. However, this interaction effect cannot be found in all stimulus feature combinations. Form and location of an object interacts with action processes but color does not affect it as much. Although sound intensity and duration interact with each other sound pitch and duration do not. There is yet no explanation for this discrepancy within the ideomotor literature. However, an explanation for this phenomenon can be the theory of magnitude which suggests that stimulus feature processed in the parietal lobe like luminance, duration, speed, and loudness are more prone to interact with each other because they are processed within the same magnitude system. To understand if the theory of magnitude can be used to explain this gap in the theory of event coding, we replicated a partial repetition cost study with features processed in both the parietal and temporal lobes. Luminance and speed were selected from features processed in the parietal lobe, and hue and texture from the ones in the temporal lobe. Based on both theories and past findings, we hypothesized that partial repetition cost would be the greatest if the task-irrelevant feature is processed in the parietal cortex. However, an irrelevant feature processed in the temporal cortex would not interfere with action selection, especially when the relevant feature is processed in the parietal cortex. The results supported our hypothesis. The repetition and alternation of task-relevant and -irrelevant features yielded big interaction effects in luminance-speed, hue-speed and hue-shape feature combinations but the interaction disappeared when speed was the task-relevant and hue was the task-irrelevant feature. A cost analysis also showed that the task-irrelevant feature needs to be processed in the parietal lobe for the effect to occur. These results show us that theory of magnitude can be combined with the theory of event coding in order to explain the discrepancy in the literature.

## **A Preliminary Study on Older Adults' and Caretakers' Perception of and Response to Social Robots**

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Living independently becomes challenging in older ages. Previous studies showed that older adults experience various physical and psychological problems (e.g., Shishehgar et al., 2018). Their connections with their environment and community might get weaker, which can cause their well-being to decrease. However, developments in robotic technology can help older adults overcome these problems. In the current study, we focused on the possible effects of three social robots (Aibo, Paro, Pepper) that can provide companionship, entertainment, and mental health care. These robots have different appearances and abilities. What these robots can provide to older adults will also alleviate the burden on caretakers. Considering all the factors, we aimed to understand both older adults' and caretakers' need for these robots, how they respond to them, and whether there are differences between their attitudes towards different robots. We conducted semi-structured interviews with older adults ( $n=18$ ) and caretakers ( $n=12$ ) by presenting pictures and videos of the three social robots and asking them to make some judgments. These interviews included both open-ended and yes/no questions. We made a sentiment analysis of yes/no questions, and we planned to analyze the answers to open-ended questions with topic modeling in the upcoming phases of the study. The sentiment analysis we performed in Python with Vnlp library's sentiment analysis class (Türker, 2021) gave us scores between 0 and 1 for each answer. We analyzed the scores with 2 (Group: Elderly, Caretaker) x 3 (Robot type: Aibo, Paro, Pepper) mixed ANOVA. The scores we got for the answers to the question "Would you like to meet and interact with this robot? Why/Why not?" showed that caretakers' sentiment scores ( $M = 0,719$ ) were significantly ( $p = .032$ ) higher than older adults' ( $M = 0,545$ ), indicating that caretakers are more willing to meet the robots. However, note that both groups gave positive responses overall. On the other hand, the answers to this question did not show significant differences between the different types of robots, nor an interaction between group and robot type. Additionally, when we asked the participants whether these robots could help them in their daily lives and whether they would like to have these robots in their homes, we found that there was not a significant effect of group or robot type or their interaction. Overall, our results suggest that both elderly and caretakers have an interest to meet with social robots regardless of their appearance. The implications of the study are significant in terms of the gerontechnology area, where older adults' technology acceptance of robot technologies led to independent, safe, autonomous, and positive aging. However, the analysis of open-ended questions with NLP techniques in the future will reveal more about older adults' and caretakers' preferences. Moreover, to cope with the care expenses of aging and provide better health monitoring services, there is an essential

need for such user need analysis studies to involve different stakeholders to explore robot user needs, demands and expectations in the early phases in order to ensure the older adults acceptance at final stages of robotics.

## **Exploring Prosocial Behavior on Video Conference Platforms: The Role of Self-Awareness**

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With the emergence of the pandemic, people started using various video conferencing programs like Zoom for work, school, or socializing for long hours. This situation even led to a novel concept called "Zoom fatigue" in the literature (Bailenson, 2021; Döring et al., 2022; Fauville et al., 2021). Zoom fatigue refers to the general, visual, social, emotional, and motivational exhaustion of individuals constantly exposed to the screen (Bailenson, 2021; Fauville et al., 2021). Possible causes of Zoom fatigue include cognitive overload, lack of physical mobility, and increased self-evaluation due to constantly being exposed to a camera view of oneself (Aagaard, 2022; Bailenson, 2021; Döring et al., 2022; Fauville et al., 2021; Ratan et al., 2022).

It is established that the exposure to one's own image (e.g., through a mirror) leads to an increase in self-evaluation (Duval & Wicklund, 1972). This effect even translates to prosocial behavior, which refers to voluntary helping and support for others (Batson, 1998; Scaffidi-Abbate et al., 2006; Lewis et al., 2021; West et al., 2011). Although prosocial behavior has various definitions in the literature, we stick to the definition from a consequentialist perspective which corresponds to the behavior that is costly to the actor but beneficial to the other/s and we developed our measures from this perspective (West et al., 2011).

It has been shown that when individuals are exposed to their images (i.e., faces), the likelihood of showing prosocial behavior increases and the underlying mechanism is thought to be heightened self-awareness and an increase in the tendency to behave in a way that aligns with one's personal values (Lewis et al., 2021). On the other hand, individuals can also exhibit prosocial behavior to maintain their reputation in the eyes of others (Berman & Silver, 2022; Bradley et al., 2018; Smith & Bird, 2000). Studies conducted in real-life and laboratory settings show that individuals who are being watched or think others are watching them tend to exhibit more prosocial behavior (Bereczkei et al., 2007; Raihani & Smith, 2015).

This study investigates the interaction between being watched and seeing one's image and the independent effects of these on individuals' prosocial behavior on video-conferencing platforms. Furthermore, we examine whether Zoom fatigue, social appearance anxiety, and social anxiety have an additional moderating effect on prosocial behavior. To address these questions, we asked the participants to solve ciphers with a partner, who was a confederate on Zoom platform. They were told to divide the work and strategize together about the task. However, participants decoded the ciphers individually. They were also informed that performance would be measured not individually but by the total number of puzzles solved as pairs.

In the first study, participants were asked to keep their cameras on/off during the game. In the condition where the camera was on, the confederate was asked to hide the participant's image to rule out the explanation of any difference in prosocial behavior due to the sense of being watched. In the game, the confederate reported starting from the end and only being able to answer one puzzle after 5 minutes, claiming they were sick and couldn't continue. The participant's performance was determined based on the total number of puzzles they solved themselves.

Our study is ongoing, and the data we present are preliminary results. We collected data from 26 participants from Koç University students in exchange for course credit. In the first part of the study, we examined whether exposure to one's image affects prosocial behavior. Our results showed that exposure to one's own image did not have a significant effect on prosociality ( $p > .05$ ). On the other hand, we found that individuals' social appearance anxiety was related to Zoom fatigue (Pearson's  $r = .389, p < .05$ ). This suggests that prosocial behavior may have a different mechanism in the video conference platforms compared to offline settings and being watched by others on video conferencing platforms may impact prosocial behavior. In the second part of the study, we will investigate the effect of being watched on prosocial behavior.



## Effect of Feedback on Memory and Metamemory Judgments in Eyewitness Memory

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Metamemory is concerned with how individuals monitor and control learning and memory. However, metamemory processes during eyewitness memory (EM) are unclear compared to other memory types. Factors such as feedback and misinformation can disrupt the confidence-accuracy relationship in memory processes (1-3 (Flowe et al., 2019, Pezdek, K. et al., 2020, Spearing, E. R. et al., 2022)). The relevance of how feedback and leading questions impact EM and metamemory judgments regarding emotionally charged events persists. This study aims to investigate the effect of feedback on EM and metamemory judgments.

It is an ongoing study, and the sample consisted of 75 healthy university students (46 females; Mage= 21.89). Participants were shown ten neutral and ten negative videos (lasting 30-60 seconds). In the first phase, participants watched the videos. Then (second phase), participants were asked to answer five open-ended questions for each video (recall). Then (third phase), participants gave confidence in three options, namely, "Yes," "No," or "Feeling of Knowing" (FOK: "I do not remember now, but I could in the future"). After that (fourth phase), participants received feedback (e.g. "Your answer is different from the vast majority of the participants; would you like to reevaluate your answer?") for one correct and one incorrect recall answer. If participants wanted to reevaluate the answer ("Yes" response), the process was repeated before moving on to the following video. Otherwise ("No response"), participants directly proceeded to the following video. Finally, participants completed a recognition test consisting of a multiple choice test.

Only the data from the fourth phase was analyzed for this poster. Independent sample t-test showed that for negative videos, correctly recalled questions, "Yes" ( $M = 0.31$ ) responses were higher than "No" feedback ( $M = 0.18$ ) responses ( $t = 3.96$ ). For incorrectly recalled questions, the "No" ( $M = 0.89$ ) response was higher than the "Yes" ( $M = 0.79$ ) response ( $t = -3.55$ ; all  $p < 0.01$ ).

For neutral videos, correctly recalled questions, "Yes" ( $M = 0.31$ ) responses were higher than "No" feedback ( $M = 0.15$ ) ( $t = 4.62$ ). For incorrectly recalled questions, the "No" ( $M = 0.89$ ) response was higher than the "Yes" ( $M = 0.81$ ) response ( $t = -3.31$ ; all  $p < 0.01$ ).

However, other effects were insignificant.

In both types of videos, participants stated that they wanted to reevaluate the questions they remembered more correctly and less they wanted to reevaluate the questions they

remembered incorrectly. The results are discussed in light of studies examining the feedback effect on eyewitness testimony.

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2. <https://doi.org/10.1016/j.jarmac.2019.11.005>

3. <https://doi.org/10.1037/h0101868>

### **Holding on to Last Words? Aphasic Word-Repetitions May Have Psychological Relevance**

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Inability to understand speech, or receptive aphasia, is well-known to occur after damage to left temporal lobe. Such patients may also have problems of semantics, e.g., they may have deficits in naming objects. Patients with receptive aphasia are also well-known to repeatedly use a word, a phrase or a sentence (verbal-perseveration). They may also coin new words (neologism), mispronounce words, semantically mis-use words. It may seem that the word/phrase being repeated or invented are random. We report a case of a 66-year-old right-handed high-grade glial tumor patient which suggests verbal-perseverations and neologisms in aphasics are not only not random but may also carry deep psychological significance for the patient.

The patient underwent neuropsychological evaluation before and days after his surgery. In the preoperative language assessments (GATA Aphasia Test, semantic and letter verbal fluency tests), the patient showed anomia, although other language abilities (i.e., comprehension, reading, speech construction, writing) were normal. In the postoperative assessment, all his major language abilities such as comprehension, reading, fluently speaking and writing were severely damaged to the extent that he was unable to communicate.

Interestingly, the patient perseverated on a single word and used it instead of almost every other word while speaking. Further, patient used new and non-existent words that were very evidently derived from this word. Crucially, this word seemed to have a key relevance in his and his family's discussions and mental preparations in lead-up to the operation.

The word he perseverated and used constantly for almost everything he wanted to say was öğren (to learn). For instance, when he was asked to tell the name of the examiner, he used the word öğren instead of the name.

The family reported that, just before the operation, they had explained the risks of the surgery to the patient. They had emphasized that he may lose his language abilities. They had motivated the patient by saying that they will learn (öğren) together and recover the impaired functions again. This likely made the word öğren not only very relevant but also emotionally salient to the patient.

The patient also showed the relatively rare right-sided hemineglect. Neglect of left-sided space and representations are very common after right hemispherical damage. Right-sided neglect,

however, is rare, especially after left temporal lobectomy. Post-operatively, the patient showed neglect of the right-side. When asked to read texts or perform some tasks on a paper, the patient neglected the right side of the paper. In addition, he neglected people on his right side.

The case suggests that perseverations and neologisms in aphasia may have deep psychological relevance to the patient. It also shows that right-sided hemineglect can occur after left temporal lobectomy.

## Are Emotional Evaluations Influenced by Culture? An IAPS Study

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The International Affective Picture System (IAPS) is one of the commonly used stimuli sets in studies investigating emotion-cognition interactions. The IAPS dataset, developed by Lang and his colleagues in 2008, was designed as standard and readily available stimuli for academics who works in this area. The cross-cultural studies on IAPS show differences in ratings of emotional stimuli across cultures (Bradley & Lang, 2007). For instance Portuguese participants revealed a lower emotional reactivity towards IAPS pictures than USA participants (Soares et al., 2015). The purpose of this study is to determine whether the normative ratings of the images from the IAPS dataset are consistent with the ratings in a Turkish sample.

A total of 115 participant used a 9-point rating scale and the Self-Assessment Manikin (SAM) to assess the arousal and valence dimensions of the 183 pictures. Of the selected images, 98 were neutral, and 80 were negative. All pictures were presented to the participants in random order. T-tests were used to compare our ratings to IAPS' original normative ratings.

The results showed that while there was a difference between the Turkish sample and the original sample in terms of arousal, there is no difference in terms of valence. Turkish sample made significantly higher ( $M = 6.62$ ) arousal evaluations for high-arousal images (6.3 and above) than the original normative values ( $M = 6.39$ ,  $p = .02$ ,  $\eta^2 = .01$ ). Also, the Turkish sample made significantly higher ( $M = 3.62$ ) arousal evaluations for the low-arousal images (3.5 and below) than the original normative values ( $M = 3,01$ ,  $p < .001$ ,  $\eta^2 = .41$ ). Regarding arousal about neutral pictures, there was no difference between the assessments and norm values. There was no difference between the original normative values and the sample evaluation for negative valence images (3.5 and below). The results of the IAPS rating presented here indicate that the IAPS is a reliable and useful tool for the study of emotion processing. Significant differences observed between the two groups in the dimension of arousal draw attention to the importance of using Turkish standard values, especially in studies conducted based on arousal.

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## **Contextual Stability, Not Prediction Errors, Underlies Event Segmentation**

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Even though we experience the world as a continuous flow, we remember our past as distinct segments of memories. This phenomenon is known as event segmentation. Here, we contrasted two theories regarding the origins of event segmentation: 1) The influential event segmentation theory suggests that memories are segmented when prediction errors occur, and 2) the contextual stability account asserts that event boundaries are generated by changes in a context, such as in location, perceptual input, or internal motivations or inferences. Participants viewed images of real-life objects and evaluated them according to one of two aspects (like/dislike, natural/manmade). We also rewarded certain object categories to further facilitate segmentation. To assess the degree of event segmentation, temporal distance and temporal order judgments were used as common standard measures. Event segmentation was observed when the same task rule and reward value (Experiment 1), and stimulus category (Experiment 2) were repeated across 5-6 consecutive images (contextual stability, e.g., A-A-A-A-A-B-B-B-B-B-A-A-A-A, etc.). However, when the intervening task rule, reward value, and stimulus category were present for just one item and did not persist in further images (prediction error; e.g., A-A-A-A-A-B-A-A-A-A-A-B, etc.), event segmentation was absent (Experiment 3). Despite creating prediction errors, as indexed by significantly increased response times at event boundaries, contextual changes did not result in event segmentation if the new context was not stable for the entire event. This finding suggests that contextual stability, not prediction errors, is the main driving factor for event segmentation.

## **Biases on Target Representations: The Within- and Across-trial Target Integration Effects in the Attentional Blink**

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The attentional blink (AB) is a robust paradigm that has been widely used in attention research. The AB refers to an inability to identify the second of two targets presented in a rapid serial visual presentation (RSVP) stream when the interval between the onset of the targets is around 150 to 500 ms. In most AB research, the focus has been on the interaction or the overlap between the processing of the first target (T1) and the second target (T2). There is evidence suggesting that people integrate T1 and T2 features in their reports when targets immediately follow each other or even at longer intervals when there are intervening distractors in between. This integration effect was found to be stronger when attention allocation to T2 was limited. However, to our knowledge, no AB study has investigated possible biasing of target reports due to feature integration from previous trials. We believe this is likely because ensemble perception, visual statistical learning, and prototype learning literatures suggest that the human visual system can automatically extract regularities from the environment and form representations which may lead to biases in current percepts. Moreover, there is evidence to suggest that such effects would be more evident when target processing is impaired. Altogether these findings imply that across-trial integration of target information may occur in the AB paradigm. In the current study, we directly investigated both within- and across-trial target integration effects in AB, expecting to see within and across-trial integration effects, modulated by attentional allocation.

We took a twofold approach in the current study: First, we analyzed continuous-measure AB data of Karabay et al. (2022), and then, we conducted an experiment to eliminate potential methodological confounds. In both experiments, targets were orientation Gabors which were presented in an RSVP among mosaic-patched distractors. The interval (stimulus onset asynchrony; SOA) between two target Gabors was either 300ms or 800ms. Participants reported the orientation of the targets in correct temporal order. The only significant difference between the two experiments was that while Karabay et al. (2022) sampled both T1 and T2 orientations from the same uniform distribution, we sampled T1 and T2 from skewed normal distributions that did not overlap, one below 90° and one above 90° (counterbalanced across participants).

As expected, in both experiments, we found evidence for within- and across-trial biases in T2 representations in the AB. In our experiment, both biases were stronger under the limited attention condition (300 ms SOA). In the secondary analysis however, while the within-trial bias showed an attentional modulation effect comparable to our experiment, the across-trial bias

was similar across SOAs. We believed that this was due to the overlap between the orientation distributions of T1 and T2 in Karabay et al. (2022). Overall, we have demonstrated that target representations in the AB may be influenced from the other target available in the current trial as well as the distributional characteristics of targets from previous trials.



## Creating Semantically Related and Unrelated Word Lists for Episodic Memory Research Using Word Embeddings

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Episodic memory is the ability to remember specific episodes from one's life. Some studies showed that subjects' episodic memory task performance could be affected by the intervention of the semantic system. For this reason, it becomes essential to examine lists containing semantically related or unrelated words to be used in episodic memory studies. In natural language processing studies, word meanings and semantic similarities can be successfully represented by learning word vectors in a large text corpus using neural networks. The current study aimed to create word lists that include meaningful words that are semantically similar and dissimilar to word embeddings obtained with neural networks.

In the study, pre-trained word vectors for Turkish of the fastText library were used to obtain word representations. This model was trained using the continuous bag of words (i.e., CBOW) model architecture with position-weights, 300 dimensions, character n-grams of length 5, size of window 5, and 10 negatives. A word pool was used that includes 981 words. The cosine angles of word vectors were compared to determine whether to add a word to the list. Two types of word lists were created. In the first type of list, word lists were created so that the words in the list were semantically related. In the second type of list, word lists were created so that the words in the list were semantically unrelated. To create semantically related words, first, it was selected random words from the word pool. Then, words from the word pool were added to the list concerning the closest word vector. Then, words which the most distant word vectors from the word pool were selected to create a new list. This process was repeated five times. To create semantically unrelated words, first, it was selected random words from the word pool. Then, words from the word pool were added to the list that did not exceed 0.22 cosine similarity, determined by trial and error. This process was repeated five times.

As a result, five lists, each including ten words, were created for the first type of list, and five lists, each including ten words, were created for the second type of list. Furthermore, group difference was found between the two list types ( $p < .05$ ). The study results showed that word embeddings can be used to investigate the intervention of the semantic system in episodic memory tasks.

### Do Bilinguals Use Gestures When They Are Disfluent?

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Using gestures decreases cognitive load and facilitates cognitive processes (Kita et al., 2017). Research suggests that gesturing might also facilitate the speech production process (Morsella & Krauss, 2004; Rauscher et al., 1996). Individuals vary in their gesture production (Özer & Göksun, 2020). Bilinguals gesture more frequently than monolinguals (Nicoladis et al., 2009; Pika et al., 2006), suggesting that gesturing helps them choose from the correct lexicon among the two competing language systems (Nicoladis, 2007). There are individual differences in terms of benefiting from gestures when speech is disfluent (Arslan et al., 2023; Avcı et al., 2022). In this study, we investigated (1) disfluency and gesture rates of bilinguals in their two languages and (2) whether and when gestures co-occur with disfluencies across their two languages. We tested Turkish-English bilingual adults ( $N = 27$ ), using Zoom Video Conferencing, in a cartoon retelling task. The participants' first language was Turkish, and English was their second language. In a within-subjects design, participants watched six Tom and Jerry cartoon clips. Participants retold half of the cartoons in Turkish and the other half in English. All clips were similar in duration and content. The order of narrative language (i.e., Turkish or English), the order of the cartoon clips, and the combination of cartoon clips and narrative language were all counterbalanced. The Oxford Quick Replacement Test (OQRT) (Syndicate, 2001) was applied to assess participants' English proficiency.

We used ELAN software (Version 6.2) (Lausberg & Sloetjes, 2009) to code disfluencies (silent pauses, filled pauses, repetitions, and repairs) and representational gestures (iconic and metaphoric gestures). We calculated gesture frequency and disfluency rate by dividing the total number of gestures and the total number of disfluencies, respectively by the total word count. Gesture-speech disfluency co-occurrences were determined and calculated based on Arslan and Göksun (2022). We calculated the proportion of disfluencies that co-occurred with a representational gesture among all disfluencies.

The paired samples t-test showed that bilinguals used more representational gestures in English than in Turkish,  $t(26) = 3.36$ ,  $p = .002$ ,  $d = .05$ . Similarly, participants were more disfluent in English than Turkish,  $t(26) = 3.36$ ,  $p = .002$ ,  $d = .12$ . When we controlled for English proficiency, individuals were still more disfluent in English,  $F(1,25) = 12.53$ ,  $p = .002$ ,  $\eta^2 = .334$ , albeit proficiency was a significant covariate of the disfluency rate in English,  $F(1,25) = 7.68$ ,  $p = .010$ ,  $\eta^2 = .235$ . For gesture-disfluency co-occurrences, we found that bilinguals were more likely to use gestures in English than in Turkish,  $t(26) = 4.50$ ,  $p < .001$ ,  $d = 0.21$ . These findings suggest that bilinguals might use representational gestures to ease their speech production process,

particularly in their second language. Our results are in line with Arslan et al. (2023), which demonstrated higher representational gesture use by Turkish-English bilingual children in their second language (English). It is important to note that our study provides only indirect evidence of gestures' self-oriented functions. This situation might also be interpreted as a communication strategy to maintain their interlocutor's attention when speaking is difficult. Creating designs to differentiate between cognitive and communicative roles of gestures is key to understanding gesture-speech interaction.

## **An Agent-Based Model to Explain the Emergence of Dominant Word Orders**

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It is known that many languages today have a dominant word order. The overall distribution of word orders in the world languages is as (SOV, SVO) > VSO > (VOS, OVS) > OSV (Dryer, 2013). But the fact that these word orders are not evenly distributed has been the subject of many research and where these dominant word orders came from is still a matter of curiosity. Various explanations have been given on this subject with the help of newly emerged sign languages which offer a valuable opportunity to study language evolution; artificial language experiments; and computational models: A dominant word order may be absent in the very initial stages of a young system; there may be cognitive biases (Kocab et al., 2019); communicative pressures shaping word order preferences (Schouwstra et al., 2020); and considering the prevalence of SOV and SVO, there is so far robust evidence for the S before O pattern (Meir et al., 2010) (Hall et al., 2014), displaying a bias for the agent preceding the patient.

In this study, we propose a model to test the existing explanations regarding the emergence of dominant word orders by searching the ways in which language structures are shaped by culture, cognition, and communication. The model comprises three components: agent characteristics (including their biases and personality traits); communication functions to simulate environmental and communal effects; and iterated learning (Kirby et al., 2014) that transfers and updates existing information from one generation to the next. 972 test cases were generated from the number of parameters included in the model and all were run.

Our results show that in some cases, dominant word order can emerge without any initial bias with different probabilities towards one order. We demonstrate that linguistic pressures and the rules of the language can influence a community's preference for specific word order. Contrastively, if a word order is not needed thanks to any mechanism in the language (case markings/suffixes) and if this community is biased from the beginning towards a word order, they can accept the bias from the beginning and carry it to the future. Results also show how the first community's size and different network structures affect the dominant word order emergence and evolution speed. As the community grows, the language may accept a word order, since the differences will be difficult to keep track of and keep in mind. On the other hand, every member of the community must be connected with each other. For this, the model is tested with different network structure types. It turns out that communities that are more connected to each other reach a regular language faster. Furthermore, communities with more flexible agents tend to change their language more readily and accept a dominant word order, while those with more stubborn individuals show little or no change in language from the beginning.

In summary, our model provides insights into the factors that contribute to the emergence and evolution of dominant word orders in natural languages. The results of this study contribute to a deeper understanding of the origins and mechanisms of word order preferences in human language while facilitating the exploration of the mechanisms underlying human learning and knowledge transfer.

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## How Does Gesture Restriction Affect Grammatical Complexity? Individual Differences in Gesture and Speech Production

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People produce gestures while speaking. Besides their communicative functions, using gestures can reduce cognitive load and facilitate speakers' cognitive processes (Kita et al., 2017). Such facilitative role of gestures can also be seen in the complexity of the speech produced. When gesture use is restricted, people produce grammatically less complex speech compared to gesture-free condition (Jenkins et al., 2017). We argue that there can also be individual differences in gestures' impact on producing complex speech. In this study, we examined whether gesture restriction affected the grammatical complexity of speech differently for high versus low frequency gesture users.

We collected data from 57 native Turkish speakers ( $M_{age} = 22.49$ ,  $SD = 2.81$ ). We used cartoon movie clips that were similar in content and duration (approx. 1 minute). There were two gesture conditions: gesture spontaneous and gesture restricted. In a within-subject design, participants first watched a movie clip without any instructions in the gesture spontaneous condition. When they watched the following clip, they were instructed to hold their hands stable while retelling what happened in the video. We used ELAN software (version 6.2) to transcribe and code gestures (iconic, metaphoric, beat, deictic, and emblem). Gesture frequency was calculated by dividing the total number of gestures by the total word count. For grammatical complexity, simple and complex clauses were coded in excel (see Kızıldereli et al., 2020). Complexity scores were calculated by dividing the total number of complex clauses by the total number of clauses.

First, participants were categorized into two groups, high gesture users and low gesture users, divided by the median gesture frequency in the gesture spontaneous condition. A 2x2 mixed ANOVA was conducted to measure how grammatical complexity scores differed across two conditions (i.e., gesture spontaneous and gesture restriction). The main effect of condition on grammatical complexity scores was not significant,  $F(1, 55) = .82$ ,  $p = .369$ ,  $\eta p^2s = .015$ . However, the interaction of gesture use frequency and gesture condition was significant,  $F(1,55) = 6.23$ ,  $p = .016$ ,  $\eta p^2s = .102$ . This interaction indicates that high gesture users have decreased grammatical complexity in their speech in the gesture restricted condition, while low gesture users have increased grammatical complexity scores in the same condition.

These findings suggest that individuals benefit from gestures in speech production differently depending on their gesture use in spontaneous speech. Those who gesture frequently in the spontaneous condition revealed lower complexity in the gesture restricted condition, suggesting

that they benefit from gestures to decrease cognitive load and produce complex speech. Conversely, low gesture users' higher complexity scores may be due to the practice they gained in the first gesture spontaneous condition. Considering that low gesture users might not already benefit from gestures as much as high gesture users, the restriction of gesture use might not have affected those participants to the same degree as high gesture users.

## Pupil Dilation in Time Perception

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Time perception corresponds to how we perceive and understand the duration, sequence, and pacing of incidents in our surroundings and is the subjective experience of the course of time. The integration of data from various sensory inputs as well as higher-order cognitive processes like attention, recall, and decision-making are all part of this intricate and multidimensional process.

Pupil size is known to increase in response to all kinds of demands like attention, working memory, decision-making, difficult perception, memory recall, etc. Such studies show increased pupil size during any kind of effortful task. In a previous study, we proposed that there are two kinds of task demands. (1) Load related to what is being done at the moment, e.g., increased attention or increased working memory. This form of load (let's call it load-1) is well-recognized. We, however, postulated a different and unrecognized form of cognitive load (load-2). This load is related to how long is the current task-episode going to last. This load comes about because we execute long tasks as one-entity, we e.g., write emails, shop and not individually execute their very-many component acts. Longer tasks mean a longer period of cognition and behavior has to be organized and controlled as one unit. We had shown that while load-1 increased pupil size, this new form of load, load-2 decreased it.

In the current study, we tested these hypotheses in a different kind of task. We use a time-interval replication task. Participants were given various time intervals, e.g., 11 seconds, to replicate by pressing a button at the beginning and the end of the interval. Such a task required that participants pay attention to their inner sense of time and press a button when they felt the required duration was over. We used a set of short (8-12 seconds) intervals and a set of longer (14-18 seconds) intervals. Longer intervals were more demanding. This was evident in more erroneous performance when replicating these intervals. But this demand was related to load 2 because the longer intervals required a longer period of attention to the passage of time and hence corresponded to a longer task episode.

We tested 32 participants (22 females, ages 18-27). If, as is popularly thought, pupil size increased during any kind of load, then it should be larger when participants replicated longer durations. In contrast, if pupil size decreased in relation to how long the task was (i.e. load 2), then pupil size would be smaller when participants replicated longer durations. We found that during the replication of longer intervals, pupil sizes were indeed smaller, both at the beginning and toward the end of the replication.



We thus show that a different kind of cognitive load that, unlike the more commonly recognized form of load, does not increase but rather decreases pupil size.

Keywords: pupil dilation, time perception, time intervals, internal task, cognitive load.

## Interpreting Conditionals in a Dynamic Judgmental Logic

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One of the most controversial topics in linguistic semantics is the interpretation of conditional sentences. The material implication account has long been challenged by ‘paradoxes of material implication’, and various remedies have been proposed. These include other ‘operator’ accounts (e.g., the three-valued systems of Łukasiewicz 1920, Ramsey 1931 and de Finetti 1936), possible worlds accounts which retain some form of truth-evaluability (e.g., C. I. Lewis 1912, Stalnaker 1968, D. Lewis 1973, Kratzer 1979), and dynamic accounts which take the antecedent as ‘shifting’ the world of evaluation (e.g., Heim 1992, Gillies 2010, Yalcin 2012, Carter, to appear).

These different analyses generally reject that a false antecedent will make the conditional sentence true regardless of the value of the consequent –the  $\langle 0, 0, 1 \rangle$  and the  $\langle 0, 1, 1 \rangle$  lines in the truth table for material implication. But most still admit the validity of the  $\langle 1, 0, 0 \rangle$  and the  $\langle 1, 1, 1 \rangle$  lines. Yet, Krzyzanowska et al. (2017) already show that the  $\langle 1, 1, 1 \rangle$  line (‘strong centering’) is rejected by their experiment participants in case the antecedent and the consequent are not inferentially relevant. Lassiter (2022) reports that in general, experimental participants conceive ‘truth’ or ‘falsity’ in ways that divert from their uses in logic, and their judgments vary depending on various pragmatic factors.

In this talk I will argue that none of the four lines of the material conditional truth table can be taken for granted in interpreted systems, which, as I will try to show, include human languages. Below is an illustration of how ‘strong centering’ can be invalid in an interpreted system where sentences already express epistemic evaluations from a certain perspective. The sentence

(1) If John has left, Mary has left too.

can be interpreted in the speaker’s or in a hearer’s knowledge state. For a person for which both the antecedent and the consequent are ‘true’ (known for sure, certain), this sentence will not be assertable. This is because indicative conditionals require the propositional contents of their antecedents to be epistemically modal or hypothetical. From a hearer’s perspective too, the sentence will not necessarily be accepted as ‘true’. It will be rejected, for instance, in a scenario where the hearer knows that both John and Mary have left, and also that Mary left because she got an urgent call from her mother.

I will present my analyses in a dynamic suppositional account of conditionals which (i) recruits ordered Kripke frames of possible world semantics, (ii) incorporates a judgmental logic which admits a rich range of epistemic values beyond truth, falsity and indeterminacy, (iii) recognizes different perspectives for interpretation, including the ‘in-built’ evaluation of the speaker, and

(iv) treats implication, modality and conditionality as mechanisms which are semantically independent from (not strictly coupled to) each other.

I will support my arguments with analyses of Turkish conditionals marked by -ise, -sa and -saydı. I will also present some possible explanations on why the material conditional, which has been empirically challenged by various sorts of data, is still practical in the discourses of logic, mathematics and in the generalizations of empirical science.

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## Designing Multimodal Utterances: The Role of Addressees' Perceived Spatial Aptitude

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Speakers tailor their utterances according to the communicational needs and the knowledge of their addressees, which is known as audience design (Clark, 1996; Clark & Murphy, 1982). This design aspect occurs multimodally; speakers also adapt their co-speech hand gestures to their interlocutors. Earlier studies showed that speakers used more gestures when talking to a child compared to an adult (Campisi & Özyürek, 2014) and when talking to people sharing a common ground than when there is no common ground between interlocutors (Holler & Stevens, 2007). Given the unique role of gestures in spatial thinking and communication (Alibali, 2005), in an ongoing project, we examined how speakers adapt their spatial speech and co-speech gestures according to the perceived spatial aptitude of their interlocutors when describing spatial problems. We recruited 24 native-Turkish speaking university students (16 females, Mage = 20.3 years). Participants first completed the computerized version of the mental rotation task in which they were presented with two 3D figures rotated with different angles (0, 50, 100, or 150 degrees) and asked to decide whether they were same or different when rotated mentally. We did not give any feedback regarding the participant's performance and measured both accuracy and reaction times. Following these, participants were asked to explain how to solve different problems to two different addressees who completed the mental rotation task with 52% (low-spatial ability addressee) or 96% (high-spatial ability addressee) accuracies. Participants were told that their explanations would be recorded and later, presented to their addressees who would try to solve these problems with the help of their explanations. They explained how to solve problems across three tasks: (1) mental rotation problems: the task for which they know the performance of their addressees, (2) near-transfer spatial task: Santa Barbara Solids Task (Cohen & Hegarty, 2007) that is a spatial visualization task that involves identifying the cross section visuals that result from the intersection of a cutting plane and a geometric solid, and (3) far-transfer verbal task: phrase explanation task which involves different Turkish phrases, such as "Suya götürüp susuz getirmek." All participants explained all tasks to both addressees in a within-subjects design (2 addressees: low vs. high-spatial X 3 tasks: mental rotation vs. spatial visualization vs. phrase description). The order of the addressee and the task was counterbalanced and the order of the items within each task was randomized across participants. In this ongoing project, we are still in the process of coding spatial speech (spatial words referring to static objects such as U-shaped figures, location/direction such as towards right, or spatial knowledge such as horizontal axis) and gestures (iconic, pointing, and beat gestures). We hypothesize that participants would use more gestures and spatial speech to low-spatial compared to high-spatial addressee, only for spatial tasks and not for the verbal task. We will present preliminary results regarding the use of spatial speech and gesture in mental

rotation explanations. These results will be discussed considering adjustments in multimodal communication for the spatial context.

## **Children Allocate More Visual Attention When Planning Informative Spatial Descriptions in Speech-Gesture Combinations than in Speech**

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How children gather information from the visual world when planning informative spatial descriptions and does this change depending on the modality of informativeness?

Communicating about spatial relations in informative ways requires unambiguously referring to objects and spatial relationship among them. To ensure this, children must pick up information from the visual world when planning descriptions. However, children acquiring spoken languages do not always use informative expressions in their spatial descriptions, especially for Left-Right [1-2]. For instance, 8-year-olds often produce under-informative descriptions in speech (e.g., side) but use iconic gestures that disambiguate these descriptions [3]. Previous research showed that visual attention differs when planning event descriptions in speech-only than speech-plus-gestures [4]. Furthermore, when planning descriptions of object locations, visual attention patterns of signing-adults who use iconic expressions in sign differ from that of speaking-adults who use expressions in speech [5]. In this study, we aim to investigate whether children's visual attention differs based on the modality of the description (speech, speech-plus-gestures) by eliciting descriptions of left-right relations using a visual world production eye-tracking paradigm [5].

Participants were 8-year-old monolingual Turkish-speakers (N=20). The stimuli consisted of 84 displays with 4 pictures showing the same two objects in various spatial configurations (Left-Right, lemon right to box; Front-Behind, lemon behind box; In-On, lemon on box). In each display, one picture, indicated by the arrow, was the target picture. Participants' eye-movements were recorded while they prepared to describe the target pictures to a confederate. 14 displays depicting Left-Right relations in the target picture were critical stimuli.

Descriptions with specific spatial nouns (Left, Right) were coded as informative in speech regardless of gesture use as speech already conveyed the spatial relation informatively. Descriptions with general spatial nouns (Side, Next to) accompanied by spatial gestures that disambiguated the relative locations of the two objects were coded as informative with gesture. The remaining descriptions were under-informative.

Of interest was whether the time course of fixations to the target picture would change depending on description type. We analyzed whether the target picture was fixated from 1500ms to 3500ms after trial onset in successive 50ms bins (from disappearance of the arrow to the beginning of the description). A glmer model showed that (1) children had more target fixations when planning informative descriptions compared to under-informative descriptions ( $\beta$

= 0.515,  $SE = 0.131$ ,  $p < 0.001$ ); (2) within informative descriptions, they had more target fixations when planning descriptions that are informative with gesture compared to when planning description that are informative in speech ( $\beta = -0.827$ ,  $SE = 0.171$ ,  $p < 0.001$ ).

Summarizing, children's visual attention to left-right relations differs in description-specific ways (informativeness and modality). Children allocate more visual attention to spatial relations to be described when planning informative descriptions and when the disambiguating information is conveyed multimodally. These results extend previous literature on the relationship between visual attention and informative object descriptions in children [6]. Furthermore, they corroborate evidence for the mediating effect of iconicity between language and human visual experience [4-5] by showing that planning descriptions in iconic ways relate to differences in visual attention also during development. Overall, results call for considering gestures and visual attention patterns when investigating children's pragmatic and linguistic development.

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## **The Role of Working Memory for Mental Operations on Long-Term Memory**

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Working memory (WM) is suggested as a workspace for mental operations. Since previous studies have emphasized the role of working memory for newly received information, its role for the information available in long-term memory remains unclear. Using a novel behavioral index, we examined the involvement of working memory for the information stored in long-term memory (LTM) during different cognitive tasks, recognition and mental integration. In the learning phase of the experiment, participants ( $N = 21$ ) studied color-location associations. Then, their memory for the associations was tested. In the main experimental session, participants received a novel position which was then followed by a color retrieval cue. At the end of each trial, a probe was presented to the participants. The main task was to report if the probe matches with any of the memory locations (recognition) or was equidistant to both memory positions (mental integration). Before the main task, participants were asked to complete a secondary perceptual discrimination task to report the orientation of a tilted line. Given that perceptual discrimination performance is enhanced at the positions stored in working memory, we hypothesized that perceptual discrimination should be facilitated for the positions that are reactivated in working memory compared to other, irrelevant positions. We observed perceptual facilitation only in the mental integration condition but not in the recognition condition. Therefore, our findings revealed that information in LTM is reactivated in WM mainly for mental operations as opposed to mere remembering, providing evidence for the role of WM as a mental workspace for mental operations.



### **Role of Estrogen Receptor $\alpha$ (ER $\alpha$ ) on the Antidepressant Effects of Ketamine**

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Ketamine holds promise as an alternative to SSRI-based antidepressants with its fast and sustained antidepressant and anxiolytic effects. Preclinical studies show that female rodents are more responsive to ketamine, which is thought to be a result of ovarian hormones, particularly estrogens. In vitro findings show that ketamine is able to bind and upregulate estrogen receptor alpha (ER $\alpha$ ), and inhibiting ER $\alpha$  blocks ketamine from upregulating AMPAR. However, these results need to be translated into preclinical models as the behavioral significance of ER $\alpha$ 's regulatory effects on ketamine metabolism remains unclear. To fill this gap, we designed an in vivo paradigm in which we administered ER $\alpha$  antagonist MPP to female Wistar rats prior to ketamine administration. The antidepressant success of ketamine is measured via Forced Swim Test (FST) and its anxiolytic effects are tested in Elevated Plus Maze (EPM) and Fear Conditioning (FC), while Open Field Test (OFT) is applied to control for locomotor activity. We predict that animals who have received ER $\alpha$  antagonist prior to ketamine treatment will show more immobility in FST and higher freezing in FC, while spending less time in open arms in EPM compared to ketamine-only group. As hypothesized, ANOVA analysis showed that ketamine group stayed less immobile than the vehicle group, while interaction between ketamine and MPP was not significant. The interaction in EPM nears significance ( $p = .063$ ). No significant change in locomotor activity was observed in OFT in either ketamine or MPP groups. Additionally, simple effect analyses showed that ketamine's effects were significant between non-MPP groups in FST and EPM, but not significant between groups that have received MPP. Overall, our preliminary results show a statistical trend in line with our predictions. Blocking ER $\alpha$  decreases females' sensitivity to ketamine; which is in support of our initial hypothesis that ER $\alpha$  may play a critical role in regulating ketamine's metabolism.

## **Can Individuals Implement Strategies to Protect Memories During Retrieval Against Divided Attention?**

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Divided attention during long-term memory retrieval is detrimental for recall performance. What if individuals know that there will be interference and postpone retrieval until interference is over? Here, we tested the effects of instructions to postpone retrieval until after anticipated distraction on retrieval costs. Across two experiments, participants first studied object-orientation associations. After an intervening task to prevent rehearsal, participants took the cued-recall phase. They were given objects as retrieval cues and were asked to report the orientation associated with the cue object by rotating the object using the mouse. Before the probe, on some blocks, a secondary divided attention task required participants to identify the location of a red star (left or right side of the screen) and report it after the orientation recall phase. Importantly, in Experiment 2, the participants ( $N = 48$ ) were instructed to delay retrieval by waiting for the attention task to be over before retrieving the cued orientation. Our logic was that holding onto the retrieval cue and performing retrieval in the absence of the secondary task should diminish divided attention costs. In Experiment 1 ( $N = 48$ ), participants were not given any instructions on how to cope with interference. The divided attention cost (i.e., larger error rates in the divided attention vs. the full attention condition) was present only in Experiment 1. However, the divided attention cost difference between two experiments was not statistically significant. Thus, our findings support the view that memory retrieval cannot be postponed at will to refrain from divided attention cost and provides evidence for the automatic memory retrieval hypothesis.

## **Designing Menus for a Sustainable Future: The Role of Non-Meat Decoys**

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**Keywords:** sustainable food choice, decoy effect, eye tracking, menu design

As the global population grows, demand for food is increasing and placing pressure on the planet's resources. To address this issue, research is exploring menu-based nudges that promote sustainable food choices and the shift towards plant-based diets. One such nudge is the decoy effect, which introduces a third option to influence an individual's preference between two options. This study aims to investigate whether the presence of a more expensive non-meat decoy option on a menu affects the selection of a target non-meat option compared to a competitor meat option. Additionally, the study examines the role of basic menu features and eye movements in the menu selection process. Thirty-six participants aged 18-32 who did not follow a special diet were included in the study, and their eye movements were analyzed during menu selection. The results showed that participants fixated the most on the main course, followed by prices and then side dishes. The meat menu was chosen by 49.1% of participants, the non-meat target menu by 33.8%, and the decoy menu option by 17.1%. Overall, participants focused their attention on the main meat dish for the longest period of time, followed by non-meat and decoy non-meat options. Interestingly, the price was fixated on significantly less when selecting the meat menu compared to the other menus. Overall, our findings suggest that the decoy effect can be used as a tool to promote sustainable food choices, and that eye-tracking data can be useful in understanding the decision-making processes of individuals and influencing them towards more sustainable choices.

## **Neural and Ocular Correlates of Conceptual Grounding in Verbal Interaction**

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During the joint action of verbal interaction, successful resolution of linguistic ambiguities highly depends on optimal conceptual distances between the meaning of what was said and what was implicated within each interlocutor, as well as between what was said and what was perceived among interlocutors of the interaction setting. The optimization phenomenon in linguistic ambiguity resolution, as a result, defines a distributed process that extends beyond each participant and the interaction setting; wherein it is best defined as the establishment of conceptual common ground. In the literature, this process has often been considered a joint action that is inclusive of partner, task, and/or topology dependent effects, such as conceptual pacts or shared visual spaces. However, temporal constraints, differences in subjective engagement in the task, as well as unfamiliarity with one another among interlocutors might all affect the neuro-cognitive establishment of conceptual common ground. In the present study, the entrainment process of optimizing and/or establishing conceptual common ground along with its behavioural and linguistic correlates are investigated for whether the achievement of a conceptual pact can be correlated with activity in the cortex by utilizing neuroelectrical, hemodynamic, and ocular measures. Employing a hyperscanning setup with dual-EEG, dual-fNIRS, and dual-eye-tracking, the present study offers prospects for a multimodal investigation of conceptual grounding in terms of gaze coordination and neural entrainment patterns in an effort to expand our understanding of human verbal interaction in a joint action setting, which might ultimately inform the design of neuroadaptive interaction settings in the future.

## The Role of Spatial Words in the Spatialization of Time

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The Conceptual Metaphor Theory (Lakoff & Johnson, 1980) claims that we use space to think about time, using spatial concepts for temporal ones by attributing location or motion to time, like “The coming weeks...” or “The days ahead...” Temporal focus is a concept that explains how people think about time based on their attitudes toward the past and the future (De la Fuente et al., 2014). De la Fuente and colleagues (2014) showed that Spanish students placed the past in front of and future behind a character in a temporal diagram, whereas the Moroccan students did the opposite. They explained this difference with cultural attitudes (progressive versus traditional) toward time. Temporal focus can be more flexible than that. Visiting a modern versus traditional art museum or seeing spatial metaphors of time that place the past in front or behind also influence how we locate the past and the future in space (Gu et al, 2019; Li & Cao, 2017). Building on this flexibility, we aimed to investigate the role of metaphorical language in temporal event placements using our version of the temporal diagram task.

We modified the original temporal diagram task, adding one square on the left and the right of the character to represent the lateral axis. We tested 96 participants using temporal scenarios with sagittal and non-sagittal spatial metaphors of time along with non-metaphorical scenarios. The scenarios included two events that were in front or behind the subject (sagittal), following each other (non-sagittal), or simply took place at different points in time without a metaphor (non-metaphorical). Every participant saw 5 scenarios of each type. For responses, the participants placed the initials of each event in 2 of the squares (de la Fuente et al., 2014). We also administered a Temporal Personal Focus Scale (Callizo-Romero et al., 2020).

We coded the front-back responses as “Sagittal.” “Lateral” responses involved event placements on the left and right of the character. Some responses used one square on the sagittal and the other on the lateral axis, we coded them as “Other”. We found that the sagittal scenarios elicited more sagittal event placements than the non-sagittal and non-metaphorical scenarios. The non-sagittal and non-metaphorical scenarios elicited more lateral responses than the sagittal scenarios. We did not find a relationship between temporal focus scores and responses.

Language seems to be a factor in how we place temporal events in space, beyond temporal focus. Language may have overridden the effects of temporal focus with the mappings provided in spatial metaphors of time. Alternatively, temporal focus effects may have subsided because our sample consisted of participants affiliated to a single culture (or similar cultures), similar to the findings of Gu and colleagues (2019). Future studies that study different spatial metaphors

of time in relation to temporal focus may shed further light on how language and temporal focus interact to influence our spatial conceptualization of time.

Keywords: time, metaphor, language, temporal focus, axis

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## Unified Benchmark for Zero-Shot Turkish Text Classification

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Effective learning schemes such as fine-tuning, zero-shot, and few-shot learning, have been widely used to obtain considerable performance with only a handful of annotated training data. In this paper, we presented a unified benchmark to facilitate the problem of zero-shot text classification in Turkish. For this purpose, we evaluated three methods, namely, Natural Language Inference, Next Sentence Prediction and our proposed model that is based on Masked Language Modeling and pre-trained word embeddings on nine Turkish datasets for three main categories: topic, sentiment, and emotion. We used pre-trained Turkish monolingual and multilingual transformer models which can be listed as BERT, ConvBERT, DistilBERT and mBERT. The results showed that ConvBERT with the NLI method yields the best results with 79% and outperforms previously used multilingual XLM-RoBERTa model by 19.6%. The study contributes to the literature using different and unattempted transformer models for Turkish and showing improvement of zero-shot text classification performance for monolingual models over multilingual models.

## **On the Edge of Cognitive Revolution: The Impact of Neuro-Robotics on Mind and Singularity**

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The mind has always been a peculiar and elusive subject, sparking controversial theories throughout the history of philosophy. The initial theorization of the mind dates back to Orphism, which formulated a dualistic structure of soul and body (Johansen, 1999), laying the foundation for Greek dualism, introspection, and the rise of metaphysical idealism. This ill-empirical stance, especially after Plato's idea of forms, led to inaccessible theoretical concepts concerning the investigation of the relationship between body and mind. Although diverse theories provide broader insights into such matters, they can also hinder progress if based on unsound methodological hypothesis. The present study aims to employ a rational reexamination of the potentiality of the concepts of mind, using abductive inspection to present a valid grasp through the lens of cognitive neuroscience, philosophy, and interdisciplinary fields. This paper speculates through empirical deduction by analyzing the literature and theories on the concept of mind and its possible implications for singularity via transhumanism.

In the contemporary world, humankind is on the edge of singularity due to the exponential growth predicted by Moore's law (Moore 1965). While many considered singularity an abstract akin to science fiction, significant projections indicate that the accelerationist change has already begun, irreversibly. This advancement occurs not only in the degree of semiconductors in electronics but also in the amplification of human cognition through external devices enabling compound information flow via the world wide web. However, the conjunction of robotics and AI may outdo humankind in the contest for sovereignty soon due to their advantageous architecture in process design, which increases the systemic risk of extinction for humankind. Achieving total control over AI is unrealistic, as it requires complete supervision over all computers and information processes across the world, rendering any regulatory efforts to foresee augmentation futile. Consequently, this paper proposes the adoption of a neuro-robotic approach, enriched with AI, and implementation through biomedical applications on the human body to augment human cognition and physicality. This study aims to raise awareness against existential risks, emphasizing that reliance solely on AI powered computers could lead to annihilation. It also aims to highlight that biological mind and body is lagging behind the modern science to compete against Artificial Intelligence. Moreover, the foundation of Artificial General Intelligence (AGI) is an epistemic foundation for cognitive machinery enhancement that cannot be reversed once its emergence becomes apparent, as with Pandora's Box. Technological singularity (Shanahan, 2015), the point where technology is intelligently engineered to engineer its own sets by compounding all possible implementations of practical and theoretical information, is appearing on the horizon. Even if there is no human agency left on the soil of Earth, there is still no turning back at that point. Humankind must actively hold the key to bend



this alteration in a way that aligns with its desires. Therefore, we propose, future for humankind lies with transhumanism.

## **Internal Attention is the Only Retroactive Mechanism for Controlling Precision in Working Memory**

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Recent research has suggested that humans can assert control over the precision of working memory (WM) items. However, the mechanisms that enable this control are unclear. While some studies suggest that internal attention improves precision, it may not be the only factor, as previous work also demonstrated that WM storage is disentangled from attention. To test whether there is a precision control mechanism beyond internal attention, we contrasted internal attention and precision requirements within the same trial in three experiments. In every trial, participants memorized two items briefly. Before the test, a retro-cue indicated which item would be tested first, thus should be attended. Importantly, we encouraged participants to store the unattended item with higher precision by testing it using more similar lure colors at the probe display. Accuracy was analyzed on a small proportion of trials where the target-lure similarity, hence the task difficulty, was equal for attended and unattended items. Experiments 2 and 3 controlled for output interference by the first test and involuntary precision boost by the retro-cue, respectively. In all experiments, the unattended item had lower accuracy than the attended item, suggesting that individuals were not able to remember it more precisely than the attended item. Thus, we conclude that there is no precision control mechanism beyond internal attention, highlighting the close relationship between attentional and qualitative prioritization within WM. We discuss the important implications of these findings for our understanding of the fundamentals of WM and WM-driven behaviors.

## 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 which provides evidence that self-generating information produces higher memory performance than reading it passively. In a typical generation experiment, participants are asked to generate some words and process the rest of the words passively. The effect can be obtained through various semantic and perceptual generation manipulations. Perceptual tasks typically focus on the surface characteristics of the words, such as generating the word through letter transposition (clod for cold) or generating it from rhyming words (bold- c \_ \_ \_). Semantic tasks, on the other hand, focus on the meaning of the words and require participants to generate the words from their associated words (e.g. hot – c \_ \_ \_). Despite the numerous studies that investigate semantic and perceptual generation tasks, studies do not typically compare the effectiveness of semantic and perceptual generation tasks directly on enhancing memory performance. One aim of the current project was to compare how participants' actual memory performance differed for perceptual and semantic generation tasks. For Experiment 1, participants read or generated words either from rhyming words (bold -cold; bold – c \_ \_ \_) or from highly associated words (hot -cold; hot -c \_ \_ \_), comprising a 2 (type of processing: generation vs read) x 2 (level of processing: perceptual vs semantic) within-subjects design. This was followed by distractor and recognition phases. Results showed that participants had higher memory performance for generated words than read ones. Moreover, an interaction between the type and the levels of processing manipulation revealed that the recognition performance was higher for the semantic generation condition than the perceptual generation condition. In contrast, there was no difference in recognition across perceptual and semantic read conditions.

A second aim of the project was 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 about one's own memory performance modifies memory performance. These questions were tested through Experiment 2. Experiment 2 was similar to Experiment 1, except for two major differences. First, participants were randomly assigned to either judgments-of-learning (JOL) or no-JOL group. Participants in the JOL-group produced a confidence rating about the likelihood of recalling each stimuli between 0-100, whereas participants in no-JOL group entered random numbers between 0-100. Second, participants recalled their responses through a cued-recall test rather than a recognition test. Results revealed two main effects for both predicted and actual memory performance such that participants predicted their performance to be higher for generate than read words and for semantic than perceptual manipulations. The actual memory results were consistent with

participants' predictions. Participants produced higher memory performance generate than read and semantic than perceptual manipulations. This indicates that participants were aware of both the benefits of generation and levels-of-processing manipulations. Finally, participants assigned to JOL-group produced higher memory performance than participants assigned to no-JOL group, implying that the mere act of making predictions about memory can modify actual memory performance through reactivity.

## **Bidirectional Relationship Between Haptic Exploration and Visual Perception of Materials**

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Exploratory Procedures are stereotypical hand movements that people use to explore soft objects (EPs, Lederman & Klatzky, 1987). These EPs may be driven by the material characteristics of objects (e.g., stroking something furry) or by the task at hand (e.g., static contact for assessing temperature but pressing to judge compliance). Here we investigated whether the effect can also be observed the other way around: Do these EPs affect our judgments about the visual material characteristics of objects? Recent research has identified five dimensions of perceived softness: deformability, viscosity, surface softness, granularity, and roughness. These dimensions are associated with specific EPs such as press, rub, rotate, run through, pull, stir, tap, and stroke. For instance, participants consistently stroke materials with hairy surfaces but run granular materials through their fingers. In this study, we conducted two experiments to investigate whether the dynamic visual presentation of an EP congruent with a specific material dimension would yield more information about the material's properties than an incongruent EP. To this end, in Experiment 1, we created 16 videos from 8 everyday materials, each showing a congruent and an incongruent EP. Participants viewed these videos in a semantic differentiation task, rating materials based on softness-related adjectives, such as goeey, velvety, elastic, and powdery. We did not observe systematic EP effects in Experiment 1, which might be due to the incongruent EPs still conveying various extra information about the material. To further investigate this, we conducted Experiment 2 with better control of the incongruency. Here, we used stirring as the incongruent EP for all materials, as it was not reported to be correlated with any specific softness dimension. The results showed that a congruent EP leads to enhanced ratings of material properties, particularly for deformable and soft surface materials. Our findings suggest that observing how a person interacts with an object in different ways can manipulate an observer's perception of its material properties. This bidirectional relationship between EPs and visual perception of soft materials has implications for various fields, including product design, marketing, and material science.

## The Effect of Linearity and Prosody in Children's Processing of Quantifier Ambiguity

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Scope ambiguities complicate language acquisition since children have to acquire a language on the basis of a limited amount of linguistic input. Child language acquisition studies show that when 4-to-5-year-old children are asked to interpret sentences with a scope ambiguity, such as “Every horse didn’t jump over the fence”, they struggle to access the inverse scope interpretation where only some of the horses jumped over the fence (Savinelli et al., 2017). One explanation for this pattern is that young children systematically interpret these utterances on the basis of surface syntax (Musolino, 1998). Although early studies explain children’s scope errors by their syntactic representations (Lidz, 2018), research yielded contradictory findings about children’s distributivity bias. Some studies showed children may be able to reach inverse scope interpretations under certain contextual manipulations (Kiss et al., 2013). However, there have been few empirical investigations into how preschoolers combine different constraints to handle this kind of uncertainty. Therefore, it is unclear which sources of information children use to disambiguate these utterances. We examine, for the first time, the effect of syntactic and prosodic information on children’s resolution of scope ambiguities in doubly quantified sentences in Turkish.

We employed a sentence-picture matching task adapted from Kırçalı (2020). The experimental sentences were in two conditions with two levels, which led to four types of experimental sentences. We manipulated the order of the quantifier as universal-first (every ... a) (e.g., Her çocuk bir kediyi okşadı) or universal-second (a ... every) (e.g., Bir çocuk her kediyi okşadı), and we manipulated the prosodic focus as focus on the existential or universal quantifier. 4-to-5-year-old children ( $M_{age} = 5:01$ ;  $N = 54$ ) and adults ( $M_{age} = 27,72$ ;  $N = 108$ ) saw two pictures, each depicting either a narrow or wide-scope reading of the target sentence. Following each pre-recorded utterance, they chose one of the two pictures. The accuracy rates were analyzed using ANOVA, which showed that neither adults’ nor children’s preferences for ambiguous sentences in the universal-second order changed with the prosodic information on the quantifier. There was a greater tendency to interpret these sentences as collective. However, we found an effect of focus only in children in the universal-first order. Although they preferred a collective meaning when the existential quantifier was focused, their interpretation became distributive when the universal quantifier was focused. Since previous research suggested children cannot access the inverse scope readings of these ambiguous sentences (Musolino, 1998), this finding was unexpected and shows children’s sensitivity to prosodic cues. However, in adults, there was a greater tendency to interpret the universal-first order sentences as distributive regardless of the focus.

This study shows that prosodic information can facilitate children's realization of alternative meanings in scopally ambiguous sentences. Since this effect only emerged in sentences with the universal-first order, this aligns with those of previous studies highlighting the role of linearity in disambiguation (Filik et al., 2004). As to why adults did not show sensitivity to prosody, we conjecture that they may be over-focusing on syntactic information in a manner masking their sensitivity to prosodic information in syntactically tasking structures, which was also attested in previous child-adult comparative studies (Wiedmann & Winkler, 2015).

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## Metalinguistic Awareness as an Indicator of Linguistic Giftedness

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Gombert (1992) viewed metalinguistic activities as a subfield of metacognition, and argues that metalinguistic reflection may result in cognitive products or symbolic objects which are easily perceived and frequently manipulated by the child and which are important for the general development of thought and, more specifically, for metacognitive development. Furthermore, increased level of metalinguistic awareness (MLA) seems to be characteristic of bi- and multilingual development (Bialystok 2001; Dolas 2021). As stated by Bialystok et al. (2014) MLA is a set of multiple skills that are related to the formal aspects of language: phonological, morphological, syntactic and lexical awareness (Altman et al. 2018). Throughout the last decades, studies on bi- and multilingual learning show that language aptitude and metalinguistic abilities or skills present related concepts which might be interpreted as identical concepts under certain circumstances (Jessner 2006). In this frame, the current study tends to highlight the role of MLA in defining the relationship among able language learners, linguistic giftedness (LG) and multilingual learning via focusing on the Dynamic Model of Linguistic Giftedness (Dolas 2021; Dolas et al. 2022) which states that the universe of able language learners intersects with the universe of metalinguistically aware ones upon the observation of cognitive and linguistic performances of a number of mono-, bi- and multilingual children from gifted and non-gifted educational contexts in a dynamic perspective. The study is a review of a previous analysis by Dolas (2021), uses a multiple linear regression model based on the scores gathered from the data of working memory and vocabulary sub-tests of the Turkish adaptation version (Savaşır & Şahin 1995) of the Wechsler Intelligence Scale for Children—Revised, and metalinguistic awareness test (Pinto 1999). The results highlight the importance of MLA in multilingual learning and can be regarded as an indicator of linguistic giftedness thus as a result of the interconnectedness of the dynamic systems in multilingual minds, language aptitude should be rearranged according to the multilingual competence and MLA levels of linguistically gifted individuals.

keywords: bilingualism, multilingualism, cognition, metalinguistic awareness, linguistic giftedness

\* Dolas, F. (2023, accepted journal article, in press). Metalinguistic Awareness as an Indicator of Linguistic Giftedness. *Rivista Di Psicolinguistica Applicata Journal Of Applied Psycholinguistics*, Pisa, Rome, Italy (doi will be announced)



## Towards a Shallow Discourse Parser for Turkish

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In recent years, the hard problems in natural language processing (NLP) are being resolved with an increasing speed and context-aware models are becoming more and more important in the field. In that respect, one of the strategic topics is discourse, the level of language beyond clauses, which has been growing as a crucial analytic level in NLP [1] and speech analytics [2]. The role of discourse parsing methods has been growing steadily to improve dialogue systems, as well [3, 4].

Exploiting discourse relations as the main conceptual model of discourse, this study focuses on the development of a shallow discourse parser for Turkish. Discourse relations are an important aspect of a text's coherence and involves the pragmatic or semantic relations that hold between clauses (addition, cause-effect, conditional, similarity). Their identification and classification appear as important challenges to be resolved to support tasks such as text summarization, dialogue systems, and machine translation that need the information above the clause level. Despite the recent interest in discourse relations in well-known languages such as English, data, and experiments are still needed for typologically different and less-resourced languages. To date, the largest annotated discourse corpus for English is the Penn Discourse TreeBank (PDTB) containing over 40,600 discourse-level annotations on Wall Street Journal texts. In the lexicalized approach of the PDTB framework, connectives are considered lexico-syntactic devices that signal the presence of an explicit discourse relation. The relations instantiated without any discourse connective are known as implicit relations. Conforming to the PDTB annotation scheme, METU Turkish Discourse Bank (TDB) has been created. It is a corpus of 3987 discourse-level annotations on multi-genre Turkish texts written between 1990-2000.

The present paper reports the most comprehensive investigation of shallow discourse parsing in Turkish, focusing on two main sub-tasks: identification of discourse relation realization types (explicit, implicit, etc.) and the sense classification of explicit and implicit relations. The work is based on the approach of fine-tuning a pre-trained language model (BERT) as an encoder and classifying the encoded data with neural network-based classifiers. We first identify the discourse relation realization type that holds in a given text, if there is any. Then, we move on to the sense classification of the identified explicit and implicit relations.

In addition to in-domain experiments on a held-out test set from the TDB, we also report the out-domain performance of our models to evaluate their generalization abilities, using the Turkish part of the TED-Multilingual Discourse Bank. Finally, we explore the effect of

multilingual data aggregation on the classification of relation realization type through a cross-lingual experiment.

The results suggest that our models perform relatively well despite the limited size of the TDB though identifying the discourse relation realization type seems to be highly language specific. We believe that the findings are important both in providing insights regarding the performance of the modern language models in a typologically different language and the low-resource scenario, given that the TDB is 1/20th of the Penn Discourse TreeBank in terms of the number of total relations.

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## **Investigation of the Effect of Uncanny Valley Phenomenon on Feelings and Memory Performance of People Familiar and Unfamiliar with Computer-Based Imagery**

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Uncanny Valley (UV) phenomenon refers to negative feelings people experience when observing humanoid robots or computer-generated imagery (CGI). Studies show that when people are shown images of robots or computer graphic designs, they tend to report positive feelings as the robot-to-human resemblance increases. However, for the stimuli just before the real human likeness, there is UV where people report negative feelings instead of positive. The aim of this study is to investigate the effect of CGI-familiarity on UV effect, on memory and feelings. We hypothesize that people with higher CGI-familiarity will show a weaker UV effect and a better memory performance compared to controls.

41 participants (18-28;  $M = 21.02$ ) reported their frequency of engaging with CGI images on a 5-point Likert scale and were asked to provide some examples of the CGI-related products they use. CGI-familiar (CGI) ( $n = 14$ ) and non-CGI-familiar (nonCGI) ( $n = 27$ ) groups were formed relying on the answers. Both groups were shown 11 images in a randomized order: 1 primary robot with no eyes or ears; 1 robot with feminine, 1 robot with masculine features; 2 female and 2 male UV-robots, and 2 female and 2 male human faces. Right after the presentation of each stimulus, participants were asked to score the attractiveness, creepiness, and humanness of that image on a 5-point Likert scale. The presentation and scoring of the images were followed by a memory task in which participants were presented one of the 11 images shown or 8 novel images (2 female and 2 male UV images, 2 female and 2 male human faces) and were asked if that image was shown in the previous presentation. All images were presented once. Neutral face images of The Averaged Karolinska Directed Emotional Faces database were used to create the stimuli. They were manipulated in open-source 3D-graphics software Blender. Stimulus presentation and data collection was done via Psychopy. Statistical testing was run by applying independent sample t-test on Jasp.

CGI-group scored significantly lower ( $p < .05$ ) than nonCGI-group in all (human, UV, robot, primary robot) creepy scores. This support the first hypothesis since CGI-group had less negative feelings towards the UV stimuli. However, the effect was generalized to all stimuli, including natural human face images which makes this finding questionable. Human humanness and human creepy scores in the nonCGI-group were found negatively correlated. This says the nonCGI-group predicts humannes to be the opposite of creepiness or vice versa. There was no significant difference in the memory test between the groups. This says the CGI-group was not better at the memory task for UV stimuli as hypothesized. CGI-familiarity may not be the only

premise of remembering the stimuli. Multiple variables may have affected the memory test results, such as stimuli having different features from each other. More detailed research on UV and CGI-familiarity can be conducted.

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## **Brain-Diffuser: Natural Scene Reconstruction From fMRI Signals Using Generative Latent Diffusion**

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In neural decoding research, one of the most intriguing topics is the reconstruction of perceived natural images based on fMRI signals. Previous studies have succeeded in re-creating different aspects of the visuals, such as low-level properties (shape, texture, layout) or high-level features (category of objects, descriptive semantics of scenes) but have typically failed to reconstruct these properties together for complex scene images. Generative AI has recently made a leap forward with latent diffusion models capable of generating high-complexity images. Here, we investigate how to take advantage of this innovative technology for brain decoding. We present a two-stage scene reconstruction framework called "Brain-Diffuser". In the first stage, starting from fMRI signals, we reconstruct images that capture low-level properties and overall layout using a VDVAE (Very Deep Variational Autoencoder) model. In the second stage, we use the image-to-image framework of a latent diffusion model (Versatile Diffusion) conditioned on predicted multimodal (text and visual) features, to generate final reconstructed images. On the publicly available Natural Scenes Dataset benchmark, our method outperforms previous models both qualitatively and quantitatively. When applied to synthetic fMRI patterns generated from individual ROI (region-of-interest) masks, our trained model creates compelling "ROI-optimal" scenes consistent with neuroscientific knowledge. Thus, the proposed methodology can have an impact on both applied (e.g. brain-computer interface) and fundamental neuroscience.

## **Give Your Ideas a Hand: How Gestures and Creative Thinking Interact**

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Hand gestures play a central role in multimodal language and communication. Interestingly, they also hold an important self-oriented function for the speaker, such as activating speakers' verbal lexicon and maintaining their visuospatial imagery. Recent findings also emphasized gestures' self-oriented function in certain types of creative thinking. For example, children who naturally gestured more told stories more creatively and children who were encouraged to gesture came up with more ideas, i.e., they were more fluent in divergent thinking, which is the ability to generate many new and original ideas. Another study has found that baseline iconic gestures in adults were positively associated with the four dimensions of divergent thinking, namely fluency, flexibility, originality, and elaboration but encouraging them only affected the originality of ideas.

Nevertheless, the effect of gestures on convergent thinking, which is a different type of creative thinking related to the ability to connect remotely associated ideas, has not been investigated before. Neither has the effect of mental imagery skills in relation to gestures and creativity even though imagery is a key component of both. Therefore, in the current line of research, we examined the role of spontaneous and encouraged hand gestures in verbal and visual convergent thinking (Study 1, in press) and verbal divergent thinking (Study 2, under preparation) in relation to individual differences in imagery skills and cognitive styles.

The results of Study 1 showed that gestures and mental imagery skills play a role in verbal but not visual convergent thinking. Regardless of whether gestures were spontaneous or encouraged, we found that overall gesture frequency negatively predicted verbal convergent thinking for individuals with low mental imagery but had a positive effect for individuals with high mental imagery. Representational gestures benefited verbal convergent thinking for everyone except those who had low mental imagery and no experience with the task. Beat gestures hampered verbal convergent thinking in people with lower mental imagery capacity and helped those with higher mental imagery and previous experience with the task.

The results of Study 2 showed that producing iconic gestures in the gesture-encouraged conditions was positively associated with fluency. Iconic gestures also positively predicted elaboration in both gesture conditions. However, spontaneous iconic gestures negatively predicted flexibility. Finally, having a verbal rather than visuospatial imagery style predicted fluency of ideas, but there was no interaction between imagery and gestures. These results demonstrated that both gesturing about the ideas and being a verbalizer can enhance the number of ideas (fluency) and the details added to them (elaboration). However, if one

produces iconic gestures when they have no task-related experience, gestures might keep them stuck in the same category of ideas (flexibility).

Overall, our findings contribute to the literature on both gestures and creativity by providing novel insights into the differential roles gestures and imagery styles play in the various components of creative thinking. Future research should address the role of other cognitive factors, such as working memory and cognitive flexibility, and experiential variables like real-life creative practices and achievements, that might affect the gesture-creativity interaction.

## Investigating Metacognitive Judgments During Eyewitness Memory in Individuals with Subclinical Obsessive-Compulsive Symptoms

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Previous studies showed that memory performance and metamemory judgments of obsessive-compulsive individuals (OCs) were lower than control participants in various cognitive tasks (e.g. Dar et al., 2022, Irak & Derin, 2020). However, OCs' memory and metamemory performance (processes involved in monitoring cognition to modify and control behavior) during eyewitness memory (a person's episodic memory of witnessing a dramatic event) are unknown and neglected. Therefore, we compared sub-clinical washers' (SWs) memory and metamemory judgments with normal controls (NCs) during the eyewitness memory task in this study.

It is an ongoing study. To date, 41 university students ( $M_{age} = 21.3$ ;  $SD = 1.73$ ; 30 female) were recruited. Participants were divided into two groups according to the Obsessive-Compulsive Inventory-Revised scale (Aydın et al., 2014), namely NCs ( $n = 20$ ; 14 female) and SWs ( $n = 21$ ; 16 female). The task consisted of four consecutive phases. First, participants were instructed to watch ten neutrals (e.g. a woman driving a car) and ten negative (e.g. men vomiting while binge eating) videos. Each video lasts 30-60 seconds. Second, participants were instructed to give judgment of learning on 6-point Likert type scale (JOL; Can you remember the details in this video?). Then, participants were instructed to answer (recall) five questions for each video and evaluated their confidence level on three options, namely yes, no or feeling-of-knowing (FOK: "I do not remember the answer now, but I can remember it in the future"). Lastly, participants completed a recognition test.

We used a 2 (group: SWS and NCs) x 2 (video type: negative and neutral) ANOVA for mixed design. Results showed that the main effect of the group was significant on the recall, recognition, and JOL judgments ( $F(1,37) \geq 4.20$ ;  $p \leq .048$ ). For all variables, NCs' performances were higher than SWs. The main effect of the video type was significant on recall, recognition, and JOL judgments ( $F(1,39) \geq 4.30$ ;  $p \leq .045$ ). Participants performed better for neutral videos than for negative ones. Despite our expectations, although SWs' FOK judgments for negative videos were higher than NCs, these differences were insignificant. Lastly, the interaction effect was insignificant for all variables.

Our results support previous literature (Abbasi et al., 2023; Dar et al., 2022), showing that individuals with SWs show poor memory and metamemory performance. Also, SWs showed memory bias and were less confident about negative videos. Therefore, we concluded that memory and metamemory problem in individuals with OCs exists for eyewitness memory.



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## **How Scene Attributes and Sound Influence Visual Exploration of Omnidirectional Panoramic Scenes**

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As virtual reality devices get more widespread, investigating how humans explore omnidirectional panoramic scenes has become a topic of interest. Several computational models now exist for predicting visual saliency in such environments. However, the existing literature largely ignores auditory cues while estimating saliency maps. To pave the road for more capable models, here, we ask how scene attributes and sound categories influence visual exploration. Considering a dataset of omnidirectional videos of dynamic scenes and eye fixations collected with and without sound, we analyzed how different semantic factors affect eye movement behavior; whether there are significant differences across human, animal, or music sounds present in the videos, or for indoor or outdoor scenes. Analyses revealed that the regulatory effects of audio in human fixations significantly increase in indoor scenes or if the audio is of music but decrease in outdoor scenes or if the audio is of animal or human sounds.

## **Manipulating Perceived Softness Through Sound Symbolism: Evidence from Turkish Onomatopoeic Words**

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Various stimulus presentations, including names, photographs, videos of materials, and touch produce similar dimensions of perceived softness: Fluidity, Deformability, Granularity, and Surface Softness. Building on our previous work, which highlighted unique associations between Turkish onomatopoeic words and material-related adjectives, such as *pıtır pıtır* for sandy, granular materials, and *pofur pofur* for fluffy materials, we employed a rating task with a semantic differentiation method to extract the softness dimensions. This study aimed to investigate whether this effect can manipulate the perception of softness in everyday materials such as honey, silk, or sand. In the exploratory part of the study, 47 Turkish onomatopoeic words and 31 adjectives were used in a rating task with a semantic differentiation method to extract the main softness dimensions. Our findings mostly aligned with the literature, revealing dimensions such as Fluidity, Granularity, and Surface Softness. However, no factors related to deformability were found due to the absence of sound symbolic words in this category. Next, we assessed the congruency of onomatopoeic words and material videos based on their loadings on each softness dimension. We conducted a new rating task, presenting material videos and spoken onomatopoeic words synchronously. We hypothesized that congruent word-video pairs would produce significantly higher ratings for dimension-related adjectives, while incongruent word-video pairs would decrease these ratings, and the ratings of unrelated adjectives would remain the same. Our results demonstrated that onomatopoeic words selectively alter the perceived material qualities, providing strong evidence for the unique sound-material associations. Overall, this study provides insight into the cross-modality of perceived softness dimensions, which manifest themselves in sound symbolism.

### **Machine-Learning Based Automated Mental State Talk Assessment**

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Mentalization has been defined as the attempt to infer mental states in one's self and others. Types and degrees of mentalization impairments (e.g., overreliance on one type of mental state and deficits in mental state attributions) have been associated with common childhood psychopathologies as well as attachment problems. The aim of this study is to use state-of-art machine learning based tools to automatically measure different types and frequencies of children's mental state language to allow easier, faster, and more precise quantification and annotation that can be used in clinical evaluations. The sample includes 134 Turkish children (mean age 7.00, standard deviation 2.01, 38% girls) with internalizing, externalizing and comorbid problems, who were referred to an outpatient psychotherapy clinic. Children were administered an attachment-based story stem task in order to code attachment security and different categories of mental state talk during the task. A Named Entity Recognition (NER) model was implemented on child narratives to categorize different mental state talk types and their frequencies (i.e., emotions, cognitions, perceptions, physiological and action-based mental states). The model achieved 90.6 accuracy and 83.9 F1 score on the test set. In order to evaluate the predictive power of the obtained mental state talk categories, the narratives were clustered according to children's problem types (internalizing, externalizing or comorbid problems) and attachment categories. The clustering model using the LDA algorithm achieved 0.574 and 0.654 coherence scores for problem and attachment types, respectively. T-SNE algorithm showed a clear difference in mental state talk use between children with secure, avoidant and disorganized attachment styles. However, the vectors clustering behaviour problem types according to mental state talk were not significant and need improvement for precision. This tool enables automatically retrieving mental state talk expressions of children in narratives and captures their variations according to attachment security. The tool can be used to develop a mentalizing profile of children before treatment and target interventions accordingly.

### **A Right-Frontal Region Critical for Identifying 3-D Objects**

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We present an intriguing case of a left-handed 20-years-old patient, HS, with a right frontal tumor. The patient underwent awake surgery. During it parts of his brain regions around the tumor were electrically stimulated using an electrical probe. Such electrical stimulation disrupts the functioning of brain regions around the spot where the probe is applied. When such stimulation was applied to the posterior parts of the patient's right frontal operculum, the patient could not identify line-drawings of a pyramid, and misidentified it as "two-triangles" or as "parallelogram". The patient could identify it correctly when the stimulation was switched-off. The patient's surgery was terminated. He was then treated with radiotherapy. The patient is currently in remission.

We reasoned that this deficit could have been due to the patient being unable to see or infer third-dimension from two-dimensional drawings of such objects. To test this, we conducted an fMRI experiment on the patient two-years after the surgery. The patient was shown a series of pictures. Some of these were pictures of two-dimensional shapes like squares, others were easily discernible three-dimensional objects e.g. cylinders. Crucially, we used a set of pictures that were of three-dimensional objects but their being three-dimensional was difficult to discern e.g. picture of cylinder taken from such an angle that the shape appears like a rectangle and requires effort to discern as a cylinder. Areas involved in a cognitive process activate more when the task is difficult and more of that process is needed. We therefore predicted that regions involved in 3-D vision will be more activated when discerning 3D hard-to-discern objects compared to when discerning 3D easy-to-discern objects. We found a significant cluster of activation at the site where electrical stimulation during operation had impaired his capacity to identify a pyramid. We also localized HS' language network. We found that his language regions were in the left-hemisphere despite his being left-handed. This also showed that his inability to identify the pyramid is unlikely to be due to disruption of some language region.

Brain regions critical for 3-D vision are unclear. Our finding suggests that a region within the right frontal operculum may be causally necessary for such vision, thus may shed light on the neural basis of perception of 3-D objects.

## **Self-Prioritization Effect: How Seeing Your Own Face Enhances Emotion Recognition**

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Prior research has established that interoception (perception of bodily signals, e.g. hunger, thirst, pain, micturition) is closely linked to emotional processing and the ability to perceive emotions in others. Similarly, self-focus, or the act of directing attention to oneself, has been shown to increase self-awareness and improve the perception of bodily sensations, as well as processing and perception of emotions. Building on these findings, this study aimed to investigate the impact of self-focus and interoceptive awareness on emotion recognition from biological motion, presented as dynamic point-light dance movements. Controlling for age, gender and baseline interoceptive awareness, participants were randomly assigned into two different groups: 1) self-focus group, 2) control group. Interoceptive awareness was measured with a heartbeat counting task. Participants in the self-focus group were supraliminally primed with their own self-face photograph with a neutral expression taken by the experimenter prior to the emotion recognition task, whereas the participants in the control group were not exposed to any priming. All participants (N=80) completed an emotion recognition task where they tried to recognize happiness, sadness, anger and neutral expressions depicted by point-light dance figures. Confirming the findings in the literature, results showed that participants with higher baseline interoceptive awareness recognized emotions better overall, regardless of group assignment, indicating that interoceptive awareness plays a crucial role in emotional recognition. Comparison between self-focus and control group showed that participants in the self-focus group recognized neutral stimuli significantly better than those in the control group. This suggests that self-focus, induced through self-face priming, can enhance attention to the self and emotional expression of the self. This can lead to better emotional recognition, but only for the emotion seen on self-face, or lack thereof (i.e. neutral expression). We interpret the findings that interoceptive awareness and self-focus can positively influence emotional recognition through distinct mechanisms. Self-focus, by directing attention to the bodily self, may heighten accuracy in emotion recognition; however, this process may also be susceptible to the influence of primed expressions. This is consistent with theoretical accounts positing that the self-face is among the most salient stimuli for human primates. Interoceptive awareness, by contrast, may enhance emotional recognition by enabling accurate perception of internal bodily sensations, rather than relying on the temporary direction of attention towards specific emotional valences.

## The Effect of Self-Distancing on Emotion Regulation and Autobiographical Remembering

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Over the years, self-distancing studies consistently showed the effectiveness of taking a distanced perspective in the face of a distressing stimulus for regulating emotions using various methods. Namely, visual and linguistic self-distancing strategies were found to be beneficial for reducing negative affect on various emotions (Kross et al., 2005; Kross & Ayduk, 2008; Orvell et al., 2021). Nevertheless, while the distanced self-talk regulated diverse emotions, the evidence suggests that visual distancing was not a useful strategy for controlling self-conscious emotions such as shame and guilt (Hung & Mukhopadhyay, 2012; Katzir & Eyal, 2013; Orvell et al., 2021). Accordingly, one of the main aims of the present study was to compare the two strategies with different types of emotions. Similar to the regulatory effect of distancing, the studies on vantage point showed that shifting from field to observer perspective led to fewer experiential ratings for the memories such as vividness or distress (Berntsen & Rubin, 2006; Robinson & Swanson, 1993). Even though distancing studies frequently used memories as stimuli, how distancing and shifts between perspectives affect memory characteristics were not completely explored. That is why we argue that studying memory phenomenology with perspective shift can be helpful for a broader understanding of distancing. For this purpose, the present study aims to investigate whether different distancing strategies (visual, linguistic), shifts between perspectives (immersed, distanced) and different types of emotions (sadness, shame) influence memory characteristics and emotion regulation. We expected a difference between sadness and shame emotions when participants in the visual strategy shifted from immersed to the distanced condition. More specifically, we expected the shift to decrease memory ratings for sadness but not for shame. In contrast, we expected a similar pattern for sadness and shame in linguistic strategy with the immersed to distanced shift. Participants ( $N = 147$ ) were randomly assigned to either shame or sadness conditions to recall a memory and rate its' characteristics. Then, depending on their original memory perspective, they were assigned to the opposite perspective of visual or linguistic distancing strategies, analyzed their feelings and thoughts from the given strategy, and rated the memory characteristics. We calculated the change between original memory ratings and manipulated memory ratings, then analyzed obtained ratings with a 2 (Type of Distancing: Visual, Linguistic) X 2 (Type of Emotion: Sadness, Shame) X 2 (Condition: Immersed, Distanced) between-subjects ANOVA. The findings revealed that, as opposed to our hypothesis, shifting from field to observer perspective, in other words, immersed to distanced, did not have an effect on memory characteristics. While the observer to field shift led to an unexpected reverse effect; that is, reliving ratings increased in visual strategy, and decreased in the linguistic group. The three-way interaction revealed similar

results for vividness but only for shame. The results will be discussed focusing on the factors moderating the effectiveness of distancing strategies.



## Second Language Acquisition and Associative Memory

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Can second language acquisition impact associative memory, the ability to bind information into a coherent episode? In line with the bilingual cognitive advantage hypothesis (Bialystok, 2011), this question is raised considering that associative memory relies on the functioning of the hippocampus which is implicated with language learning (Qu et al., 2020), allowing for associations between word phonology and meaning (Duff & Brown-Schmidt, 2012). To this end, past research shows increased hippocampal volume for second language learners, decreased grey matter volume for immersed and proficient bilingual younger adults (DeLuca et al., 2019), and mixed behavioural outcomes for associative memory (Bellander et al., 2016; Martensson & Lövdén, 2011). Such findings imply that aspects of the language experience may mediate the relationship between second language learning and behavioural effects, rendering it important to examine such aspects (e.g., level of proficiency in the second language and duration of exposure to the second language), which was an objective of the current study.

A total of 112 native Turkish speaking young adults aged between 18 and 24 ( $M = 20,5$ ) who self-reported to be simultaneous or sequential multilinguals from Koç University participated in the current study for course credit. Following informed consent, participants completed a demographic questionnaire, the Turkish translation of the Language Experience and Proficiency Questionnaire (Marian et al., 2007), and an associative memory task deployed using PsychoPy. For the associative memory task, participants studied a list of 26-word pairs, performed a buffer activity, and then were tested for their ability to recognize single (item) words and the intact versus the re-arranged word-pairs from the study list. The hit rate and the false alarm rate for the item and associated words were used to calculate a corrected associative and item recognition score in which a higher positive score is indicative of better associative and item recognition. For the current presentation, linear regression analyses were carried out with individuals who reported to be a late second language acquirer ( $N = 80$ ) and showed a significant negative relationship between the corrected associative recognition score and length of second language exposure (at school)  $R^2 = .074$ ,  $F(3, 77) = -.237$ ,  $p = .044$ , and understanding in second language proficiency  $R^2 = .067$ ,  $F(3, 79) = -.396$ ,  $p = .032$ . Regarding item recognition, a significant negative relationship was found between length of second language exposure (in country)  $R^2 = .089$ ,  $F(3, 77) = -.249$ ,  $p = .034$ . No other significant relationships were found. The current findings regarding associative memory show that greater bilingual experience (i.e., higher levels of second language proficiency and exposure to the second language) leads to lower level of ability to recognize intact information. Such findings are in line with the Dynamic Restructuring Model (Pliatsikas, 2020) suggesting that once language acquisition has reached peak levels like hippocampal volumes returning to baseline levels so may behavioural

improvements. This opens a discussion around the long-term effects of bilingual cognitive gain and calls for replication studies.

### **Wavelet Transform Coherence on fNIRS-hyperscanning data from Cooperative n-Back task**

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Proper understanding of the human mind requires understanding of the social dimension as well as individual, since acting in isolation is quite uncommon for humans. Joint action is a domain in which motivational and cognitive elements interact in complicated ways that are yet to be well understood.

In this study, sixty two participants were tested in thirty one same gender dyads during sessions of individual and cooperative n-back task that span the levels between 0-back and 3-back. Throughout the experiment, simultaneous data was recorded via Lab Streaming Layer from fNIRS and EEG hyperscanning, which also included ECG and EOG measurements.

Results of the n-back task was in parallel to the literature regarding the findings under increased workload: There was a positive correlation between n-back level and reaction times, error rate (for missed trials and wrong responses), heart rate, and deoxy-hemoglobin levels across PFC increased as workload increased; whereas heart rate variability (same for three different way of measuring: SDNN, RMSSD, pNN50) and oxy-hemoglobin levels across PFC decreased. The analysis of individual fNIRS data over n-back levels showed a significant effect across all optodes except the 7th optode. Largest effect sizes were seen in optode 14 for HbO and in optodes 10 and 11 for HbR. On the other hand, significant effects were found regarding task condition in 12 out of 16 optodes, there was a localization favoring the right hemisphere. Largest effect sizes were seen in optode 12 and 14 for HbO and optodes 10 and 11 for HbR.

Wavelet Transform Coherence in fNIRS were observed to increase as participants moved to higher n-back levels. However, this effect was lost in 3-back, probably due to the task getting too difficult to track the other participant's effort. In the study, the n-back levels always came in the same order, starting with the easiest and ending with the hardest: 0-back, then 1-back, then 2-back, and finally 3-back. So, the increase in the first blocks and then decrease later could be explained with the effect of time, as previous studies report a drop in Wavelet Transform Coherence values over time, however, these studies featured longer experiments and the decrease in WTC they reported occurred later than the duration of this study. In this study, each block lasted 75 seconds with a 10 seconds long interval in between each block, which is not long enough to observe this reported drop over time in WTC. Therefore, it is more likely that the increase in WTC is due to participants sharing the task until they are forced to focus only on their own. This finding is in line with the growing literature on wavelet transform coherence during joint action that interbrain connectivity is observed among prefrontal cortex regions of co-actors. DLPFC is the most often reported sub-region in the PFC for this effect, but other areas

such as inferior or superior Frontal Gyrus, or FPC also show increase in interbrain connectivity during various cooperative tasks.

## **Subjective and Physiological Imagery Strength During the LTM Retrieval vs. VWM Maintenance**

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Visual working memory (VWM) is a cognitive system that maintains and manipulates a limited amount of visual information for the task at hand. We use VWM to remember what we already know (LTM retrieval) or to hold information in mind (VWM maintenance). A phenomenon that is closely related to VWM is visual imagery, i.e. the ability to represent and manipulate visual perceptual information without direct sensory input. While studies showed overlapping representations of imagery and VWM, the evidence from people with aphantasia showed that those with subjectively low or absent imagery can still perform well on VWM tasks. When we retrieve visual information from long-term memory, it buffers into a VWM representation similar to the one used for perceptual inputs, mapped into the sensory-specific cortex. At the same time, we often experience more or less vivid imagery, resembling perceptual experience. Previous research demonstrated that sensory representations are reactivated during the working memory maintenance process, but experimental evidence, testing the effects of visual imagery during LTM retrieval, is missing.

In our study, participants perform LTM retrieval and VWM maintenance tasks where they are asked to hold in mind for 6 seconds either a previously learned object (LTM condition) or a newly presented object (VWM condition), as vividly as possible. On each trial, participants rate the vividness of an item from 'perfectly clear' to 'no image at all' on a scale adopted from the Vividness of Visual Imagery Questionnaire (VVIQ). Afterwards, the recognition of the held items is tested (accuracy and RT).

We measure the sensory strength of visual imagery using pupil eye response via eye tracker. We examine the relationship between this physiological index of imagery and individual differences in subjective vividness of imagery, measured trial-by-trial and on the original 16-item VVIQ, completed independently. We expect that these measures will be interrelated, which would further validate pupillometry as a measure of imagery. Additionally, we will compare which measure of vividness (either trial-by-trial or VVIQ) serves as a better predictor of pupil eye response. Finally, for the first time, we will examine this relationship not only for VWM maintenance but also for LTM retrieval.

Next, we investigate whether people with better imagery perform better (in terms of accuracy or reaction time) on the VWM task (VWM condition) compared to people with poorer imagery. Particularly, we expect higher psychological or subjective strength of visual imagery to be

predictive of participants' better VWM performance. If found, these results would further suggest that imagery and VWM rely on similar mechanisms. We will also investigate if people with better visual imagery perform better on the LTM task, compared to people with poorer imagery.

The main novelty of our work is that we compare how subjective vividness correlates with the sensory strength of imagery during the LTM task vs. VWM task. This will clarify whether visual imagery can serve as a strategy for LTM reactivation. Our study will advance the understanding of individual differences in imagery in relation to VWM maintenance and LTM retrieval.

## **Against Representations That Do Not Represent: Reply to Thomson and Piccinini**

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The reality of neural representations has been a thoroughly discussed yet unsettled matter of the philosophy of cognitive neuroscience during especially the last decade. Thomson and Piccinini (2018; Piccinini, 2020; 2022) are trying to settle the debate and claim that we can be sure neural representations are indeed real because we have observed and manipulated them experimentally. While doing so, they first rely on Hacking's famous work (1983) and the new experimentalist tradition that stemmed from it. According to that school of thought, experiments have a life of their own and they can be decisive in seeing if a theoretical construct, an entity, really exists or not. Secondly, since what makes a representation genuine is its content, it is a requirement to provide a naturalization account of mental content to argue that neural representations are real entities. Piccinini (2020, 2022), following informational teleosemantics, tries to give such an account in which he departs from more traditional informational teleosemantics and proposes 'to be used in service of a purpose by another system' as the main criterion for the naturalization of content. In this work, we will argue against these claims and will try to show why this debate cannot be settled by any empirical finding or experimentation. To ground our argument, we will first argue that empirical studies cannot settle such an ontological debate as no experimental setting is independent of theoretical conceptualization, and provide some examples from the history of science in support of this argument. We are also going to show how almost exactly the same experimental design can have different interpretations which are at odds with each other, meaning that it's always our philosophy-laden theoretical gloss that matters when it comes to concluding what an experiment can show us. Then we will explain how Piccinini's attempt at naturalizing content only leaves the notion of 'purpose' unnaturalized this time, resulting in a failure. Lastly, we will posit some requirements for the notion of neural representation to be meaningful and useful, i.e., owing its natural status to something other than correlation, as a criterion widely accepted by the literature, and we will argue that this criterion cannot be met 'in principle' which shows that neural representations cannot be real entities in any meaningful sense.

## **Exploring Phenomenological Differences in Bilinguals' Remembered Past and Imagined Future Events Across Languages**

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How individuals remember their past is related to how they imagine their future as neuroimaging, developmental, and cognitive studies have demonstrated. Research on how bilinguals remember their personal past in their two languages has revealed that they have a tendency to recall their memories in the language in which they were initially encoded, and these memories often exhibit notable differences in some phenomenological characteristics such as vividness and sensorial details compared to memories remembered in the other language. Whether future events imagined in the first and second language display similar differences is a related research question which has been studied scarcely. The aim of the present study was to examine the phenomenological characteristics of bilinguals' remembered past and imagined future events across their languages. The study focused on only to negative events as the valence of an event is a crucial factor that affects the content of recalled memories, and previous studies that have examined bilingual autobiographical memories with a specific valence have predominantly focused on negative memories.

Sixty-one Turkish-English subordinate bilinguals (F = 43, %70) participated in two sessions, each conducted in a particular language (Turkish or English, with the order counterbalanced) and separated by one week. Participants' level of proficiency in each language was assessed with Language Experience and Proficiency Questionnaire (LEAP-Q). In each session, after completing Positive and Negative Affect Schedule (PANAS), participants were asked to imagine and write down the most negative event that might reasonably happen to them in the next 15 years as detailed as possible. Then, they rated the phenomenological characteristics of the event (vividness, emotional valence, emotional intensity, preoccupation with emotions, emotional distancing, sensory details, observer perspective, and field perspective) with Autobiographical Memory Characteristics Questionnaire (AMCQ) and answered three questions related to the temporal and linguistic details of the event. Next, they were asked to recall the most negative event from their past, write it down, rate its phenomenological characteristics with AMCQ and evaluate its temporal and linguistic details.

Preliminary analyses indicate that when participants imagined future events in Turkish (first language), they rated them as having higher emotional intensity, while future events imagined in English (second language) were rated as having more emotional distance. Regarding the past events, participants rated the events in Turkish as more vivid and emotionally intense compared to English. Lastly, valence ratings indicated that participants regarded Turkish events as more negative than those in English, both for future and past events. This study's findings contribute



to our understanding of the impact of second language use on autobiographical memory and shed light on the relationship between second language and emotional experience. Additionally, this research is especially noteworthy in that it represents one of the first investigations into how bilinguals imagine future events in their second language, which has yet to be explored in depth in the current literature.

Keywords: bilingualism; autobiographical memory; episodic future thinking; language and emotions

## The Relative Importance of Pre-Exposure Schedule on Perceptual Learning Effect

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Perceptual learning effect is the demonstration of enhanced discrimination between two similar stimuli following passive pre-exposure to these stimuli. One of the factors suggested to affect perceptual learning is exposure schedules. In a concurrent exposure schedule two different stimuli (e.g. AX and BX, where A and B represent the distinctive elements of the stimuli and X those features they share in common) are presented simultaneously, (AX-BX). In block exposure schedules, stimuli are presented in consecutive block of trials, so that the presentation of one stimulus (e.g. BX) is not started before the block of trials involving the presentation of the other stimulus (e.g. AX) is completed (AX, AX.../BX, BX...). There is only a small number of studies comparing concurrent and block exposure schedules and these studies indicated enhanced perceptual learning effect following concurrent exposure relative to block schedule for human but not for animal participants. On the other hand, several studies have reported perceptual learning effect for both human and animals following the block exposure condition when this condition was compared with the control condition involving no exposure phase. Enhanced perceptual learning effect following concurrent exposure for humans is problematic for associative accounts of perceptual learning and consequently some theorists questioned whether these findings for humans reflect genuine perceptual learning. Hence, it is important to understand the reliability of the reported findings about perceptual learning for human participants in order to direct theoretical arguments in the future.

The present study which aimed to examine the role of stimulus exposure schedules on perceptual learning effect was conducted online due to COVID-19 pandemic. A total of 75 adults, 42 women and 33 men, participated in the experiment and they were assigned into three groups of equal size using block randomization. The experiment consisted of exposure and subsequent testing phases. At the start of the exposure phase, Group Concurrent and Group Block were presented with an instruction aimed at directing their attention to any differences between two similar visual stimuli and they were then expected to follow the pairs of stimuli presented on the screen without any explicit response during 30 exposure trials. For Group Concurrent, two different stimuli were presented simultaneously on the screen, while for Group Block; two different stimuli were presented in two successive blocks of trials. Group Control did not receive the exposure phase. After the exposure phase all participants received three blocks of 60 test trials during which they were expected to discriminate between two visual stimuli using a target detection task.

Perceptual learning effect was found only for Group Concurrent. Although this finding is consistent with the previous studies, absence of perceptual learning effect following block

exposure schedule is not consistent with the earlier findings. Additional experiments in rather controlled laboratory conditions are needed to evaluate the reliability of the present findings that were collected online as well as to explore the role of the instruction on the perceptual learning effect for humans.

## **Does Simulating Older Self Increase Memory Positivity?: Effects of Self-Enhancement on the Valence of Post-Simulation Memory**

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Humans can travel across time in their minds. Mental time travel to the past and to the future are respectively referred to as autobiographical memory and future simulation. Mental time travel is accompanied by a sense of self at different time points in life. Thus, a different sense of self is predicted to affect how the memory is interpreted. After individuals simulate a memory as if another person experienced it, it affects their phenomenological experience of the original memory such that phenomenological characteristics of the original memory start to be more similar to simulated memory. Additionally, individuals wish to enhance their future self, and this is associated with a positivity bias for the future in which future simulations are perceived as more positive than autobiographical memories. Socioemotional selectivity theory proposes that when individuals become older, their goals shift to more positive emotional goals and this results in a positivity effect of increased attention and memory for positive emotional information. Older individuals interpret the past more positively and enhance their emotion regulation strategies. Based on these findings and theoretical propositions, the goal of the present study was to investigate the effects of simulating a memory as an individual's older self versus another older individual on the phenomenological experience of the memory and the affect related to the memory. There were 98 university students (54 males, 44 females) as participants. In the first session of the experiment, participants retrieved an important negative event (the original memory) and then provided phenomenological ratings related to the event and their affect related to this memory. After one week, in the second session, while one group was instructed to simulate themselves as an older person (older-self condition), the other group simulated another older individual (older-other condition). They retrieved and rated the same memory with these simulated older selves (the simulated memory). After that, they were asked to retrieve and rate the original memory once again as their current selves (the post-simulation memory). Lastly, the attitudes toward older individuals were measured to control possible confounds. The positivity of the memories in the older-self condition was found significantly higher than the older-other condition for all memory types. In the simulation memory, negative affect related to the memory decreased and remained at similar levels in the post-simulation. That is, participants, felt less negative about the original memory after the simulation. There were significant differences between the three memory conditions for vividness, observer perspective, field perspective, reliving, emotional valence, and emotional intensity. The results provided support for the theory that individuals wish to enhance their future self. Additionally, the results showed that simulation of a negative memory as being experienced by an older individual could regulate emotions about the memory by reducing negative affect related to this

memory. The present study once more highlights the strong relationship between self and memory, showing how distancing from the self can be reflected in the phenomenological experience of memories.

Keywords: Autobiographical memory, self, aging, emotion

## **Sensory Constraints and Selective Attention in Food Settings: Examining Food Type Effects Using Visual Crowding**

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This study explores the impact of sensory limitations in cluttered environments on consumer behavior, specifically concerning dishes. Dishes are often exhibited in cluttered environments such as table settings or glass windows, which put sensory limitations over how each item is recognized and therefore can affect consumer behavior, including willingness to pay. Visual attention is crucial in the food presentation process, and visual elements such as shape, color, and contrast can attract attention and influence consumer behavior. However, when it is challenging to distinguish each food item in crowded displays, it is difficult to predict customers' attention and how intuitive reactions influence their decision-making.

To investigate the attention strategies used for different types of food in cluttered environments, we introduced sensory limitations caused by the spacing between food items. We utilized visual crowding – a phenomenon where an object in the periphery of our vision becomes difficult to perceive or distinguish when surrounded by other objects– to investigate the visual recognition of different types of food. We measured the recall performance of participants to understand if particular food types or presentation types affect recall.

We created four different settings (menus) and used two different presentations (plates) in the experiment. To create the settings, we positioned different food groups on modern and traditional plates. Each menu included a food or meal from the meat, milk, carbohydrate, vegetable, and sugary food group. In half of the trials, we located three plates on top of the fixation point and two plates below, in a circular setting, and in the other half, we flipped the localizations. The plate surrounded by two other plates was the target item, and we analyzed the recall performance of the target item. We photographed each food on both a traditional plate and a modern plain white plate.

Our analysis showed that the recall performance for the meat group was higher than the other food groups. We found that while plate type did not significantly affect recall performance, food type did. We suggest that familiarity and food memory play an important role in recall and that these high-level factors are resistant to low-level mechanisms. However, we found that the recall performance for different plate types does not differ although visual appeal is a factor that influences consumption behavior. Our results suggest that sensory processes can elicit selective mechanisms that impact visual attention in food perception.

## **Individual Differences in Working Memory Reactivation of Long-Term Memories Predict Protection Against Anticipated Interference**

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Most daily tasks require frequent information exchange between working memory (WM) and long-term memory (LTM). However, the factors that modulate the reactivation of LTMs in WM when perceptual interference is anticipated remain to be explored. One possibility is that LTMs can be reactivated in WM when anticipating interference given that the focus of attention in WM has been shown to protect information against interference. An alternative is that information can be kept passively in LTM when anticipating interference since retrieval from LTM is vulnerable to interference. Here, we contrasted these possibilities regarding the effects of anticipated perceptual interference on WM reactivation of LTMs using the contralateral delay activity (CDA) in the EEG. On each trial, participants saw a previously studied object that was tested after a brief retention interval. In half of the blocks, the retention contained perceptual distractors. There was significant CDA in both conditions. The CDA amplitude we measured was almost half of what was observed in the literature for one real-life object which suggested partial reactivation of LTM in WM. The CDA was equal for interference and no interference conditions. We identified individual differences in the reactivation of memories. Half of the participants had larger CDA on interference blocks (WM preparers) and others on no interference blocks (LTM preparers). LTM preparers had significant interference costs in accuracy whereas WM preparers showed no interference costs, suggesting that preparing against interference via reactivating LTMs in WM is a more effective strategy than relying on passive LTMs. Moreover, in interference blocks, contralateral alpha suppression, an index of spatial attention, disappeared during retention in anticipation of interference, mostly in WM preparers. These results indicate that individuals stopped attending to reactivated memories when anticipating interference, presumably to prevent the involuntary encoding of perceptual distractors that appear at attended locations. Together, these results highlight individual differences in preparing for anticipated interference in recruiting WM to store LTMs, and their effects on proneness to interference.

### **Assessing Object vs. Spatial Dimensions of Visual Play**

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Our research investigates the development of individual differences in visual imagery, based on a cognitive and neuroscientific approach that distinguishes between object imagery (processing pictorial appearance of objects in terms of their shape, color etc.) and spatial imagery (processing of spatial relations, and spatial transformations) abilities. As imagery assessment at preschool age is quite challenging, one promising direction is looking at play. Our ongoing research focuses on the assessing object vs. spatial dimensions of visual play preferences in children. A previous study (Blazhenkova and Booth, 2020) constructed and validated a visual play questionnaire (PPQ), which included ratings of different children's play activities with a significant visual component. We found that visual-object play (e.g., exploring drawing media or decorative crafts) can be dissociated from visual-spatial play (e.g., assembling and disassembling mechanisms or playing with construction toys), consistent with object and spatial visualization dimensions. PPQ was developed mainly as a research tool, and it was rather an exploratory instrument with several limitations. It did not incorporate a wide list of visual play activities, the descriptions of games were rather general and prone to different interpretations. Nevertheless, it showed good reliability of the scales, and positive correlations with the criterion measures. Here, we aimed to develop a more comprehensive assessment of visual play that would be linked with object and spatial visualization abilities. In the current research, we created stimuli that are more ecologically valid, depictive, and self-explanatory, so that participants can understand how to play a game without a former knowledge, and a verbal description. The new stimuli comprise pictures with specific examples and include contemporary games. These stimuli represent 17 object (requiring processing of color, shape, pictorial details) and 17 spatial (requiring processing of 3D structure, spatial relationships) visual manipulative play activities. Each picture represents the toy pieces, the hands performing an action such as assembling these pieces, and 3 options of a creative product. The stimuli with visual-object and visual-spatial play visuals were administered for evaluation on 30 different Likert scales in terms of their complexity, visual attractiveness, sex-appropriateness, usefulness, and educative purpose. In addition, participants were asked about their age, sex, education specialization, abilities and hobbies in art, science and humanities domains, and attitudes towards children. The data is currently collected from students (18-25 years old) who don't have children. This sample is expected to have more objective opinions about games not biased by the experience by play of their own children. These participants also have relatively recent experience of their own childhood play. Depending on the outcome of this study, we will be able to create matched pairs of object and spatial games, based on their complexity and visual attractiveness. They will



be employed in the subsequent studies that will involve adults and children. Subsequently, object and spatial stimuli will be matched in pairs, which would allow creating a simple preference assessment, without incorporating verbally based Likert-scale ratings. Additionally, we will explore stimuli evaluations in relation to cognitive and socio-economic profiles of participants.

## **Biological Motion Perception in the Framework of Perceptual Decision-Making: An Event-Related Potential Study**

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Perceptual decision-making has been investigated on non-human primates and humans using various techniques, from invasive to non-invasive. Neural correlates and underlying mechanisms have been revealed. The results have been primarily explained by employing the drift-diffusion model that considers the sensory evidence accumulation process and the decision boundary that needs to be reached before initiating the action. Specifically, in EEG studies, the event-related potential named Centro-Parietal Positivity has been found to build over time in line with the sensory evidence strength and reaches a certain level during the response. Therefore, this potential is thought to reflect the two essential components of the decision-making process. On the other hand, biological motion perception is a crucial ability performed with remarkable efficiency in human visual systems. Failure to decide accordingly could have life-threatening consequences. Since previous research on perceptual decision-making commonly used simple random-dot motion as stimuli, it remains unknown whether the mechanisms revealed with these stimuli would be generalizable to more complex and socially meaningful stimuli such as biological motion. Thus, studying the information-processing stages of biological motion perception in the framework of perceptual decision-making will provide crucial insights, given the vital significance of biological motion perception and questions about the domain-general decision-making mechanisms. In this respect, our study aims to provide evidence for the underlying temporal and neural correlates of decision-making using EEG during a biological motion perception task. To manipulate the strength of the sensory evidence, in other words, the difficulty, we used point-light displays as stimuli given the established usefulness in using biological motion research. This allows us to flexibly change the noise in presenting the actual targets. Our results ( $N = 16$ ) revealed that the CPP tracks the sensory evidence strength manipulated by our design using different noise levels. Additionally, we found that CPP reaches a certain level during the response regardless of the difficulty level. Hence, these findings further support the domain-general mechanisms of perceptual decision-making. However, it has been found that CPP onset and its peak latency are observed later than the previous studies employing simpler stimuli, such as random-dot motion. This finding suggests that underlying information-processing stages are responsive to task complexity. Since this study provides the first evidence by integrating the two fields, these findings will provide a benchmark and introduce potential ideas for further studies.

### **Indirect Reward Does Not Capture Attention**

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Recent research suggests that indirect rewards can impact behavior by influencing memory and decision-making processes. However, whether features that are indirectly rewarded can bias selective attention remains to be explored. Here we tested the hypothesis that spreading of reward value to the items that are not themselves rewarding will lead them to automatically capture attention later on. We analyzed response times (RTs) of 54 participants while they performed three different visual attention tasks. In the first phase, participants searched for target objects in two types of scenes and indicated their location on the screen (e.g. balloons in cities, bottles in parks). During Phase 2, participants performed a change detection task for background images (e.g., cities and bottles) but were rewarded for accurate responses only in one of these two categories. In the last phase, participants completed a search task, similar to the first phase, with the addition of two novel background image types and a distractor which they should ignore. If the reward value spreads to target object categories associated with background images, then responses in Phase 3 should be faster when targets associated with backgrounds rewarded in Phase 2 are targets and slower when they are distractors. We found no significant reaction time or accuracy difference in Phase 3 for identifying indirectly rewarded and non-rewarded targets. Furthermore, the presence of a distractor that was indirectly associated with reward did not slow down reaction times beyond distractors that were not associated with reward. Thus, we conclude that reward does not generalize to items in a way to impact the guidance of selective attention. Future research is needed to test if this is due to a lack of spreading reward from background images to targets, or a lack of an impact of established reward spread on attention.

## Perception of Acoustic Roughness in Human, Instrument and Artificial Sounds

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Human screams and similar artificial sounds, such as digital alarm sounds and sirens, inform listeners about arousing, alarming, or threatening events in the environment. A critical common feature of these sounds is ‘acoustic roughness’ (Arnal et al., 2019). Acoustically rough sounds feature strong amplitude modulations in frequencies between 30 and 150 Hz, which are associated with perceived alarmness and fear, hence with aversiveness (Arnal et al., 2015). Although acoustic roughness is naturally present in screams or alarm sounds, applying it synthetically on otherwise neutral sounds in controlled fashion is crucial for generating standardized auditory stimuli which can be used to understand cognitions and behaviors affected by aversive signals. The original method for synthetically adding acoustic roughness to neutral sounds (hereafter referred to as AmpMod) has been to simply add amplitude modulations in the desired frequency range, which generates highly aversive, but also highly unnatural sounds. Recently, Liuni et al. (2020) developed an alternative algorithm named ANGUS, which uses a specific filtering protocol to produce arguably more naturalistic acoustic roughness applications. However, direct comparisons of the aversiveness and naturalness of the rough sounds synthesized using these two algorithms have not yet been documented. Thus, the present study examined the perceptual differences regarding aversiveness and naturalness of original human vocalizations, instrument sounds, and computer-generated artificial sounds and their rough versions generated using these two different algorithms.

Thirty-four undergraduate students (25 female, 9 male) with age range of 19-25 ( $M = 20.9$ ,  $SD = 1.3$ ) participated in the present study. Auditory stimuli consisted of 3-second recordings of neutral vocalizations of 4 vowels from a female and a male actor, 8 wind instruments, and 1 computer generated harmonic tone, all with a fundamental frequency of 261.6 Hz (C4 in musical notation). These original sounds were processed with both AmpMod and ANGUS algorithms to generate their rough versions. Participants were presented with all stimuli in a random order and rated both the aversiveness and the naturalness of the sound after each presentation in a 9-point Likert scale.

As hypothesized, rough versions of human and instrument sounds were generally rated to be more aversive than their original versions, whereas there was no clear difference between the aversiveness of rough sounds generated using the two algorithms. For computer-generated artificial sounds, there was a ceiling effect for aversiveness, such that even the original versions were rated as extremely aversive compared to all human and instrument sounds. Regarding the naturalness ratings, in line with the predictions, original versions of human and instrument

sounds were rated more natural than their rough versions, while the two different versions of rough sounds did not differ in naturalness.

These results suggest that while there is no difference in the perceived aversiveness and naturalness of the rough sounds generated by the two algorithms, rough versions of human and instrument sounds, but not of artificial sounds, were more aversive and less natural than their original versions. Hence, both roughness algorithms are functional for generating aversive auditory human and instrument sounds, which can be used to investigate affective processes.

## The Effect of Correlated Color Temperatures of Lighting in Coffee Shops on Attention Load

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Light is crucial for human evolution, and with the rapid growth of urbanization it has become an indispensable part of human life (Sanders et al., 2020). Today, it is known that people spend almost 90% of their lives indoors (Allen & Macomber, 2020). Therefore, it is very important to investigate the influence of light on cognitive and neural processes. This study aimed to examine how different light colors, also known as correlated color temperature (CCT), affect attention processes in indoor environments. According to the theory of perceptual load (Lavie, 1995), attention is a limited capacity and the extent one can allocate attention to a stimulus depends on one's attentional load. Tasks that have a high attentional load require a greater amount of attentional resources than tasks with a low attentional load. Accordingly, it is harder for someone to be distracted by task-irrelevant stimuli under high attentional load than low attentional load. In this study, an attentional load task (Schwartz et al., 2004) in which a rapid stream of "t" shapes with different colors and orientations were presented at fixation with either a distractor or nothing in the background were employed. Participants had to identify any red t-shape in the low-load task, whereas in the high-load task, they had to identify particular color-and-orientation conjunctions (e.g. yellow upright or green inverted crosses). virtual coffee shop environment with different light temperatures (2000K, 6000K, and 10000K) was used as task-irrelevant distractor while participants ( $N = 30$ ;  $F = 18$ ; age range = 18-36, mean age = 24) performed the low load or high load task at the fovea. Their reaction time and accuracy were collected. Results showed that both attentional load and CCT have a significant effect on reaction times. Cold colors (6000K and 10000K) were more distracting than warm colors (2000K), particularly for low attention load tasks. Additionally, the control condition was significantly different from 6000K and 10000K. However, there was no significant difference between the control condition and 2000K. Furthermore, low attentional load tasks had higher accuracy than high attentional load tasks. Although the results are based on the preliminary data, the study provides novel insights into the relationship between light color temperature and attention processes in indoor environments, which may guide the design of more effective lighting strategies for multifunctional spaces. The study's findings may be particularly useful for designers of indoor environments, such as offices and classrooms, where attentional demands are high and lighting is an essential factor affecting cognitive performance. The study's two-phase project aims to collect both behavioral and neurological data, and future research may further investigate the underlying neural mechanisms of the observed effects.

## **The Flight of Time at Meal Time**

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There is a temporal aspect to the performance of native behaviour. According to Timberlakean Systems Theory, related behavioural forms occur in clusters that depend on motivational states. Such clusters vary in terms of the time course under which they unfold. These time courses are observable. Do these different time courses involve corresponding levels of subjective time perception? Initial results are described of an experiment using mid-session reversal, a technique for studying temporal sensitivity in animals, while biasing expression of specific motivational states. Pigeons appear to overestimate the passage of time when they peck, relative to when no pecking is involved. I discuss what the presence of motivational influences on subjective time perception means for an understanding of temporal cognition.

### **Combining Forces for Causal Reasoning: Children's Predictions About Physical Interactions**

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Understanding causal relations is essential to reason about, explain, and predict interactions between entities and objects, being a key aspect of early socio-cognitive development (Muentener & Bonawitz, 2017). There has been intensive research with children using tasks that employ unfamiliar stimuli and ask children whether a machine will activate under different causal, statistical or counterfactual dependencies (e.g., Gopnik & Sobel, 2000; Gopnik et al., 2004). While there is considerable work on causal perception (e.g., Leslie & Keeble, 1987; Schlottman et al., 2013), and physical reasoning (e.g., Hood, 1995; Howe et al., 2012), relatively less research has been concerned with preschoolers' reasoning about how familiar physical and causal processes unfold (e.g., Kominsky et al., 2021). The force dynamics model of causation allows us to investigate children's reasoning about how interactions of multiple physical forces lead to an outcome. The force dynamics model expands the simple cause-and-effect relationship to involve more complex relations such as enable and prevent (Talmy, 1988; Wolff, 2007), and provides a framework to explore the limits of children's causal reasoning.

The present study investigated 4-year-olds' ( $N = 58$ ) reasoning about complex causal physical interactions by predicting a motion's endpoint, aiming to replicate and extend previous findings on children's causal physical reasoning (George et al., 2019; Göksun et al., 2013). In particular, we asked whether estimations of a motion's distance and direction were differentially critical aspects of intuitive physics when reasoning about force interactions.

In an online task, children were presented with four configurations that involved different interactions of forces and consequently different patterns of motion. These were Cause (one force moving an object), Enable (a secondary force promoting the motion), Prevent-180° (an opposing force hindering the motion), and Prevent-90° (two-dimensions; a perpendicular force altering the motion). Each configuration was coupled with multiple-choice options, arranged spatially in ways that elicited children to predict the outcome in terms of either the Distance or the Direction of the motion. Results revealed differences between the configurations, with Cause being the easiest and Prevent-90° being the most difficult to predict. Furthermore, predictions were more accurate when options were about the motion's Direction, while Distance options may have aggravated reasoning.

The present study replicated and extended previous findings on children's intuitive physics and causal cognition by showing that accuracy in reasoning is not only dependent on the number of forces and dimensions at work, but also interacts with estimating the motion's distance and direction.



## **The Effects of Lie Generation on Memory and Metamemory from a Value-Directed Remembering Perspective**

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Lying is a common aspect of interpersonal relationships. The healthy maintenance of these relationships requires successfully remembering one's lies and the truth. However, not all lies or the truth are equally important. Therefore, it becomes necessary for liars to prioritize some lies (or the truth) over others to navigate the social world successfully. Relatedly, value-directed remembering (Castel et al., 2002) is a phenomenon in which individuals strategically prioritize important information over other information to help them remember it more. The current study investigated whether and how participants prioritize high-value over low-value information in a lie-generation paradigm (Besken, 2018).

We investigated the effects of lying versus truth-telling to general knowledge questions differing in value on memory and metamemory. The study used a 2 X 2 within-subjects design, with encoding condition (lying versus truth-telling) and value (high versus low) as the factors. Before encoding, participants were told that their task was to maximize their points and explicitly emphasized to focus on high-value trials to maximize their points.

During encoding phase, participants generated plausible lies from the same category to half of the general knowledge questions and told the truth to the other half. Half of the questions were low-value (each worth 1 point), and the other half were high value (each worth 10 points). Then, participants made memory predictions between 0 (will not remember my response at all) and 100 (will definitely remember my response) after each general knowledge question. Following a distractor task, they received a free recall test.

We hypothesized that lying should induce disfluency, as measured by first keypress latencies. Because of this, lie trials should receive lower memory predictions than truth trials. However, lying should lead to higher memory performance in the free recall test. As for value, we expected higher memory predictions and actual memory performance for high- than low-value trials.

The results demonstrated that the first keypress latencies were higher for lie than truth trials, implying more disfluency for lie condition. Memory predictions were higher for truth than lie trials, and high-value trials received higher memory predictions than low-value trials. For actual memory performance, participants recalled more lie than truth trials. However, there was no effect of the value manipulation.

The findings revealed two metacognitive illusions regarding lying and value. The first is a double dissociation between memory and metamemory for lying. Participants predicted remembering

the truth more than the lies, in contrast to their higher actual memory performance for their lies. The second relates to a single dissociation for value. Although participants predicted to remember more of high- than low-value trials, actual memory performance was equal for both. The results imply that individuals can integrate multiple cues while predicting their memory and that some cues may be more valid than others. The study also highlights the boundary conditions for value-directed remembering in memory.

## Gesture Use in Autobiographical Memory

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Speakers employ co-speech gestures when thinking and speaking. Recently, gesture's role in autobiographical memory has also been explored. For instance, it was suggested that representational gesture use was positively associated with episodic details in autobiographical event narratives and the recollective quality of past autobiographical memories (Aydin et al., 2023). In the present study, we would like to explore the quality of the same relationship when gesture use is manipulated; e.g., encouraged.

Gestures, particularly representational ones, support autobiographical event constructions by activating existing episodic elements and causing new ones to be formed in the autobiographical recollections, based on the gesture-for-conceptualization framework (Kita et al., 2017). Therefore, we expect the representational gesture rate to be higher during past recollections -which are imbued with episodic components than when participants imagined future events. We also expect the subjective phenomenology to be higher in the gesture-encouraged condition than in the spontaneous gesture condition. This is because gestures are thought to undertake information-chunking roles to allow for further processing during remembering, such as a sense of recollective experience. Therefore, in the current study, we examined whether the heightened use of gesture would lead to an increase in the episodic content and the phenomenological characteristics of autobiographical memories.

A group of participants ( $N = 86$ ) were assigned to two conditions: a (1) gesture-encouraged condition -in which participants were instructed to use their hand gestures during event narration-, and a (2) gesture-spontaneous condition, in which they were not specifically instructed for gesture use. During the sessions, participants were expected to verbally narrate three events (a past autobiographical, a future autobiographical, and a non-autobiographical event) and then rate their phenomenological characteristics (e.g., the feeling of reliving). Also, a non-recollective control condition was added, in which the participants were asked to describe the images presented to them. The experimental sessions were video-recorded and then transcribed to code for gesture use and autobiographical event details. Narrative codings are ongoing and we expect participants in the gesture-encouraged condition to use more gestures which in turn will lead to an enhanced recollection of autobiographical memories (i.e., higher episodic specificity) than in the gesture-spontaneous condition. The results will be reported and discussed within the theoretical frameworks of the relationship between gesture, thought, and autobiographical event construction.

Keywords: co-speech gestures, autobiographical memory, episodic specificity

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## **The Main Problem with Neuroimaging Research in Explaining Cognitive Faculties**

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Several researchers and neuroscientists have been arguing for localized modular functions in the brain, specifically cognitive functions that are specific to language (Fedorenko, Behr & Kanwisher, 2011; Fedorenko, Duncan & Kanwisher, 2013; Kanwisher, 2010; among others). These researchers and neuroscientists use several methods and neuroimaging tools, specifically fMRI, and conduct a wide variety of experiments. However, many other neuroscientists and philosophers argue against localization and modularity in the brain (e.g., Anderson, 2010; Westlin et al., 2023). In this article, we elaborate on why arguments for modularity and localization are weak and why experiments that are conducted in favour of these arguments do not shed light on the nature of cognitive faculties and the brain's role to carry them. There are two main reasons for such failures. First, the lack of an adequate theory of mental representation in neuroscientific research, which causes problems such as creating a gap between content and correlation in brain research and obscuring the relationship between cognitive faculties and the brain. The issue is more important than it is thought; without an adequate theory of mental representation, the data that is gained through experiments using neuroimaging tools are open to overinterpretation, which means the experimenter can interpret the data however they want, and it leads to the replicability problem (Frisch, 2022). The second main reason, which we will argue for most, is an inadequate understanding of cognitive faculties. Neuroimaging experiments carry a lot of assumptions that rely on a mixture of functionalist and identity theory perspectives of the mind. However, there are reasons to doubt this mixture. One reason is the constructive role of the body and the environment in cognitive faculties. Another comes from questioning whether positing theoretical constructs such as mental representation is necessary for explaining the brain's functioning and performing cognitive faculties. We believe considering these reasons will lead the way to an adequate understanding of cognitive faculties.

In this article, first, we will summarize how neuroscientists argue for localization and modularity by focusing on Evelina Fedorenko's (2010, 2011, 2013) research. Then, we will introduce several criticisms from the literature directed against current neuroimaging research (Anderson, 2010; Arantes & Cendes, 2020; Frisch, 2022; Fultot et al., 2019; Westlin et al., 2023). Our aim in introducing these criticisms is to reveal the common instinct and motivation behind these criticisms: an inadequate understanding of cognitive faculties in current neuroimaging research. We will elaborate on this main problem by providing several experimental research, mainly from Cisek and Kalaska (2010) and therein. Finally, we will argue that to overcome the main problem, neuroscientists, who argue for localization and modularity, either need to provide an adequate theory of mental representation and apply it to their research or bite the bullet and

change their understanding of cognitive faculties by considering the constructive role of the body and the environment and nonrepresentational approaches to the brain's functioning and the nature of cognitive faculties. If neuroscientists won't choose to go one of these ways, then, it is unlikely that they will be able to provide an adequate understanding of cognitive faculties or come up with convincing counterarguments against their critics.

## **Future Thinking During the COVID-19 Pandemic: Effects of Health-Related Worries on Valence of Future Events Across 15 Countries**

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The COVID-19 pandemic as a global problem has affected millions of people by bringing physical and psychological problems such as worries. Worry is characterized by the presence of negative thoughts and feelings that cannot be controlled, related to future events that are perceived as possibly threatening (Borkovec et al., 1983). Worry has a crucial impact on an individual's mental health and perception of the world (Andrews & Borkovec, 1988). The negative thoughts and feelings linked with worry can interfere with memory (Hayes et al., 2008; Leigh & Hirsch, 2011), resulting in difficulties in interpreting both past and future events (Behar et al., 2005; Jing et al., 2016; Feng et al., 2022). These negative thoughts and worries might affect personal and collective future thinking. While personal future thinking is envisioning what might happen in one's future, collective future thinking is envisioning the event of one group's future (Szpunar & Szpunar, 2016). The aim of this study is to investigate the impact of health-related worries on individuals' emotional valence of future global and national events and to explore if this impact varies depending on whether the events are voluntary or involuntary. Moreover, since people live in different contexts, we expected there might be different worry levels depending on the COVID-19 severity (total confirmed cases) of countries. 2742 participants (68.7% female, Mage = 28.49, SD = 13.64) from 15 countries. Participants are asked to complete a survey that includes demographic information, and personal questions about the pandemic. Then, they are asked to report three past and three future events at both global and country-specific levels, and involuntary future events. We found differences depending on the worry levels and severity of the COVID-19 pandemic across countries. It indicates that higher worry levels resulted in more negative valence in terms of involuntary future events. These findings emphasize the importance of worry and COVID-19 severity level in the emotional valence of future events and will be discussed on the individual and global level of future thinking.

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## **Assessing Emotions in Animals Through Cognition: Judgement Bias Test as a Promising Model for Behavioral Neuroscience**

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Animal models are frequently used in neuroscience, both for basic brain research and for investigating the etiology of diseases/disorders and potential treatments. Due to the emotional aspects of mental disorders in humans, studying such disorders in animals requires more than just observing their behaviors or physiological responses; it is necessary to deduce the underlying emotions as well. Stress related mood disorders such as anxiety and depression are commonly measured in rodent models by three tests: the Forced Swim Test (FST), the Elevated Plus Maze (EPM), and the Open Field Test (OFT). Among these tests, the FST is said to measure behavioral despair, and the other two anxiety tests are said to measure the species-specific behaviors of rodents when they are anxious. However; conceptual discussions about these tests still continue. Some argue that the FST is not a behavioral despair thus depression model but instead it is a learning paradigm that measures how well the rodents learn about the novel situations. Anxiety tests are also criticized for not providing a consistent measure of anxiety and solely measuring the instinctive behaviors of animals in new environments. Therefore, there is a quest for a test that can measure the underlying emotional factors behind these disorders accurately, serving as an alternative to the commonly used tests that have been prevalent for a long time due to their successful prediction of the effectiveness of antidepressants and anxiolytics. In response to this need, approximately 20 years ago, the Judgement Bias Test (JBT) was developed to measure the effects of emotions on cognition in animals. This test evaluates an animal's cognitive bias by measuring their response to ambiguous stimuli, which is thought to reflect their emotional state. Nonetheless, further research is needed to validate its use as a common anxiety/depression test and establish standardized protocols. In this poster presentation, the pros and cons of the common anxiety/depression tests will be described by comparing them with the Judgement Bias Test. It will also be discussed whether it is possible to assess an animal's emotional state through their cognitive biases. Lastly, some suggestions will be provided about what can be done to measure and increase the validity of this new test. As there is a need for a test that accurately measures the emotions of animals and this new test attempts to measure emotions through cognition, discussing this test at such a conference is crucial for enhancing its visibility and questioning its applicability with other experts in the field.

### **Listener Judgements of Preverbal and Postverbal Constituents in Western Armenian**

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Keywords: Armenian, prosody, word order

Armenian is an Indo-European language that has two standard varieties which are Eastern Armenian (EA) and Western Armenian (WA). Both have a free word order (predominantly, a flexible Subject (S)- Object (O) - Verb (V)). However, two varieties differ in focus projection for pragmatic purposes. Unlike the auxiliary movement in EA, in-situ focus projection in WA is a more frequent strategy for this purpose. Hence, prosody and in-situ focus projection are more prominent strategies in WA. Although Armenian has a lexical stress on its final full vowel (schwa is an exception), lexically unstressed syllables can bear a boundary tone at the phrase level. In a typical out-of-the-blue-context sentence, the preverbal slot is generally attributed to neutral focus (answers to questions such as What happened?). Moreover, H\* accent is associated with narrow focus. Postverbal slot, unlike EA, however, is highly unlikely to get any H\* accent except in the context of storytelling or prepared speech. The present study examines listeners' judgment on information packaging in WA. To evaluate the prominence of the preverbal and postverbal constituents, we conducted an experiment with between-subject design on 30 native speakers. Listeners were asked to identify the new information, i.e., focus of the sentence without having been provided a background information about the stimuli. The data was extracted from a natural corpus recorded in a linguistics summer camp following the guidance of Questionnaire by Skopeteas et al. (2006). 63 sentences with preverbal and postverbal focus were selected from the corpus. The experiment was designed in PsychoPy and was conducted at Getronagan Armenian High School, the procedure was as following: audio stimuli were presented one by one without the written form displayed on the screen. Each time speakers were asked to type the "new information". All data was then analyzed via JASP. One way ANOVA test was applied to the results and p-value was significant (<0.001) for three sentence categories (preverbal, postverbal and sentence). Results show that, in all focus sentence types, preverbal answers were more likely to be labeled as the new information. For preverbal sentence type, verbs and postverbal constituents are perceived as new nearly at the same percentage. Most variation in results are seen in the "sentence focus" type. For each sentence type, nearly 20% of the responses were the verbs of the sentence, however this was more frequent in postverbal sentences. This means that the fronting of the verb blocks the information at the right periphery to be treated as new information to a certain extent. In postverbal sentences, results also showed that the immediate right part of a VO sentence is less treated to be included in the focus phrase. On the other hand, this is the contrary when the sentence type is OV; the nearest element is more prone to be detected as new information. Our

results indicate that the SVO cognitive optimization of free word order languages still needs further research and is a promising research topic for future studies.

## **Influences of L2 exposure on L1 Theory of Mind Talk: Comparison of Bilingual vs. Monolingual 5-, 7-, and 9-Year-Olds.**

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Children's ability to understand abstract and invisible mental states of themselves and others is known as the theory of mind, and it undergoes developmental changes, especially in preschool ages (Astington & Jenkins, 1999). Mental state language (MSL) could be defined as the verbal and explicit expression of mental states and seen as a precursor of ToM abilities (Rosnay & Hughes, 2006; Peterson & Slaughter, 2006). Bilingual children are found to perform better in ToM tasks compared to monolinguals (Bialystok & Senman, 2004). In light of previous research, this study aims to examine the influences of early L2 exposure on the production of mental state words. For this purpose, we used a narrative elicitation task to compare bilingual and monolingual children's narratives.

A total of 154 children aged 5-, 7-, and 9-year-old were recruited in two groups: Turkish monolingual ( $N = 77$ ,  $M_{month} = 96.1$ ,  $SD = 21.9$ ) and L1-Turkish-L2-English bilingual children ( $N = 77$ ,  $M_{month} = 93.2$ ,  $SD = 19.4$ ). Children narrated stories based on a wordless picture book, "Frog, Where Are You?" (Mayer, 1969). We used a detailed coding scheme for mental state words, which include expressions about perception (i.e., hearing), physical state (i.e., sleeping), desire (i.e., want), motivation (i.e., trying), emotion (i.e., happy), and thoughts (i.e., think, know) (Evsen, 2022). The total type (i.e., number of different MSL words) and token (i.e., total number of MSL words) ratio of MSL for type and token were calculated by dividing the raw number of MSL words for both token and type by the total number of words. In addition, children's language competence in L1 and L2 was examined by Turkish Receptive and Expressive Vocabulary Test- Receptive subtest (TIFALDI-R) (Kazak-Berument & Güven, 2013) and Peabody Picture Vocabulary Test-4 (PPVT-4, Dunn & Dunn, 2012).

Two ANCOVA analyses were conducted to examine the influences of language group (i.e., bilingual or monolingual) and age (5, 7, and 9 ages) on type and token of MSL production. Results indicated that the main and interaction effects of language and age were not significant for neither type nor token scores. However, for type, results indicated that L2-proficiency (as measured by PPVT-4) was significant [ $F(1,146) = 5.54$ ,  $p = .02$ ], which indicates that as children's L2-proficiency increased, they included a greater number of types for MSL words. Although the total number of words produced by bilingual children ( $M = 184$ ,  $SD = 88$ ) was significantly higher [ $t(152) = 3.19$ ,  $p = .002$ ] than by monolingual children ( $M = 144$ ,  $SD = 66$ ), results indicated that they did not use more types and tokens of MSL words. Overall, it is suggested that enhanced L2 proficiency is associated with the number of types of mental state words regardless of the language group.

Overall results indicate that there was no effect of language group on MSL word production in narratives. One potential reason might be that the monolingual group was also exposed to L2-English, which might have dampened the difference between the two groups. The positive association between L2-proficiency and use of different varieties of MSL words points to a probable enrichment of mental state vocabulary in childhood.

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### Contiguity Effect is Asymmetric Across Pairs, How About Within

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In the literature, paired associates and list recall have been studied separately. Recall probabilities of forward and backward recalls have been found approximately equal in paired associates. In this regard, two hypotheses were proposed: the associative symmetry hypothesis (ASH) which suggests holistic encoding of pairs, whereas the independent association hypothesis (IAH) separates the encoding of forward and backward. On the other hand, in free recall, subjects tend to successively recall words studied in nearby positions, denoted as the contiguity effect, favoring the following word over the preceding one. Temporal Context Model (TCM) is an account for the contiguity effect and proposes items studied nearby positions have similar study contexts, recalling one item activates its context along with its neighbors' context which results in the contiguity effect. Kılıç et. al. (2013) developed a probed recall task to test the contiguity effect by interrupting the linearity of the experimental procedure in which participants study multiple lists of words with distraction tasks in between. In the test session, participants were given probe word to recognize and performed a recall from the same list as probe. In the current study, we used paired associates in the task to test whether contiguity effect and forward asymmetry will be observed across word-pairs. Therefore, we employed their probed recall task on the paired associates where participants studied multiple lists of pairs. At test, they were given a pair to recognize and required to go back to the list that the member was presented in and recall another word from the list. Conditional response probability (CRP) curves were plotted and Wilcoxon rank test were performed to examine contiguity effect and forward asymmetry across pairs. Wilcoxon rank test was chosen since the data were not normally distributed. CRPs indicated within list contiguity ( $W(67) = 1995, p < .001, r = .979$ ) with the forward asymmetry ( $W(67) = 419, p = .02, r = .367$ ), also between list contiguity ( $W(69) = 2124.5, p < .001, r = .981$ ) with the forward asymmetry ( $W(69) = 1255.5, p = .025, r = .328$ ). Lastly, a within pair analysis was performed to test whether first pair item ( $M = 9.157, SD = 3.549$ ) were recalled more than the second pair item ( $M = 8.414, SD = .4.525$ ), the Wilcoxon rank test did not reveal any significant difference ( $W(69) = 1132, p = .276, r = .159$ ). Thus, we observed that these two patterns of recall data from the probed recall task are in line with the previous findings in the literature of paired associates and list recall patterns which fits the contextual coding mechanism of TCM.

## **Implicit Metacognition Conforms Group Decisions in a Bayesian Fashion**

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One of the most prominent social influences on human decision making is conformity. Especially when perceptual information is vague, the private and public information should be incorporated into perceptual judgments. The Bayes optimal way of solving this problem entails weighting the contribution of information based on their reliability during this process. Here, in a numerical estimation task, we investigated whether humans rely on the statistics of endogenous perceptual and public information in a Bayes optimal fashion while estimating numerosities. Such results would hint at implicit metacognitive processing of magnitude representations. Our results demonstrated that participants adjusted their initial estimations towards group mean only when group estimations were more reliable with respect to participants' endogenous metric uncertainty. These support the Bayesian optimal social conformity. The implications are discussed in the implicit metacognition framework.

Keywords: social conformity, Bayesian weighting, implicit metacognition, numerical estimation

## **The Effect of Bilingual Experience and Home Language Environment on Cognitive Control of Bilingual Children**

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Cognitive advantages of bilingualism have been investigated by comparing the cognitive abilities of the monolingual and bilingual groups (Abutalebi, 2007). Currently, there is a growing interest in whether different dimensions of bilingual experience could be associated with cognitive abilities in bilingual individuals (Kang, 2019). Previous work demonstrated that a higher rate of language switches was associated with smaller mixing cost in errors in shifting tasks (Soveri, 2011). Additionally, the proficiency level of a second language, as well as the extent that people tend to mix their languages (i.e., language use) in daily lives are associated with the amount of practices implemented in various cognitive processes (Costa, 2009). This, in turn, lead to enhanced cognitive performance. Due to limited work examining the interrelations between different dimensions of bilingual experience as well as their contributions on cognitive performance, here we investigated the (1) interactions among the above-mentioned dimensions of bilingual experience both from young children and parents (i.e., children's and parents' code-switching frequency, language proficiency, language use), and asked which of these variables are more strongly related to children's cognitive control abilities.

Participants were families (parents ( $n = 48$ ); children ( $n = 24$ , AgeRange=2.5-4)) from Turkey which use more than one language within home environment on a daily basis. They provided 15-minutes long audio recordings of interactions that allowed us to conduct natural observations of code-switching frequency within the household. The Bilingual Language Experience Calculator (BiLEC) questionnaire (Unsworth, 2013) was applied to investigate children's and parents' language proficiency and language use. Children's cognitive control abilities are assessed via Dimensional Card Sort (DCCS) Task (Zelazo, 2013) and Visual Search Task (Verhagen, 2020) via online meeting.

Three bilingual researchers proficient in Chinese & English ( $n = 1$ ) and Turkish & English ( $n = 2$ ) transcribed and coded audio recordings for code-switching frequency of parents and children. Additionally, four other bilingual experience-related variables (children's and parents' language proficiency and use) were calculated from the BiLEC. Lastly, children's cognitive control performance was coded as total accuracy scores of each task.

We conducted correlation analysis to detect possible associations among children's and parents' code-switching frequency, children's and parents' language proficiency, children's and parents' language use, cognitive task scores, and age. Children's code-switching frequency was positively associated with children's language use ( $r = .402$ ,  $p = .051$ ), and negatively associated with age ( $r$



=  $-.438$ ,  $p = .032$ ) and parent's language proficiency ( $r = -.480$ ,  $p = .018$ ). Parents' language proficiency was negatively associated with parents' language usage ( $r = -.437$ ,  $p = .033$ ). Children's language usage was positively associated with parent's language usage ( $r = .460$ ,  $p = .024$ ) and children's language proficiency ( $r = .419$ ,  $p = .042$ ). Lastly, children's cognitive task performance was strongly correlated with age ( $r_{DCCS} = .559$ ,  $p = .004$ ,  $r_{VisualSearch} = .585$ ,  $p = .003$ ) but not with any of the bilingual experience related variables from both children and parents (all  $ps > 0.05$ ).

Summarizing, preliminary results indicated that the more evenly children use their home languages, the younger the children, as well as the less proficient their parents' second home language, the more frequently children switched from one language to another on a daily basis. Also, the more proficient parents are in their second home language, the less likely they are to speak in a language that differs from each other's. Moreover, whether or not children use their home languages evenly is positively associated with whether children have equal mastery for those languages and whether parents apply the "one parent one language" policy. Lastly, we discovered that age but bilingual experience related variables act as a strong predictor for children's cognitive control abilities. This study is among the limited work that studied the association among all three dimensions of bilingual experience by investigating code-switching frequency through natural observation and their potential "bilingual effect" on cognitive performance (Kałamata, 2021).

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### **The Interdependence of the Memory Reactivation of Items and Task Rules**

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Working memory (WM) is critical for goal-directed behavior and stores task rules and task-relevant items. These representations are stored in two subsystems: procedural WM governs task rules, and declarative WM stores representations of visual task-relevant items. The relationship between the storage of task-relevant items and task rules has been under debate, as some studies suggest that they are independent, whereas others propose they are interdependent. We aimed to test these accounts by investigating the effects of reactivating task rules on the reactivation of task-relevant items. For this, we used contralateral delay activity (CDA), an electroencephalogram marker of WM storage of items.

Participants ( $N = 45$ ) stored targets for a recognition or a size comparison task. Each target was repeated across six trials to enable their handoff to long-term memory (LTM). Critically, the task rule changed during some target repetitions. This manipulation allowed testing whether updating the task rules triggers the reactivation of task-relevant items.

First, there was a significant CDA for novel items, suggesting that they are stored in WM. Second, the CDA amplitude decreased with target repetitions suggesting the handoff to LTM. Importantly, CDA increased again on task-switch compared to task-repeat trials, suggesting that reactivation of task rules triggers the reactivation of task-relevant items in WM. Thus, this study demonstrates that WM reactivation of LTM is interdependent for task rules and task-relevant items.

**Keywords:** working memory, long-term memory, memory reactivation, contralateral delay activity, working memory subsystems

## **Disentangling Memory Precision and Internal Attention Through Repeated Memory Storage Reveals That Memory-Guided Attention Relies on Internal Attention**

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Humans often rely on memory-guided attention, such as when searching for a friend in a crowded square. There are two opposing views on what enables a memory item to guide attention. According to one view, items that are internally attended to in working memory guide attention in the external world (Olivers et al, 2011). A recent view claims that rather than internal attention the precision of items determines their attention-guiding abilities (Williams et al, 2022). Contrasting these views is challenging given that internal attention is the main predictor of precision (Serin & Günseli, 2022). To overcome this challenge, we relied on repetitions of the same memory item across trials, which has been shown to reduce internal attention but increase precision. In every trial, participants were presented with a memory item, a colored circle. After a brief delay, in half of the trials, they were asked to report the memory color on a color wheel. To measure memory-driven attention, in the other half of the trials, participants were presented with a visual search task that included filled circles with a gap on one side. Participants needed to find the circle with the top or bottom gap among eight other distractor circles with left or right gaps (e.g., a top gap circle among circles with gaps on the right or left) and report the direction of its gap. The color of one of the distractor circles matched the memory color in half of these search trials while it was a novel color in the other half. Importantly, the same memory item was repeated in 5 consecutive trials. When the memory color was stored the first time, it involuntarily guided attention during visual search, as indexed by a larger reaction time for memory-match vs novel distractor trials. With every repetition of the memory color, the memory precision improved, as reflected in smaller errors in the color wheel report. In contrast, the attentional guidance ability of the memory color diminished, indicated by a reduced reaction time cost for memory-matching distractors. Thus, improved precision did not result in improved attentional guidance. Given the previous electrophysiological studies that show repeatedly stored items receive less internal attention (Günseli et al., 2014a,b; Reinhart & Woodman, 2014), we suggest that reduced memory-guided attention was due to reduced internal attention. Accordingly, we conclude that internal attention governs memory-guided attention rather than memory precision.

## **Word Frequency Cues to Word Order: A Cross-Linguistic Study in Italian and Turkish Adults**

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Learning the relative order of function and content words is a fundamental aspect of language acquisition. While content words carry lexical meaning, functors define grammatical structure. Since functors are more frequent and phonologically more reduced than content words (De La Cruz-Pavía et al., 2021), infants can rely on these cues to distinguish them and use functors as anchors to the grammar of their native language (De La Cruz-Pavía et al., 2021). The relative order of functors and content words varies across languages, and infants are sensitive to this basic order by 8 months (De La Cruz-Pavía et al., 2021); so are adults (Gervain et al., 2013). The current study tests the anchoring effect in Italian and Turkish adults. First, we test whether previous lab-based results with Italian adults (Gervain et al., 2013) are replicable using online testing. Second, we leverage online testing to assess understudied languages such as Turkish. As in Gervain et al. (2013), after listening to a 17-minute familiarization with an artificial language, in which frequent words mimicking functors and infrequent words mimicking content words alternated, participants chose between test items with a functor-initial (Italian-like) and a functor-final (Turkish-like) order. So far, we have tested 18 Turkish and 12 Italian adults. Results (Figure 1) indicate that Turkish participants have functor-final preference, as predicted, while Italian speakers showed no preference. Pooling the results with the previous study (Gervain et al., 2013), we found a significant difference between Italian and Turkish speakers' preferences and no difference between the in-lab and online Italian groups. The findings suggest that functors provide cues for learning new linguistic material, and adults show sensitivity to the frequency of distribution of functors.