Embodied and Situated Language Processing

September 29-30

University of Messina

eslp2023.com

Welcome

Dear ESLP attendees,

The conference series on Embodied and Situated Language Processing has provided a forum for interdisciplinary discussions on linguistic processing in embodied and situated settings since 2007.

ESLP conferences have evolved along with the field they represent and have successfully adapted to various contingencies, such as the pandemic with a fully online edition in 2021.
Some researchers have left, while many others have joined with enthusiasm. This year's hybrid conference will continue along these lines by offering an informal and stimulating environment to foster research discussions between established and early career researchers.

It is my pleasure to welcome you in Messina, and I hope ESLP will once again prove to be a vibrant and stimulating scientific event.

**Claudia Gianelli,
Main Organizer**

Welcome

Dear ESLP attendees,

it is my pleasure to welcome you on behalf of the Center for Psychological Research and Intervention (CeRIP).

At CeRIP, our central mission revolves around equipping individuals with the necessary tools to nurture their mental health and well-being throughout their entire life span. We are committed to offering guidance, prevention, precise diagnosis, and effective treatment for a wide range of psychological challenges and disorders.
To fulfill this mission, we conduct innovative psychological research and collaborate with similar research centers and academic institutions, both nationally and internationally. Conferences like ESLP serve as an ideal platform for us to foster our core mission and to cultivate new connections and collaborations.

I wish you all a very pleasant and successful conference.

Francesca Liga,
Director, CeRIP

Scientific Commitee

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Support

We kindly acknowledge the support of the Center for Psychological Research and Intervention (CeRIP) and the University of Messina.

The conference is sponsored by ANT Neuro and Gorilla.

www.gorilla.sc

Schedule at a glance

Friday, September 29, 2023

9:00 - 9:15	Welcome
9:15 - 10:15	Keynote 1: **Anna Borghi**
10:15 - 11:00	**Poster Session and Coffee**
11:00 - 13:00	**Short Talks**
13:00 - 14:00	**Lunch**
14:00 - 15:00	Keynote 2: **Friedemann Pülvermuller**
15:00 - 17:40	**Talks**
19:30	**Get Together/Aperitivo**

Saturday, September 30, 2023

9:00 - 9:15	Welcome
9:15 - 10:15	Keynote 3: **Penny Pexman**
10:15 - 10:30	**Coffee Break**
10:30 - 11:30	Keynote 4: **Agustin Ibañez**
11:30 - 13:10	**Talks**
13:10 - 14:10	**Lunch**
14:15 - 15:15	Keynote 5: **Claudia Gianelli**
15:15 - 15:30	**Coffee Break**
15:30 - 17:50	**Talks**
17:50 - 18:00	**Conference Prizes**
18:00 - 19:00	Round Table: **Journal of Cognition Special Issue**
21:00	**Social Dinner**

Friday, September 29, 2023

9:00 - 9:15 Welcome

9:15 - 10:15 Anna Borghi Keynote

Concepts, social interaction, and knowledge outsourcing

10:15 - 11:00 Poster Session/Coffee Break

11:00 - 13:00 Short Talks

P1. Shen, G. *The role of episodic and visual-semantic memory systems in abstract and concrete conceptual processing*

P2. Lussiana, E. *Body-object interaction ratings for 357 French nouns*

P3. Lamarra, T. *Lexical decision and semantic processing latencies for words that vary in concreteness and specificity*

P4. Gervasi, A.M. *Addressing the role of new verbal labels associated with novel actions, a behavioral study*

P5. Miklashevsky, A. *Sensorimotor semantics: Individual variability in effects*

P6. Shen, G. *Exploring the role of contextual features in abstract concept representation*

P7. Milanesi, M. *Exploring action-related desynchronization: mu rhythym responses to visual and linguistic stimuli*

P8. Vitale, F. *The inhibitory effect of linguistic negation on motor cortical activity*

P9. Capuano, F. *Disentangling population stereotypes from individual differences in aces*

P10. Bernotat, J. *Personality matters - how a robot's behavior conveys personality and how this affects potential drivers' preferences and trust in hri*

P11. Gigandet, R. *Unraveling the interplay between verbal utterances, bodily shape, and beliefs: novel insights into embodied language processing*

P12. Zappa, A. *Can social gaze in a naturalistic vr environment contribute to l2 word learning?*

P13. Schulz, M. *Coordination of referring expressions in visually situated communication: maximal informativity or uniform encoding?*

Friday, September 29, 2023

13:00 - 14:00 Lunch

14:00 - 15:00 Friedemann Pülvermuller Keynote

From semantic grounding to brain-constrained neural modelling of symbols and concepts

15:00 - 17:40 Talks

T1. Connell, L. Access to inner language enhances memory for events

T2. Fargier, R. Situational variability in narrative contexts facilitates the learning and retention of novel words

T3. Zeelenberg, R. Evidence for Mental Simulation During Language Comprehension in Non-native Speakers

T4. Marson, F. Cross-linguistic similarities and differences in perceptual experiences of abstract and concrete concepts

T5. Zona, C.I. Visually situated thematic-role representations in L1 and L2: An individual difference study

T6. Kühne, K. Not on time alone? Situated flexibility of embodied time concepts

T7. Laubrock, J. What is the origin of spatial numerical associations?

T8. Abashidze, D. Can the recent-event preference be modulated by early morphosyntactic cues? Evidence from eye tracking

19:30 Get Together/Aperitivo

Saturday, September 30, 2023

9:00 - 9:15 Welcome

9:15 - 10:15 Penny Pexman Keynote

Multimodal grounding of abstract concepts

10:15 - 10:30 Coffee Break

10:30 - 11:30 Agustin Ibañez Keynote

A spatiotemporal coding framework of allostatic-interoceptive overload in neurodegenerative diseases

11:30 - 13:10 Talks

T9. Brozzoli, C. *Initial motor skills determine the benefits of tool-use learning over syntax in language*

T10. Williamson, T.R. *Assessing Individuals' Embodied Linguistic Gestures*

T11. Li, B. *Embodied Words: Exploring the Relationship Between Word Associations, Physical Appearance, and Body Image*

T12. Tuena, C. *Linking Memory for Action Language and Spatial Memory: Insights From an Unexpected Result*

T13. Fisher, V.J. *A process model of "introjecting" verbal instructions into moving bodies*

13:10 - 14:15 Lunch

14:15 - 15:15 Claudia Gianelli Keynote

Replications, many labs and many analysts: what's next for embodied cognition research?

Saturday, September 30, 2023

15:15 - 15:30 Coffee Break

15:30 - 17:50 Talks

T14. Pohl, J. *Vertical and Horizontal Space-Valence Associations: A Meta-Analysis*

T15. Knoeferle, P. *Grounding language processing: Specifying linguistic/compositional representations and processes*

T16. Dobler, F. *Verbal symbols support concrete but enable abstract concept formation: Evidence from brain-constrained deep neural networks*

T17. Malyshevskaya, A. *Priming from time to numerical magnitude and length of randomly generated number words*

T18. Villani, C. *The semantic content of concrete, abstract, specific and generic concepts*

T19. Haslett, D.A. *Similar-sounding associates mitigate concreteness effects*

T20. De Livio, C. *Investigating Conceptual Representation of Gender Identity in the Italian Language: A Mixed Methodology Study*

17:50 - 18:00 Conference Prizes

18:00 - 19:00 Journal of Cognition Special Issue Round Table

21:00 Social Dinner

Abstracts - Talks

Access to Inner Language Enhances Memory for Events

LOUISE CONNELL[1] AND BRIONY BANKS[2]

[1]Maynooth University, Ireland, [2]Lancaster University, UK

Events are temporally-bounded experiences involving people, objects and actions that can be segmented into sequences of smaller meaningful events (e.g., the steps involved in constructing a piece of furniture). We investigated whether inner language enhances memory for events in a naturalistic, non-verbal task where participants constructed simple models from memory. Across four experiments, we used linguistic suppression in a dual-task paradigm to test whether inner language improved overall memory performance and completion time, additionally exploring the number of events that could be recalled. We found that access to inner language at encoding consistently affected memory performance: when inner language was disrupted at encoding, participants were poorer at recalling the models and remembered fewer events. This effect was present whether or not the number of events to be recalled exceed event memory capacity (estimated to be approximately 7-8 events). Critically, the effect of linguistic suppression on memory performance was greater than a control secondary task that did not affect access to language; that is, poorer performance was not solely due to dual-task effects. The results support the proposal that inner language enhances event memory via a mechanism of linguistic bootstrapping, which in turn extends theories of event memory and adds to a growing body of evidence that inner language is a highly valuable cognitive tool.

Situational variability in narrative contexts facilitates the learning and retention of novel words

RAPHAËL FARGIER[1], ANDREAS FALCK[2], TINE HOVLAND[2], HAKAN BAYAR[2], AND JANNE VON KOSS TORKILDSEN[2]

[1]Université Côte d'Azur, CNRS, BCL, France, [2]Department of Special Needs Education, University of Oslo, Norway

A large part of our knowledge comes from our direct interaction with the external world, while many concepts and words are also learned from reading stories. Importantly, real-life experiences are never entirely repeated or entirely changing, and it remains unclear what features of variability lead to better learning of words and their meanings. In this project, we designed a web-based learning experiment, and used short fictional narratives as proxies to variability in real-life experience to examine this issue. Eight novel target words were created. Two core semantic features were assigned to each word (e.g. "can be grasped", "sticks"). Participants encountered the words in a block of 3 successive narrative contexts that could be identical or could vary to different extents. We manipulated variability in non-core object features (e.g. color, size) and variability in situational features of the stories (e.g. protagonists, locations, events). After each story, participants were invited to define the target word through typing. Several scores were computed including the number of core features mentioned per definition. The study was pre-registered on OSF (https://osf.io/6gezm). Final dataset included 280 participants. Definition scores indicated significantly better learning of core semantic features in the conditions with situational variability, including the condition with variability in both object and situational features. Although performance dropped at follow-up up 1 day later, performance remained higher in the conditions with situational variability. Our results suggest that situational variability in narrative contexts support word learning as well as identification and retention of core semantic features of words.

Evidence for Mental Simulation During Language Comprehension in Non-Native Speakers

RENÉ ZEELENBERG AND DIANE PECHER

Erasmus University Rotterdam, Amsterdam, Netherlands

In a sentence-picture verification task, pictures of objects are verified faster when they match the orientation, shape, or color implied by the preceding sentence. This suggests that people mentally simulate these visual characteristics during language comprehension. Whereas the results of studies with native speakers have been largely consistent, studies with non-native speakers have provided inconsistent results. We will discuss several studies from our lab that successfully replicated match effects for non-native speaker of English during language comprehension, indicating native-like visual simulations. In addition, we found that participants displayed better delayed recognition memory when the shape of the depicted objects matched the shape that was implied by the sentence than when it did not, suggesting that visual simulations were generated automatically. Together, these findings suggest that simulations occur spontaneously in non-native language comprehension.

Cross-linguistic similarities and differences in perceptual experiences of abstract and concrete concepts

FABIO MARSON[1,2], PATRIZIO PAOLETTI[1], REVITAL NAOR-ZIVS[3], JOSEPH GLICKSOHN[3] , FILIPPO CARDUCCI[2], MARK A. ELLIOTT[4], TADHG HARRIS[4], AND TAL DOTAN BEN-SOUSSAN[1]

[1]Research Institute for Neuroscience, Education and Didactics, Patrizio Paoletti Foundation, Assisi, Italy, [2]Neuroimaging Laboratory, Department of Physiology and Pharmacology, Sapienza University of Rome, Rome, Italy, [3]Department of Criminology, Bar-Ilan University, Ramat Gan, Israel, [4]School of Psychology, National University of Ireland, Galway University Road, Galway, Republic of Ireland

According to embodied language theories, word meaning is embodied in sensorimotor experiences built from actual interactions with objects and people. Experiences related to concrete concepts are thought to involve exteroceptive modalities (i.e., sight, touch, hearing, taste, and smell), while experiences related to abstract concepts are thought to mostly involve activation of bodily states perceived through interoception. Interoception is involved in different emotional, cognitive, and social functions, and likely underlies higher-order social functions like empathy. Noteworthy, words and their related experiences (especially regarding social interactions) can differ based upon the linguistic and cultural milieus within which they are learned and used. Consequently, we hypothesized that interoception would be equally important in grounding abstract concepts across languages, but its relationship with empathy would show cross-linguistic variability. However, very few studies have explored cross-linguistic differences between the perceptual components of words. We collected Perceptual Strength ratings for 80 words and administered empathy and bodily sensitivity questionnaires to 624 participants divided into Italian, Hebrew, and English native speakers. We found that abstract concepts are characterized by high interoception ratings and that interoception ratings have a prominent role in differentiating abstract and concrete concepts similarly across languages. Additionally, we observed good cross-linguistic consistency in clustering subtypes of concepts using perceptual strength only. Finally, interoception ratings were consistently associated with bodily awareness across languages, while their relationship with empathy showed cross-linguistic variability, with Hebrew native speakers showing stronger association than Italian and English native speakers. Results will be discussed according to embodied linguistics and linguistic relativity.

Visually situated thematic-role representations in L1 and L2: An individual difference study

CARLOTTA ISABELLA ZONA, CLAUDIA FELSER

University of Potsdam, Germany

While second-language (L2) speakers exhibit lower sensitivity to case information in building thematic-role representations, they have been found to rely on non-syntactic cues equally or more than first-language (L1) speakers, suggesting a trade-off in the use of both information sources. However, possible L1-L2 differences in the use of information from visual scenes for thematic-role assignment have not been investigated systematically. This study examined sensitivity to case cues as a predictor of L1-L2 differences and its relation to the use of information from visual scenes for thematic-role assignment. 45 L1 and 39 L2 speakers listened to thematically unambiguous subject- and object-extracted relative clauses in German and answered written agent-identification questions. The sentences were presented either in isolation (Experiment 1) or with scene depictions conveying either the same or the opposite thematic roles as the sentence did (Experiment 2). The results revealed robust effects of sentence-picture congruence on agent-identification accuracy in both groups and for both clause types. L2 (vs. L1) speakers responded less accurately to object-relatives particularly. While visual effects were equal in size across groups, decreasing case sensitivity was associated with less accurate agent identification, particularly of object-relatives presented with incongruent scenes. Notably, case sensitivity emerged as a predictor of performance beyond L1-L2 grouping. These findings extend situated-language models to L2 speakers and demonstrate the role of conflicting visual cues for L1 and L2 thematic-role representations. The observed performance differences are attributed to variability in the reliance on syntactic/non-syntactic information across individuals, which may be determined by varying sensitivity to specific cues.

Not on time alone? Situated flexibility of embodied time concepts

KATHARINA KÜHNE

Potsdam Embodied Cognition Group, University of Potsdam, Potsdam, Germany

Previous research in embodied cognition had shown a connection between the past and the left side, as well as the future and the right side, or the Mental Time Line (MTL). However, these associations were observed only when participants explicitly focused on temporal information rather than other semantic aspects. It remains unclear whether varying semantic tasks can implicitly activate the MTL. We hypothesized that the salience of time semantics in a specific task would influence MTL activation. In three online experiments, we employed varying semantic categorization tasks: animacy judgments (animate vs. non-animate), spatial judgments (space-related vs. -unrelated), and general temporal judgments (time-related vs. -unrelated). Unobtrusively to study participants, each experiment included past- and future-related words. Response times were measured. More than 100 native German speakers took part in each of the experiments. Surprisingly, the pattern of MTL activation varied depending on the task: MTL activation was stronger in spatial judgments compared to animacy judgments, suggesting an asymmetry between different conceptual domains, with space being more salient. We also found the impact of task difficulty on the strength of the embodied effects in language processing, with the more difficult space judgment task resulting in more pronounced effects than the easier animacy judgment task. Notably, explicit general temporal judgments did not activate the MTL. Our findings demonstrate a situated modulation of embodied time representations but also question the necessity of space-time associations for processing time concepts.

What is the origin of spatial numerical associations? Experimental evidence for the brain's asymmetric frequency tuning hypothesis

JOCHEN LAUBROCK, XIN LI, MARTIN H. FISCHER

University of Potsdam, Germany

More than 20 years of research on the SNARC effect clearly established that numbers are associated with space in human adults. Whereas cultural factors shape and modify this association, spatial numerical associations (SNAs) have been demonstrated in human infants, newborn chicks and other animals. What is the cause of these apparently hard-wired SNAs? In the brain's asymmetric frequency hypothesis (BAFT) we have recently argued that SNAs derive from a combination of hemispheric lateralizations of perceptual and response related processes. On the perceptual side, there appear to be hemispheric biases for processing higher vs. lower parts of the spatial frequency spectrum. On the response side, effectors are controlled by the contralateral hemisphere. We have shown that numerosity and energy in the spatial frequency spectrum are confounded in the type of numerosity stimuli typically used in animal experiments. The BAFT has been challenged by the finding that SNAs are still obtained when the confound between numerosity and spatial frequency is removed (Adriano et al., 2022). Our re-analysis of Adriano's data, however showed that they actually support the BAFT. Here we present this re-analysis as well as a series of new experiments to test the BAFT. Since BAFT predicts stronger SNAs with the kind of standard numerosity stimuli typically used, a common design factor of all experiments is the comparison of standard stimuli with spatial frequency equalized stimuli. Using this common factor, the experiments add perceptual as well as reponse-related factors in order to investigate how numerosity and space are associated.

Can the recent-event preference be modulated by early morphosyntactic cues? Evidence from eye tracking

DATO ABASHIDZE[1], ANGELA SCHMIDT[1], ZURAB OQROPIRIDZE[2]

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Eye-tracking research has revealed that viewing an action-event affects the subsequent processing of spoken sentences (ref). Consequence, tense, and other cues may be initially ignored and the efficient integration of linguistic cues for utterance prediction diminished. This robust biasing role of visual information has been termed the recent event preference (ref). Studies examining the role of morphosyntactic cues in predictive language processing have thus far yielded mixed results. Furthermore, it is unknown whether the recent-event preference can be modulated by early morphosyntactic cues. The current study (N=24) addresses this issue by utilizing Georgian sentences, in which an early morphological marker at the first noun phrase hints towards past or future actions events. Participants viewed a videotaped actor performing an action and then heard a sentence (e.g., eksp'eriment'at'or-ma daamarila uk've k'it'r-I, 'Experimenter-ERG salted:AOR.3SG recently cucumber-NOM') referring to that recently performed action or listened to an alternative sentence (e.g.,eksp'eriment'at'or-i daamarilebs male p'omidors, 'Experimenter-NOM salt:FUT.3SG soon tomato-DAT') referring to an equally plausible future action. Eye-tracking data showing the preference for viewing the objects associated with either the recent or future action-events were analyzed. The results, crucially, revealed that the use of early morphosyntactic cues increased the probability of anticipating the plausible future event (compared to previous studies). The analyses, moreover, confirmed that these cues were used at an earlier stage, i.e., there was a significant effect of early cue presentation. However, in agreement with previous studies, these cues were insufficient to eliminate the overall recent-event preference.

Abstracts - Talks

Initial motor skills determine the benefits of tool-use learning over syntax in language

M. AUGIER[1], J. ROUSSEY[1,2], V. BOULENGER[3]*, A.C. ROY[3]*, C. BROZZOLI[1]*

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Language leverages the sensorimotor circuits handling perception and action to process phonemes and semantics. Recently, we revealed that planning to use a tool and understanding sentences with a complex syntax activate the same brain structures within the Basal Ganglia (BG) and prompt similar patterns of neural activations. In line with those shared resources, we showed that using a tool improves syntactic comprehension in language. Individuals are however not equally dexterous in using tools and the initial motor skills might determine their motor learning curve and, ultimately, the occurrence of syntax learning transfer between tool use and language. Indeed, according to the exploration-exploitation model of motor learning, different processes during motor learning differently recruit the BG. We tested (1) whether individual initial tool-use dexterity impacts motor learning; (2) whether different tool-use learning curves (linear vs. asymptotic) determine different benefits for syntax. We first assessed tool-use dexterity in 40 healthy adults with the Purdue pegboard test. We then evaluated syntactic comprehension in the same participants, before and after tool-use training. Our results show that the majority of participants with low scores at the initial motor assessment with the tool, displayed linear rather than asymptotic progression during training. Crucially, a significantly larger improvement in syntax was found in less dexterous participants (mostly linear learners) compared to more dexterous ones (equally distributed in linear and asymptotic learners). Our findings support the idea of syntax as a domain general function for action and language.

Assessing Individuals' Embodied Linguistic Gestures

T. R. WILLIAMSON[1,2,3,4] AND A. SECKI[1]

[1]University of the West of England, [2]Southmead Hospital, Bristol NHS Trust, [3]University of Oxford, [4]University of Southern California

Research investigating motor and linguistic areas of the brain have established functional connections between them for somatotopic semantic processing (Pulvermüller et al., 2005; Vukovic et al., 2017). Such findings have extended beyond concrete, lexical meanings: abstract concepts (Barber et al., 2013), metaphors (Cacciari et al., 2011; Desai et al., 2013), and idioms (Boulenger et al., 2009; 2012; Williamson, 2022) all implicate sensorimotor systems. So too do communicative gestures that accompany language (iconic and metaphoric co-speech gestures; McNeill, 1992). Evidence shows gestures engage embodied semantic systems (Joue et al., 2020), and that transcranial magnetic stimulation can influence the processing of lemmatised gestural forms (De Marco et al., 2018). These findings clarify a fortiori embodied functionality, but assessing their interrelation individual-by-individual remains an open question. In this work-in-progress talk, background linking the cognitive neurolinguistics of embodiment and gesture (Chui et al., 2021; Hauk et al., 2004) will first be given. The embodied, communicatively facilitative contributions of gesture will then be outlined (Holler et al., 2018; Rasenberg et al., 2022). Bringing these findings together, a gesture/action-semantic task battery assessing individuals' gestural function will be proposed. Tasks within this battery vary by gesture type (Kendon, 2004); involve both production (Brown & Yuan, 2018) and comprehension (Krason et al., 2022); and leverage tools across embodiment (Glenberg & Kaschak, 2002), gesture research (Ripperda et al., 2020) and motor function (Rossi et al., 2018). Lastly, applications to Pulvermüller's work on aphasia (Pulvermüller & Berthier, 2008) and others (e.g., Parkinson's; Cardona et al., 2014) will be explored.

Abstracts - Talks

Embodied Words: Exploring the Relationship Between Word Associations, Physical Appearance, and Body Image

BING LI, ROBIN G. G. GIGANDET, AND TATJANA A. NAZIR

SCALab - UMR CNRS 9193, Université de Lille, France

Embodied cognition theories propose that our understanding of language and concepts is deeply rooted in our sensorimotor experiences. Can linguistic constructs act as a basis for underlying embodied cognition? Beyond direct simulations, the present study investigates how freely associated words shape the perception of physical appearance and potential functions in robotic agents. Participants were engaged in a free association task in response to images of various robots. These words were then analyzed within a semantic space to unveil their interrelationships. Surprisingly, clustering based on these words revealed remarkable similarities in appearance of the associated robots. This finding suggests that words, even those not explicitly tied to physical features, convey meaningful information about the embodiment of robots. To further explore this phenomenon, different lists of words associated with specific robot groups were used as body description and were fed into ChatGPT. Engaging in conversations that required specific actions, ChatGPT responded in coherence with the physical appearance of the robots associated with the given words. This intriguing result indicates that appropriately combined words possess a remarkable ability to convey information about an agent's physical aspects beyond semantics. By demonstrating that even words indirectly related to physical features carry knowledge about agents' body and functions, this study surpassed the confines of direct action simulations emphasized in prior research. The word-based body images revealed connections between word associations, physical appearance, and the coherent responses of an AI model, and fostered the development of contextually aware and physically coherent robotic systems.

Linking Memory for Action Language and Spatial Memory: Insights From an Unexpected Result

COSIMO TUENA[1], DANIELE DI LERNIA[2], GIUSEPPE RIVA[1,2], CLAUDIA REPETTO[3*], AND SILVIA SERINO[4*]

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*equally contributed

Online simulation of action language can be influenced by individual proclivity to egocentric (body-dependent) or allocentric (body-independent) frames of reference, indicating a cross-talk between the language and space domains. In this study, we wanted to explore whether a similar connection exists between verbal and spatial memory. Specifically, we sought to explore if individual egocentric/allocentric performance in a spatial memory task predicts verbal memory performance of concrete and abstract transfer sentences. Thirty-four healthy young adults undertook a virtual reality task, in which they encoded the location of different objects and lately had to indicate their position using either egocentric or allocentric cues. During the verbal memory task, participants encoded two-characters transfer sentences, in which the agent was either the reader (1st person perspective) or someone else (3rd person perspective). Recognition memory was tested. Linear mixed models showed that spatial egocentric memory significantly predicts the recognition of first-person abstract sentences compared to first-person concrete sentences. Spatial allocentric memory did not predict verbal memory. In addition, significant correlations were found: spatial egocentric error is negatively associated with both third-person concrete and abstract sentence recognition, and is negatively associated with firs-person abstract sentence recognition; lastly, spatial allocentric error is only negatively associated with first-person abstract sentence recognition. Contrary to our predictions, we found different associations that link a body-based memory representation of the space with memory for abstract action language, particularly for first-person abstract sentences. This study questions if abstract language might require a body-based simulation in memory that is dependent on spatial cognition.

Abstracts - Talks

A process model of "introjecting" verbal instructions into moving bodies

MICHAEL KIMMEL[1], STEFAN SCHNEIDER[1], AND VICKY J. FISHER[2,3]

[1]Cognitive Science Hub, University of Vienna, [2]Multimodal Language Department, Max Planck Institute for Psycholinguistics, Nijmegen, [3]Language Use and Cognition group, Vrije University, Amsterdam

In a multitude of somatic practice fields such as dance, martial arts, sports, meditation, and therapy, coaches and teachers use words to convey imagery that impacts bodily movement and experience. Examples include "hang from a thread" to inform alignment, or "move like mist" to enhance the quality of movement. Previous research (e.g., psychology, neuroscience, linguistics, skill research) has looked at the effects and functions of such imagery, but the somato-cognitive process of how "imagery alights on the body" (McIlwain & Sutton 2014) is insufficiently understood. In this talk we present a microphenomenologically informed process model of body-oriented imagery conveyed through language, a process we term "introjection". We argue that this cannot be captured as language simply "infusing" the body. Instead, we demonstrate, through reference to casestudy vignettes, that this involves a complex sense-making process, which typically coorchestrates multiple resources, as well as responding in unique ways to the situation, personal habits, and prior skills of the "user". We propose that this is best understood as a bi-directional alignment process between aspects in the mind such as interpreting metaphoric images and somatic aspects such as body attention and actual movement. We propose a process model of introjection that explicitly embraces an integrative stance in incorporating the best of various research universes, notably cognitive linguistic, enactivist, and ecological dynamic accounts.

Vertical and Horizontal Space-Valence Associations: A Meta-Analysis

JAN POHL[1] AND ALEX MIKLASHEVSKY[2]

[1]Technische Universität Dresden, Germany, [2]Potsdam Embodied Cognition Group, University of Potsdam, Germany

Multiple studies demonstrate Space-Valence Associations (SVAs), i.e., the association of positive concepts with the right side or the upper space and negative concepts with the left side or with the lower space. However, the size of this effect is unknown, and the factors modulating it remain unclear. We conducted a meta-analysis investigating SVAs across the vertical and horizontal dimensions. We analyzed 212 experiments from 91 articles examining the modulating role of culture, the specific subdomain of valence under study, participants' handedness, and the experimental task. For the vertical dimension, we found a publication bias (Egger's test, $p < .001$), and once trimmed, the effect was not significant anymore ($r = .109$, $p = .072$). For the horizontal dimension, we found a significant effect ($r = .337$, $p < .001$) and no publication bias (Egger's test, $p = .706$). There was a significant effect of handedness on horizontal SVAs, with reverse SVAs in left-handers. There was no significant impact of cultural factors, valence subdomain, or task relevance of valence on horizontal SVAs. Our results demonstrate robust horizontal SVAs and the predominant role of embodied factors (handedness) over culture. Our meta-analysis also questions the robustness of vertical SVAs. We will discuss the results in the context of the embodied cognition approach and in comparison to recent findings from other abstract domains.

Abstracts - Talks

Grounding language processing: specifying linguistic/compositional representations and processes

KNOEFERLE

Humboldt-Universität zu Berlin, Berlin, Germany

Much empirical evidence suggests that language comprehension is grounded in visual perception and motor responses in some form or other. However, we rarely fully specify linguistic representations and cognitive processes when accommodating the grounding of sentence comprehension. Which representational formalisms and associated (computational) models might be well-suited for accommodating incremental and compositional grounding effects? Are different representation formats equally suitable and what mechanisms and representations do models assume to accommodate grounding effects? I argue that we must minimally specify compositional semantic representations, a set of incremental processes/mechanisms, and an explicit link from the assumed processes to measured behavior. Representational formats can be contrasted by holding the set of processes/mechanisms constant; processes/mechanisms can be contrasted by holding representations constant. I will illustrate such psycholinguistic modeling for example experimental investigations.

Verbal symbols support concrete but enable abstract concept formation: Evidence from brain-constrained deep neural networks

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The meaning of concrete symbols, such as the words "sun" or "run", can be learned in the context of objects and actions, thereby grounding their meaning in the world. However, it is controversial whether a comparable avenue to semantic learning is available for abstract symbols, like "democracy". We investigate the functional side of grounding mechanisms using brain-constrained deep neural networks to learn concrete and abstract concepts from the statistical regularities of their related sensorimotor experiences. The neural networks include auditory and articulatory areas of the perisylvian language cortex, as well as several extrasylvian sensorimotor and connector hub areas. We find that learning concrete concepts leads to robust neural circuits. These putative correlates of concrete concepts yield substantial activations when stimulated. In contrast, such activation is greatly reduced for abstract concepts. Correspondingly, circuit activity self-sustains for some time for concrete but ceases immediately for abstract concepts. Crucially, only after learning a verbal symbol frequently co-occurring with conceptual instances, were robust and long-lasting circuit activations observed for both concrete and abstract meanings. These results indicate that, although abstract concepts cannot be learned from experience, concrete and abstract symbolic semantic representations can be built from experiences based on the interplay between perceptions, actions and language.

Abstracts - Talks

Priming from time to numerical magnitude and length of randomly generated number words

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Access to abstract concepts is accompanied by regular attentional shifts with small magnitudes and past-related words associated with facilitated left-space responses and large magnitudes and future- related words – with right-space responses. Hence, one could predict priming effects from words denoting time to magnitude-related concepts. In our study, 46 participants read time-related words and then randomly generated numbers on lateral head-turns. LMM analyses of the produced numbers' magnitude revealed the following. First, there was a main effect of Time, i.e., larger numbers were generated after future-verb primes than after past-verb primes. Second, a reliable interaction between Time and Turn demonstrated that participants generated larger numbers after reading future verbs AND turning right head turns. In addition, there was also an effect of Time on the letter length of the produced numbers, i.e., participants produced longer word responses after future verbs. Finally, our same analysis also revealed an interaction between Time and Turn with longer word responses produced after future verb primes + right head turns. Overall, our findings suggest the following. First, they offer new evidence supporting ATOM theory via demonstrating an interactive spatial-conceptual mapping system underlying both access to numbers and words denoting time. Second, time-related biases in random number generation were observed in the absence of the well-documented lateral head-turn effect suggesting a degree of competition between conceptual top-down cues (time-related words) and sensory motor bottom-up cues (head turn) with the former partially suppressing the latter.

The semantic content of concrete, abstract, specific and generic concepts

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Conceptual categories can exhibit variations in both concreteness (e.g., cake vs. idea, Villani et al., 2019) and specificity (e.g., fruit vs. cherry or feeling vs. joy, Bolognesi et al., 2020). However, previous research has primarily focused on either concreteness or specificity, neglecting the potential semantic differences that can arise from their interplay (Bolognesi and Caselli, 2022). This study aims to address this gap by conducting an in-depth semantic analysis of 1049 Italian words, for which specificity and concreteness scores are available. The findings of our study reveal that different semantic types are associated with varying levels of concreteness. Moreover, semantic types account for a substantial portion of the variance in concreteness ratings. Notably, this predictive power is enhanced when accounting for categorical specificity, highlighting the importance of controlling for word specificity in future research on the "concreteness effect" (Pexman et al. 2017). Additionally, a cluster analysis of concreteness and specificity ratings identifies four sub-groups of concepts characterized by coherent semantic content. Overall, our results highlight the importance of categorical specificity in the study of conceptual concreteness, opening new research paths for the study of conceptual grounding.

Abstracts - Talks

Similar-sounding associates mitigate concreteness effects

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It can be hard to think of associates for words with abstract meanings (de Groot, 1989). When meanings are obscure, people more often supply similar-sounding associates (Stolz & Tiffany, 1972), and similar-sounding words help people represent less familiar meanings (Haslett & Cai, 2023). So, do abstract words elicit similar-sounding associates, and do those associates facilitate processing? We investigated the phonological similarity of 292,781 monomorphemic English associates in the small world of words project (De Deyne et al., 2019). In a linear regression model, sensory experience ratings accounted for over 6% of the variance in phonological similarity of associates, which cannot be explained by the phonological similarity of semantic neighbours or of randomly paired words (Table 1, Figure 1). Instead, abstract concepts seem to bias people towards similar-sounding words. We then fit the interaction of the phonological similarity of associates with concreteness ratings as a predictor of concreteness decision RT and with imageability ratings as a predictor of recognition memory accuracy (because imageability best predicts memory performance; Khanna & Cortese, 2021). In both cases, similar-sounding associates mitigated the disadvantage for words with abstract meanings, after parcelling out other lexical variables and, again, when compared to randomly paired associates (Tables 2 and 3, Figure 2). These findings support theories that people use language to represent abstract concepts (e.g., Paivio, 1991), and they relate those theories to form-meaning systematicity. Notably, iconicity has the opposite relationship with sensorimotor experience (Winter et al., 2017), implying that similar-sounding associates and sound symbolism serve complementary functions.

Investigating Conceptual Representation of Gender Identity in the Italian Language: A Mixed Methodology Study

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This research examines the impact of novel linguistic forms on gender identity self-definitions. Prior work has shown that gender experience influences concept representation, with embodied cognition literature highlighting the role of sensory and bodily experiences in language processing. From a socio-cultural view, gender is shaped through personal experiences and interactions, involving social metacognition processes (i.e., the need for others in the search and negotiation of conceptual meaning). This study focuses on the usage of nouns in self-definitions, particularly in gendered languages like Italian. Thirty-nine non-binary participants–lying outside the normative linguistic gender of feminine and masculine–were interviewed about their gender identity experiences and linguistic preferences. The resulting texts were analyzed using a combination of text mining and traditional linguistic analysis tools. The dataset consisted of 1140 nouns, and semantic norms on ten dimensions; Abstractness, Concreteness, Familiarity, Context Availability, Modality of Acquisition, Age of Acquisition, Body-Object Interaction, Interoception, and Emotionality. Principal Component Analysis was used to identify significant relationships in the dataset. Results indicate that the nouns used by non-binary participants can be grouped into two components. The first is related to abstractness and associated dimensions, while the second covers body-object interaction, interoception, and emotionality, reflecting embodied aspects. This second component combines internal and external aspects of bodily experiences. Our findings suggest that cultural and social processes linked to gender identity impact conceptual relations, blending internal and affective experiences with bodily interactions, thereby shaping gender identity narratives.

Abstracts - Posters

The Role of Episodic and Visual-Semantic Memory Systems in Abstract and Concrete Conceptual Processing

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Abstract concepts are more flexible and context-dependent than concrete concepts. However, the mechanisms underpinning the representational flexibility of abstract concepts remain unclear. We hypothesise that abstract conceptual processing relies on the episodic memory system, which enables the flexible integration of contextual information to represent abstract concepts. In contrast, concrete conceptual processing primarily relies on the visual and semantic memory systems for representation. Pilot Study 1 (N = 20) involved semantic judgements of abstract and concrete words in baseline, and with visual and semantic interferences. Visual interference (i.e. displaying complex shapes as the backdrop of the target word) selectively impaired semantic judgements of concrete words. Semantic interference (i.e. displaying reallife objects as the backdrop) impaired semantic judgements regardless of concreteness. Pilot Study 2 (N = 24) involved the same semantic judgment task in baseline and during the maintenance phase (between encoding and retrieval) of an episodic source memory task. Memory encoding was either unitisational (where elements are combined into an integrated unit, e.g., a red ball) or relational (where elements are related but treated as separate entities; e.g., a ball in red light). We found that semantic judgements were impaired under high unitisational memory load, regardless of concreteness. Our preliminary findings suggest that semantic judgements of concrete concepts rely more on sensory information than abstract concepts. However, both abstract and concrete semantic judgements equally depend on the semantic and episodic memory systems. There is little indication that semantic judgements of abstract concepts rely more heavily on the episodic memory system for integrating relational information.

Body-Object Interaction Ratings for 357 French Nouns

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The Body-Object Interaction (BOI) is a measure that defines the ease with which a human body can physically interact with a word's referent (Siakaluk, Pexman, Aguilera et al., 2008). This measure is consistent with the grounded perspective according to which knowledge emerges from past sensory-motor experiences. Previous studies have found that high BOI words are processed faster and more accurately than low BOI words (e.g., Tousignant & Pexman, 2012). This BOI effect suggest a modulation of language processing by the BOI level of the words. BOI norms thus seem useful in the study of language processes. However, no such norms are yet available in French. Therefore, the present study aimed to collect BOI ratings for a set of French words. We selected 357 French object-names, for which we retrieved norms of concreteness, imageability, subjective frequency (Bonin et al., 2003) and lexical characteristics (Lexique v.3.83, New et al., 2011; 2004). Stimuli were divided into two equivalent lists of 204 items, including 51 words common to both. Procedure was adapted from Pexman et al. (2019): via an online survey the participants rated word BOI levels for one of the lists on a 7-point scale. We collected BOI ratings from 85 participants. The results exhibited good reliability between the even and odd participants across the lists as well as for the 51 control words common to both lists. This study represents a first step towards development of BOI norms for the French language.

Abstracts - Posters

Lexical decision and semantic processing latencies for words that vary in concreteness and specificity

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Research on conceptual concreteness shows that concrete concepts, such as "banana," are processed more quickly than abstract concepts, such as "freedom." This phenomenon is commonly referred to as "the concreteness effect" (Pexman et al., 2017). However, previous studies investigating the concreteness effect have often used stimuli that are not balanced in terms of categorical specificity (Bolognesi and Caselli, 2022), leading to comparisons between generic abstract concepts like "feeling" and specific concrete concepts like "screwdriver." In this study, we propose that the level of specificity may influence lexical access and account for a portion of decision latencies. We hereby present two behavioral studies: a lexical decision task (LDT) and a semantic abstract/concrete decision task (SDT) conducted on words with different degrees of concreteness and specificity. We report that in LDT, we did not find a concreteness effect. This is consistent with the idea that decision latencies are explained by orthographic familiarity, rather than deep semantic processing; in SDT, we found a concreteness effect, but not a specificity effect. However, when examining the interaction between the variables, we found that specific+concrete concepts are processed faster than generic+concrete, but that generic+abstract are equally fast as specific+abstract. Additionally, a post-hoc analysis of concreteness ratings indicates that specific+concrete are significantly more concrete than generic+concrete, and specific+abstract are significantly more concrete than generic+abstract. We interpret the complex pattern of results in relation to the type of semantic processing task adopted in the study and discuss the implications for embodied and situated language processing.

Addressing the role of new verbal labels associated with novel actions, a behavioral study

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Language and action might have co-evolved in the human brain. Indeed, many neuroscientific and neuropsychological studies show an anatomical and functional link between these cognitive functions. Although the interest in the impact of semantics of language on cognition is increasing, studies on the semantic modulation of action are dated and mostly concern existing words. Our study focus on new labels' impact might have on novel sensorimotor experiences. We hypothesize that a new label might act as an anchor on the novel sensorimotor set of information. We extend this suggestion assuming that, when associated with novel actions, new labels facilitate categorization and motor chunking processes on the action sequence. Consequently, labeled actions are represented in a superordinate chunk and therefore recalled and performed faster. In order to address this hypothesis, we intend to carry out a behavioral experiment in which participants have to alternately execute two novel actions acquired through illustration videos alternately. Crucially, for half of the participants, actions are also associated with new labels. Qualitative results obtained from a pilot study on ten participants suggest that, on average, participants start the action earlier when the action is associated with a new label. However, the distribution of the answers shows a peak of faster answers when there is no action-label association, although for fewer participants. More data from other participants will be collected and analyzed before the conference. Results will be discussed in the framework of recent theories on impact of language on cognition.

Abstracts - Posters

Sensorimotor semantics: Individual variability of effects

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Embodied cognition suggests that sensorimotor information (e.g., vision, touch, smell, or manipulability) plays a functional role in processing language semantics. However, previous research mainly focused on demonstrating the effects of sensorimotor information on word processing at a group level. In this study, I conducted lexical decision and semantic judgment tasks using 506 nouns to explore whether there is inter-individual variability of these effects. Random coefficients were extracted for each participant for each sensorimotor variable from linear mixed-effects models to measure individual effects. Like in previous studies, at the group level, I observed significant effects of certain sensorimotor variables on reaction times. More importantly, participants exhibited substantial individual differences in sensorimotor semantic effects on word processing, and these effects correlated at the individual level. In the lexical decision task, participants who demonstrated stronger manipulability effects on reaction times also showed weaker gustatory effects, indicating a negative correlation between these variables. Furthermore, the haptic, visual, and gustatory modalities exhibited positive correlations with each other, suggesting that participants who showed an effect in one modality were more likely to show effects in the other two. In the semantic judgment task, manipulability effects were negatively correlated with both gustatory and auditory effects. This study represents the first systematic examination of individual variability in sensorimotor semantic effects during language processing.

Exploring the role of contextual features in abstract concept representation

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Concrete concepts like 'cat' can be effectively represented by a set of constituent features such as 'furry' and 'legs'. However, abstract concepts like 'democracy' do not lend themselves to such straightforward representation. Instead, they are often represented in flexible semantic and situational configurations, heavily reliant on contextual information for comprehension. For instance, understanding 'democracy' may involve considering contextual features such as 'polling stations' and 'votes'. Nevertheless, there is a lack of empirical evidence demonstrating the role of contextual features in grounding abstract concepts. The study tested whether abstract (vs. concrete) concepts rely more on contextual features than constituent features in a feature generation task. Native English speakers ($N = 40$) generated semantic features for 104 abstract and 104 concrete words. The generated features were categorised as constituent or contextual features. The results revealed a significantly higher proportion of contextual features for abstract concepts than for concrete concepts. We additionally examined the extent to which feature generation was driven by linguistic associations and by sensorimotor similarity between features and corresponding concepts. Our findings revealed that linguistic associations, but not sensorimotor similarity, significantly predicted the probabilities of feature generation. Furthermore, linguistic associations predicted the probabilities of constituent features more strongly than contextual features. Our results provide direct evidence that abstract concepts depend more heavily on contextual features. Moreover, linguistic associations between a concept and its constituent semantic features appear to play a more significant role in feature generation.

Abstracts - Posters

Exploring Action-Related Desynchronization: Mu Rhythm Responses to Visual and Linguistic Stimuli

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Embodied cognition posits that overlapping neural structures underlie the performance, perception, and comprehension of motor actions. Notably, this holds true for both visual (action observation) and linguistic processing (verbs). Previous electroencephalographic (EEG) evidence has demonstrated that mu rhythm desynchronization recorded over central electrodes serves as a reliable marker for execution, as well as visual and linguistic processing of actions. In this study, we included thirty-five healthy participants and aimed to confirm and extend existing evidence by (1) directly comparing the same actions presented in two modalities (visual vs. linguistic) and (2) manipulating the semantic content of the action-related stimuli (individual vs. social actions). Control stimuli included blurred images and pseudowords, and each experimental session concluded with a block of action execution. By identifying and clustering independent components, we identified two clusters located in or near the left and right premotor areas, which exhibited significant desynchronization (all conditions collapsed) between 180 and 400 ms after stimulus presentation. Importantly, only the left cluster exhibited significant desynchronization following both action verbs and images compared to control stimuli, while individual and social actions did not show a difference. Finally, the same two clusters demonstrated significant mu-rhythm desynchronization during action execution, further supporting the notion of a shared mechanism across conditions and modalities and validating this measure in the context of embodied cognition. However, additional research and analyses are necessary to explore its sensitivity to semantic manipulations, such as the presentation of individual and social actions.

The inhibitory effect of linguistic negation on motor cortical activity.

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According to the embodied approach of language meaning, negation applied to an action context reduces activation of the negated concept. Previous studies have shown that negating an action-verb reduces motor activity, as measured by motor-evoked potentials (MEPs) using transcranial magnetic stimulation (TMS). This inhibitory effect of negation seems to rely on the inhibitory mechanism of motor control. Here, we aimed to investigate how the processing of action negation modulates corticospinal excitability (CSE) and inhibitory mechanisms within the primary motor cortex (M1), as measured via single-pulse (spTMS) or paired-pulse TMS (ppTMS), respectively. We conducted separate sessions to assess CSE and short intracortical inhibition (SICI), a measure of interneuron GABA activity. Participants were presented word-by-word with action (i.e., Now you won't grab a nutcracker.) and attentional sentences (i.e., Now you will admire a bracelet.). At 250 ms from the verb onset, a TMS pulse was delivered over the left M1. The results revealed that MEPs resulting from spTMS were smaller for action negated sentences compared to affirmative sentence. In contrast, SICI obtained with ppTMS was significantly reduced for action negation sentences than for affirmative sentences. No differences were detected for attentional sentences. The present study confirms the suppressive effect of action-negation on CSE and, more importantly, provides unprecedented evidence that inhibitory networks within M1 contribute to action negation processing.

Abstracts - Posters

Disentangling population stereotypes from individual differences in ACEs

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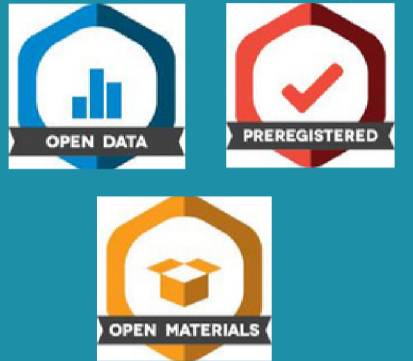
Action-sentence compatibility effects (ACEs) are not sufficient to support strong embodiment: most experiments cannot distinguish whether these effects stem from sensorimotor experience or simply from action stereotypes. Teskey et al. (2022) exploit a case where motoric experience and action stereotype mismatch: opening screw-top lids is performed counterclockwise but is stereotypically associated to a clockwise motion. They find that ACEs on sentences describing the opening/closing of screw-top lids reflect the action stereotype. Concurrently, Capuano et al. (2022) found that individual differences in motoric experience with screw-top lids affected the direction of the ACE. The aim of our study was to disentangle the effect of action stereotypes from that of motoric experience. In three experiments, subjects show evidence for a stereotypical association of open to clockwise and close to counterclockwise 1) when responding to the words open/close, 2) when judging the direction of motion of open/close sentences, and 3) when reading sentences describing the opening/closing of screw-top lids. Large individual differences in terms of reliance on the stereotype are detected, with subjects that rely less on the stereotype behaving more in accordance with their motoric experience. The data so far is suggestive that both action stereotypes and motoric experience might play a role.

Personality matters – How a robot's behavior conveys personality and how this affects potential drivers' preferences and trust in HRI

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The overarching goal that excites developers and researchers alike is whether a robotic assistant should be equipped with personality features. In interpersonal relationships, verbal and nonverbal behavior is a key factor revealing an agent's stable and dynamic characteristics, such as their age, personality, emotions, and intentions. Communication is furthermore inevitable to convey practical information in everyday life. As robots increasingly enter our everyday lives, a robot's behavior and language style matter. In our research, we focus on one of the closest contact situations humans and robots can face each other: The car driving context. Based on personality research, we designed an extrovert and an introvert robotic driving assistant by manipulating the assistant's speech competences and behavior. Using open-software CARLA, we simulate realistic traffic scenarios in a safe lab environment to research whether a robot's behavior and language convey personality facets similar to human communication styles and whether participants' preferences depend on their own personality and cognitive load. Following Ahmad and colleagues (2019), we moreover investigate whether cognitive load enhances trust in the robot and participants' preferences for a robot's personality. Our research is innovative because basic research questions linked to behavior perception, personality, and trust in robotic agents are addressed in a realistic scenario that people likely face in the near future. Therefore, our findings might enrich psychology, linguistics, and social robotics while providing practical implications for developers of robotic assistants.

Abstracts - Posters

Unraveling the Interplay between Verbal Utterances, Bodily Shape, and Beliefs: Novel Insights into Embodied Language Processing

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Embodied cognition theories propose that our perception is influenced by our bodily experiences. Here we explored the significance of coherence between verbal utterances and the physical appearance of a speaker — a limbless robot. Our aim was to understand how the absence of limbs would impact our perception, specifically when the robot engaged in discussions related to limb-associated actions. We hypothesized that our bodily experiences would influence our perception, enabling us to detect incongruencies in such scenarios. We employed the N400 effect — an electrophysiological marker of semantic processing — as dependent measure. Participants were presented with sentences spoken by the limbless robot, with half of the sentences referring to limb-related actions. Additionally, we sought to explore participants' beliefs regarding the possibility of hidden limbs in the robot. Surprisingly, only 30% of participants assigned a probability of 0 to the possibility of hidden limbs, indicating a prevailing inclination toward beliefs contradicting the robot's physical evidence. The results revealed a compelling relationship between participants' beliefs and neural processing. Participants who regarded the possibility of hidden limbs as 0 showed the expected N400 effect, indicating sensitivity to the incongruity. Conversely, those who believed in hidden limbs exhibited a reduced or absent N400 effect when processing limb- related sentences. These findings demonstrate our remarkable ability to reconcile the discrepancy between the robot's appearance and the conveyed meaning. They offer insights into the intricate interplay between embodied experience and beliefs, and into the influence of these factors on the processes of perception and of language comprehension.

Can social gaze in a naturalistic VR environment contribute to L2 word learning?

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Success in adult second language (L2) learning is extremely variable and learning context could play a major role in how quickly and successfully a new language is learned. Given that natural language use is inherently social, situated and interactive L2 learning could form richer linguistic representations and better engage learners. Social gaze plays an important role in social interaction by conveying social and emotional states, as well as referential information. In the current study, we will examine whether social gaze (SGZ) helps learners to resolve referential ambiguity and attracts attention, therefore facilitating multimodal encoding during L2 learning. Using a teacher-learner, forced-choice paradigm in an ecologically valid virtual reality (VR) environment, referential SGZ will be manipulated such that learners will interact with virtual teaching-agents that vary in their referential reliability (i.e., the informative value of their SGZ). Depending on the social agent, SGZ will be either informative (100% of the gazes indicate the "correct" answer during learning), highly uncertain (50% correct SGZ) or fully unreliable (0% correct SGZ). We predict that if SGZ facilitates L2 learning, both immediate and long-term retention of new words will be improved for words learned in the 100% SGZ condition. The aim of this study is not only to gain understanding regarding the contribution of social gaze during L2 learning, but also to propose a VR paradigm that can be altered to investigate and manipulate different aspects of social interaction during language learning and processing.

Abstracts - Posters

Coordination of referring expressions in visually situated communication: maximal informativity or uniform encoding?

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In situated communication, speakers are often faced with the problem of unambiguously identifying target referents in possibly complex visual contexts. Recent studies suggest speakers may optimize their linguistic encodings to benefit the listener. This planned experiment aims to investigate whether entropy-reducing properties of referential expressions influence speakers' linearisation choices in coordinate structures. In a web-based production experiment designed as a referential communication game, 60 participants will describe a target crate containing two objects to a simulated listener, using utterances of the form "Where is the crate with (NP1) and (NP2)?". We manipulate the frequency of one of the two objects in the target crate across conditions while keeping the frequency of the other object constant, resulting in 21 critical items in which one target object is either more, equally, or less entropy-reducing than the second object (all item sets counterbalanced; 21 filler items). Object names used in the experiment are matched for length and frequency and pretested to ensure that they are consistently named by German speakers. Speakers' linearisation choices will be analyzed using generalized linear mixed models. If speakers are sensitive to the informativity of the target referents and encode their utterances based on maximal informativity, we expect a larger number of coordinations starting with the object that reduces referential entropy to a greater extent. By contrast, a preference to place less entropy-reducing objects early would suggest a strategy consistent with the Uniform Information Density hypothesis.

Abstracts - Online Posters

Horizontal magnitude representation enhances memory for stimuli presented at congruent locations

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Previous studies have shown a person's trained reading and writing direction (RWD) will guide the generation of mental models for spatial organization, placing the semantic maximum of a dimension ("oldest", "largest", etc.) at the origin. In two experiments we investigated the effectiveness of linguistic congruence between a pre-existing mental of RWD and the order in which words are placed in a sentence. In Experiment 1, right-to-left RWD Farsi speakers, and in Experiment 2, left-to-right RWD English speakers saw 96 trials where fantasy names were located at the beginning (left) or at the end (right) of the sentence, associated to supposedly be "largest" or "smallest". Later they recognised these names and their size context. In Experiment 1, Farsi speakers responded faster and more accurately large items previously presented on the right. In Experiment 2, this effect reversed with large items previously presented on the left. For nondominant items ("smallest") no laterality effects were observed for English speakers. All participants exhibited a bias for positive (yes) responses to items previously learned as "largest".

Mime Initiation Latency for 189 Object Photographs: A Behavioral Motor Norm

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Motor affordance factors have become increasingly important to consider when designing experiments, selecting stimuli, and controlling sources of variance. Previous measurements of motor affordance factors have relied on subjective ratings (e.g., "Could you easily mime the action …"; Magnié et al., 2003). In the current study we report the use of a behavioral measure — mime initiation latency (MIL) — the time that it takes for a participant to initiate pantomimes in response to photographs of manipulable objects. We found MIL was moderately correlated with conceptually related motor variables (e.g., graspability, manipulability) but less or not correlated with psycholinguistic variables (e.g., visual complexity, object familiarity) and conceptually unrelated motor variables (e.g., grasp use concordance). Results from correlation and regression analyses support MIL as a valid behavioral motor affordance norm. The current norms may be valuable for neurophysiological investigations of motor representational processes such as motor activation and motor conflict.

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