ESLP 2025

Embodied and Situated Language Processing Conference

23-26 September, 2025

Aix-en-Provence
France

Table of content

Keynotes

Poster Session 1: Computational and Semantic Perspectives on Language and Cognition

Session 1: Abstract Concepts & Embodiment

Chair: Daria Goriachun

Abstract concepts are more represented in episodic contexts via attention and memory binding
Guyu Shen, Amy Athkinson, Bo Yao

Neurophysiological evidence for abstract concept embodiment in bilinguals: The role of L2 proficiency and self-relevance
Yufen Wei, Guillaume Thierry

What is so difficult about abstract words, anyways? A neuromechanistic explanation using brain-constrained neural network models
Fynn Dobler, Lorenzo Stroppa, Friedemann Pulvermüller

Session 2: Vision in Language Processing

Chair: Fynn Dobler

Visually-situated ellipsis resolution: 2 self-paced reading studies on English VP ellipsis and Dutch sluicing
Kohei Haneda, Anja Schüppert, Roel Jonkers

Morphosyntactic sensitivity predicts reliance on visual scenes for thematic-role comprehension
Carlotta Isabella Zona

The eye pupils adjust to implied luminance when reading narratives
Jakob Scherm Eikner, Luca Onnis, Bruno Laeng

Session 3: Motor & Action Representation

Chair: Luciano Fadiga

Grip force modulation by action language in people with aphantasia
Melisa Yavuz, Florentin Vandeville, Camille Mignard, Jacques Jayez, Tatjana Nazir, Olivier Capra

Uncovering the role of expertise and sensorimotor impairments in shaping action representation via language
Fortunata Romeo, Chiara Barattieri Di San Pietro, Paolo Canal, Lorenza Sola, Marco Rigoni, Marina Zernitz, Valentina Bambini

---

Poster Session 2: Embodiment, Learning, and Interaction in Language

Grounding the arbitrary: Acquired embodiment of grammatical gender
Luca Onnis, Alfred Lim

Grounding language in space and time
Luca Onnis, Michael Spivey

Methodological updates for the grip force paradigm
Florentin Vandeville, **Olivier Capra**

What if "mooff" is round and "mottie" small? Computational insight into sound symbolism in pseudowords
Iva Šaban, Luca Rinaldi, Marco Marelli

Learning abstract concepts in social interaction: an investigation of behavioural and brain dynamics
Gal Rozic, Sara De Felice, Antonia Hamilton, **Gabriella Vigliocco**

Meta-analysis of motor compatibility effects in embodied language research: Work in progress
Alice Winter, Barbara Kaup, Carolin Dudschig, Michael Kaschak

Well, it depends: How spatial distance influences mental representations
Lilian LeVinh, Karin Bausenhart, Hanspeter Mallot, Rolf Ulrich, Barbara Kaup

Eyes on the prize: gaze-guided learning of foreign words in social VR interactions
Ana Zappa

Turn-taking in Singaporean multilingual parent-child dyads
Vivian Hanwen Zhang, Luca Onnis, Shimon Edelman

Session 4: Embodiment: Benefits, Extension, Limits

Chair: Kristof Strijkers

Can we ground novel words? Mapping perceptual features from language-based representations to human intuitions
Giulia Loca, Simona Amenta, Marco Marelli

Challenging embodied cognition: Insights from human and ChatGPT language evaluations
Elisa Scerrati, Giuseppe Riva, James Hampton, Claudia Repetto

When sensorimotor grounding is unhelpful: A registered report on word memory
Louise Connell, Agata Dymarska

Session 5: Word Learning & Interactive Processes

Chair: Ana Zappa

Learning new words and concepts in interaction: the role of verbal and non-verbal behaviours
Christopher Edwards, Francesco Cabiddu, **Gabriella Vigliocco**

Learning words through interaction: Verbal coordination in child-caregiver dyads
Greg Woodin, Yan Gu, Abdellah Fourtassi, Stefano James, Gabriella Vigliocco

Playing with gestures: Evidence of L2 grammatical morpheme learning?
Natasha Janzen Ulbricht

Session 6: Language in Context: From Emotion to Communication

Chair: Véronique Boulenger

The unique role of language in reshaping perceptual discrimination: Evidence from comparative learning paradigms
Tally McCormick Miller, Friedemann Pulvermüller

N400 modulation by emotional context in motion-based conceptual time metaphors
Rosa Illán Castillo, Jennifer Krzonowski, Alice Roy, Véronique Boulenger

Understanding cetacean vocal behaviour, a case study with long-finned pilot whales
Paul Best, Lise Habib-Dasetto, Jules Cauzinille, Lilian Haristoy, Ricard Marxer, Fabienne Delfour, Thierry Legout, Marie Montant

---

Session 7: Inner Processes & Social Cognition

Chair: Claudia Gianelli

The silent guide: How inner speech shapes new action learning and performance
Angelo Mattia Gervasi, Claudia Mazzuca, Anna Borghi, Claudio Brozzoli

Testing primed associations of gendered political charisma using high-fidelity virtual avatars
Scott Kunkel, Diego Frassinelli, Alec Gallo, Philine Link, Alejandra Quiros Ramirez, Susumu Shikano, Stephan Streuber, Tamara Rathcke

Grounding the breakdown: Central and autonomic correlates of L2 listening obstacles
Triscia Biagiotti, Davide Spinelli, Emilie Cousin, Monica Masperi, Chantal Delon-Martin

Keynotes

Keynote 1: Barbara Kaup

The interplay of modal and amodal processes in language comprehension at the word level and beyond

University of Tübingen, Germany

Introduced by: Tatjana Nazir

Grounded, or modal, approaches to language comprehension propose that meaning arises from sensorimotor simulations: words serve as cues that reactivate experiential traces, which are then combined into simulations of described events. Yet this account faces a critical challenge—how are such simulations composed into coherent sentence meanings? Unlike classical amodal models, grounded approaches offer little specification of the composition mechanism. Acknowledging that comprehenders rely not only on sensorimotor experiences with the referents of linguistic input, but also on the many linguistic experiences they have gathered with the respective words and sentences might offer a solution. These experiences enable the construction of so-called distributed meaning representations for which composition mechanisms are available.

In this keynote, I will discuss a range of models of language comprehension that together incorporate these three representational formats and posit multiple routes to meaning. I will begin by situating the debate within the broader context of cognitive psychology, focusing on the question of representational formats. I will then zoom in on language, tracing how this debate has shaped research over the past 25 years. Finally, I will systematically compare competing models, review the empirical evidence for the component assumption, and conclude with an integrated perspective on the interplay between different types of meaning representations in comprehension.

Keynote 2: Dan Dediu

Variation is real and does matter for language: from phonetics to the colour vocabulary and beyond

University of Barcelona, Spain

Introduced by: Marie Montant

For too long a time, we worked on the implicit (and, often, explicit) assumption that what matters are Universals (with capital "U"), those that would unify all of humanity, its psychology, languages and cultures, and would make studying "it" so much simpler. And, to do so, we relegated, willingly or not, all variation to the level of pesky noise (to be dealt with through clever designs, average-focused stats, or even sheer neglect) or, at best, as cute culture-specific rules that slightly tweak those universals. However, during the last few decades, it has become clear that variation is not noise, that it is an essential aspect of humanity and of its products, that it is needed to explain us, and that it does not threaten to dehumanise "the other" or to allow value hierarchies back in.

In this talk I will survey a wide range of topics, going from from the influence of the anatomy of our vocal tract on the speech sounds of languages, to the effects of variation in colour perception on the way languages talk about colour, and to how the speakers and their language form a system dynamically optimising information transmission. These not only highlight the amount and kind of variation that is "out there", but also show how one can study and analyse it using modern techniques and approaches. Hopefully, these examples will inspire more work, within and outside language, that tries to understand the patterns of variation that exist, and how they influence the diverse phenomena we are interested in.

Keynote 3: Vincent Janik

How did the marine environment shape unique features in dolphin communication?

University of St Andrews, Scotland

Introduced by: Paul Best

Many studies have highlighted similarities in cognition and communication in primates and cetaceans. Common features are often ascribed to similar challenges when navigating social relationships in fission-fusion societies. While both taxa live in such societies, most other aspects of their lives are very different. Dolphins use a featureless, three-dimensional space similar to how flying birds use the air, they have few sensory inputs outside of the acoustic domain, and their flippers cannot manipulate their environment in the way a primate hand can. They also have to move constantly, mainly to take regular breaths at the water surface.

Their reliance on acoustic signals is mainly a result of a severely limited visual range and the absence of olfactory cues underwater. Trying to maintain group cohesion is a serious challenge under these circumstances, leading to the evolution of skills like vocal learning to increase signal diversity and highly synchronised chorusing when cooperating. Two independent sound sources help them to create two-voiced signals which expand the acoustic space available to them. In this presentation I will give an overview of what we know about dolphin communication, showcase some of the communication patterns we found and compare them to those of other highly social mammals. Further comparisons between species will be helpful to identifying selection pressures that contributed to the evolution of vocal complexity and to understand how drastically different environments shape communication systems.

Keynote 4: Katja Liebal

The challenge of a multimodal approach to primate communication

University of Leipzig, Germany

Introduced by: Shreejata Gupta

Many theories of language evolution draw on comparative evidence from our closest relatives, the nonhuman primates. Most of these approaches propose a unimodal origin of language—typically gestural or vocal—and seek corresponding precursors to human language in other primate species. Yet, to capture the full complexity of primate communication and to identify meaningful phylogenetic precursors to human language, a multimodal perspective is essential.

In this talk, I will review the current state of research on primate communication and highlight key gaps in our knowledge. I will also discuss theoretical and methodological challenges that have so far limited a multimodal approach. Finally, I will outline promising new directions and recent advances that move us closer to understanding the complexity of primate communication and provide insights into the evolutionary pathways that gave rise to human language.

Poster Session 1: Computational and Semantic Perspectives on Language and Cognition

Using Large Language Models to Predict Sensory Information: A Case Study of Nominal Compounds in Mandarin

Jing Chen*†[1], Emmanuele Chersoni[2], Marco Marelli[3], and Chu-Ren Huang[4]

[1]Università degli Studi di Milano-Bicocca – Italy
[2]The Hong Kong Polytechnic University – China
[3]Università degli Studi di Milano-Bicocca – Italy
[4]The Hong Kong Polytechnic University – China

Abstract

Large Language Models (LLMs) have shown strong performance in estimating psycholinguistic variables such as emotion and familiarity (Martinez et al., 2025; Brysbaert et al., 2025), and have been reported to better interpret nominal compounds with higher degrees of concreteness (Rambelli et al., 2024). However, it remains unclear how well LLMs can estimate embodied features (i.e., sensory) in conceptual representations, given their lack of sensory grounding (Xu et al., 2025). In this case study, we investigate to what extent state-of-the-art LLMs can predict the sensory information in Mandarin nominal compounds. To answer this question, we compiled a novel dataset of 2,675 Mandarin nominal compounds and collected up to 20 valid human ratings for each compound across five sensory dimensions. We then prompted several LLMs, including GPT-4, DeepSeek-v3, Qwen-plus, Ernie-4.0, and Claude-3-5, with the same sensory-related questions as presented to human participants, under different prompting settings, and evaluated their performance accordingly. Our results suggested consistently high correlations between model outputs and human ratings across all sensory modalities and models, with Spearman correlations ranging from 0.678 to 0.910 (mean $\pm$ SD $= 0.840 \pm 0.057$). However, a notable difference emerges when comparing LLMs and human participants: LLMs consistently exhibit high inter-coder agreement across different prompting conditions, whereas human participants show low to moderate variability in their sensory judgments. This may reflect that LLMs' representations are an "averaged" abstraction of human linguistic production as encoded in their training data, potentially smoothing out individual differences shaped by diverse sensory experiences.

Keywords: sensory modalities, nominal compounds, Mandarin, LLMs

*Speaker
†Corresponding author: jing.chen@unimib.it

What language sees is what vision tells: insights from non-human primates on the representations induced by data-driven semantic models

Fabio Marson*†[1], Marco Ciapparelli[1], and Marco Marelli[1]

[1]Università degli Studi di Milano-Bicocca = University of Milano-Bicocca – Italy

Abstract

Distributional Semantic Models (DSMs) capture semantic representations leveraging statistical recurrences of words as they cooccur in human language. Recent studies suggest that language might be optimized to compress multimodal information in a lighter format facilitating processing of complex meanings. If this is the case, we should be able to observe a representational isomorphism between DSMs and neural activity of animals that do not use human language.
Thus, we analyzed intracranial recordings from the visual ventral stream of two macaques during passive observation of ~17k different images of concrete objects. We adopted Representational Similarity Analysis to predict neural activity from a language-based DSM (English word2vec), a high-order vision-base semantic model (layer fc7 of AlexNet; henceforth vision-H), and a low-level visual features vision-based model (HOG; henceforth vision-L) over time and regions of interest (i.e., V1, V4, and IT).

First, DSM predicted neural activity from approximately 40ms after stimulus onset onward in both macaques. Unsurprisingly, vision-H model predicted neural activity better than the DSM, with the two showing a similar pattern over time and regions. The vision-L model was found to predict the neural activity better than DSM and similar to vision-H model in V1 and V4 in an earlier time-window (~40ms), with its predictive accuracy rapidly decreasing. Importantly, we observed a tradeoff from the early advantage of vision-L over language in primary visual areas to language overperforming vision-L from approximately 50~60ms after stimulus onset, especially in IT. Conversely, the advantage of vision-H was found to be stable across time and regions.
The current results suggest that neural activity during visual processing can be captured by both language and visual semantic models in non-human primates, advocating for the idea that the statistical recurrences underlying their structure might constitute a general representational mechanism expressing experience beyond the modality from which models have been computed.

Keywords: rsa, primates, distributional semantic models, visual ventral stream, intracranial recordings, representational format

*Speaker
†Corresponding author: fabio.marson@unimib.it

Does multimodal pre-activation influence linguistic expectations in LLMs and humans?

Sasha Kenjeeva* , Giovanni Cassani[1], Noortje J. Venhuizen[1], and Afra Alishahi[1]

[1]Tilburg University [Tilburg] (CSAI) – Netherlands

Abstract

The meaning representations that humans construct for words capture both linguistic and multimodal sensorimotor information (1). Previous work has shown that multimodal sensorimotor information is accessed during online language processing: a context in which "moon" is a highly predictable continuation resulted in facilitated processing for "tomato" (similar shape) compared to "rice" (2). To investigate to what extent multimodal pre-activation influences linguistic expectations during sentence processing above and beyond linguistic predictability, we designed a data-driven experimental setup that orthogonally manipulates multimodality (sensorimotor similarity from Lancaster norms (3) and ViSPA (4): MM dimension) and linguistic predictability (Cloze probability (5): L dimension). We validated our stimuli with plausibility, visual and co-occurrence similarity norming studies; an example is shown below:

Context: The impatient man kept looking at his ... (likeliest completion: "watch")

• "compass": zero Cloze completion, visually similar to watch (L-MM+)

• "wife": predicted Cloze completion, visually dissimilar to watch (L+MM-)

• "phone": predicted Cloze completion, visually similar to watch (L+MM+)

• "dog": zero Cloze completion, visually dissimilar to watch (L-MM-)

In the experimental setup, we test both human processing difficulty (through reading times) and LLM processing behaviour (surpisal). We hypothesized that high sensorimotor similarity to the likeliest Cloze completion should result in decreased processing effort in LLMs and humans, even when a word is not predictable from the linguistic context. Specifically, the visual pre-activation of the referent of the likeliest completion ("watch") is predicted to result in decreased processing difficulty of "compass" (L-MM+) compared to "dog" (L-MM-), due to their visual similarity. We did not find such an effect in either language-only (6) or dual-stream vision-language (7) LLM surprisal. Preliminary results from the reading time study show that humans, contrary to LLMs, do show some sensitivity to visual similarity during online processing. We are now investigating this effect in order to gain a deeper understanding of multimodal activation during language processing.

*Speaker

References

(1) Davis, C. P., & Yee, E. (2021). Building semantic memory from embodied and distributional language experience. Wiley Interdiscip. Rev. Cogn. Sci., 12(5), e1555.

(2) Rommers, J., Meyer, A. S., Praamstra, P., & Huettig, F. (2013). The contents of predictions in sentence comprehension: Activation of the shape of objects before they are referred to. Neuropsychologia, 51(3), 437–447.

(3) Peelle, J. E., Miller, R. L., Rogers, C. S., Spehar, B., Sommers, M. S., & Van Engen, K. J. (2020). Completion norms for 3085 English sentence contexts. Behav. Res. Methods, 52(4), 1795–1799.

(4) Lynott, D., Connell, L., Brysbaert, M., Brand, J., & Carney, J. (2020). The Lancaster Sensorimotor Norms: Multidimensional measures of perceptual and action strength for 40,000 English words. Behav. Res. Methods, 52(3), 1271–1291.

(5) Günther, F., Marelli, M., Tureski, S., & Petilli, M. A. (2023). ViSpa (Vision Spaces): A computer-vision-based representation system for individual images and concept prototypes, with large-scale evaluation. Psych. Rev., 130(4)

(6) Radford, A., Wu, J., Child, R., Luan, D., Amodei, D., & Sutskever, I. (2019). Language models are unsupervised multitask learners.

(7) Wang, P. et al. (2024). Qwen2-vl: Enhancing vision-language model's perception of the world at any resolution. *arXiv:2409.12191*.

Keywords: multimodality, language models, sentence processing, surprisal, reading times, word meaning, grounded semantics

Multimodal memory traces determine false memory formation

Marco Petilli*†[1], Francesca Rodio[2], Daniele Gatti[3], Marco Marelli[1], and Luca Rinaldi[3]

[1]Department of Psychology, University of Milano-Bicocca, Milano, Italy – Italy
[2]Institute for Advanced Studies, IUSS, Pavia, Italy – Italy
[3]Department of Brain and Behavioral Sciences, University of Pavia, Pavia, Italy – Italy

Abstract

Memory formation is a complex phenomenon shaped by multiple types of experiential traces, yet the precise contribution of each remains uncertain. In this study, we explore the generation of false memories by leveraging a range of data-driven computational models, which allow us to independently quantify language-based and vision-based experiential knowledge. These models are based on large-scale databases comprising 639 billion words and 15 million images, respectively.

To examine the distinct and combined effects of these knowledge sources, we conducted two false memory experiments: one using images as stimuli and the other using words. Our results reveal the presence of both modality-independent and modality-dependent processes in memory trace formation. Specifically, we found that both prior visual and linguistic knowledge contribute to memory formation, regardless of whether the material to be remembered is visual or verbal. However, the degree of influence varies depending on the modality: visual knowledge plays a more significant role in image-based tasks, while linguistic knowledge is more influential in word-based tasks.

This dual and modality-dependent contribution highlights the adaptive nature of memory, demonstrating how the human mind dynamically integrates diverse experiential traces during the formation of false memories.

Keywords: False memories, multimodal knowledge, vector, based models, vision, based similarity, language, based similarity

*Speaker
†Corresponding author: marco.petilli@unimib.it

Brain Vocabulary: EEG-Based Semantic Feature Maps for Concrete and Abstract Verbs

Milena R. Osterloh*[1,2], Laura Ciaccio[1,3], Johann Berger[1], Luigi Grisoni[1,4], and Friedemann Pulvermüller[1,2,5,6]

[1]Brain Language Laboratory, Freie Universität Berlin, Berlin – Germany
[2]Einstein Center for Neurosciences [Berlin] – Germany
[3]Department of Brain and Behavioral Sciences, University of Pavia, Pavia – Italy
[4]Center for Translational Neurophysiology of Speech and Communication, Fondazione Istituto Italiano di Tecnologia, Ferrara – Italy
[5]Berlin School of Mind and Brain [Berlin] – Germany
[6]Cluster of Excellence 'Matters of Activity', Humboldt Universität zu Berlin, Berlin – Germany

Abstract

Introduction

Words become meaningful when experientially grounded in perception and action. Neuroimaging studies support this view, showing that different semantic categories – and even individual words – elicit distinct patterns of brain activity (e.g. Antoine et al., 2024; Grisoni et al., 2021; Pulvermüller et al., 2001). Recent work further demonstrates that semantically similar words evoke more similar patterns of neural activity (Carota et al., 2017, 2021, 2023; Fernandino et al., 2022). However, most prior research has focused on concrete nouns, leaving verbs and particularly abstract semantic domains relatively unexplored. This EEG study investigates how word-specific spatiotemporal patterns of brain activity reflect the semantic features of verbs across both concrete and abstract word categories.

Methods

Fifty-two healthy adult native German speakers participated in the experiment. Stimuli comprised 120 German verbs from four semantic categories: Actions-Face, Actions-Hand, Emotion, and Performative. Verbs were presented in a passive reading paradigm. A collapsed localiser approach identified time windows of interest in the grand-average ERP spanning 0 to 800 ms. Mixed-effects linear regression models were applied to each time window to assess category-related effects.

Results

A significant interaction between word category and topographic gradient was observed in time windows centred around 250, 300, and 400 ms. Model-based estimates showed that Actions-Hand verbs elicited more positive amplitudes at posterior electrode sites across these

*Speaker

latencies.

Differences between abstract and concrete verbs also emerged from _˜200 ms, with a significant interaction between concreteness and gradient in the same time windows. Early frontal differentiation was observed around 300 ms, alongside marginal posterior effects at _˜250 ms.

Conclusions

Neurophysiological differences between semantic verb categories emerge from _˜200 ms post-onset, with pronounced effects for Actions-Hand verbs. Crucially, early ERP responses also reflect abstract-concrete distinctions. Ongoing work will use RSA to examine how brain activation similarities relate to experiential semantic similarities derived from behavioural ratings.

References

Antoine, S., Grisoni, L., Tomasello, R., & Pulvermüller, F. (2024). The prediction potential indexes the meaning and communicative function of upcoming utterances. *Cortex*, *177*, 346-362. https://doi.org/10.1016/j.cortex.2024.05.011

Carota, F., Kriegeskorte, N., Nili, H., & Pulvermüller, F. (2017). Representational Similarity Mapping of Distributional Semantics in Left Inferior Frontal, Middle Temporal, and Motor Cortex. *Cerebral Cortex*, *27*(1), 294-309. https://doi.org/10.1093/cercor/bhw379

Carota, F., Nili, H., Kriegeskorte, N., & Pulvermüller, F. (2023). Experientially-grounded and distributional semantic vectors uncover dissociable representations of conceptual categories. *Language, Cognition and Neuroscience*, 1-25. https://doi.org/10.1080/23273798.2023.2232481

Carota, F., Nili, H., Pulvermüller, F., & Kriegeskorte, N. (2021). Distinct fronto-temporal substrates of distributional and taxonomic similarity among words: evidence from RSA of BOLD signals. *NeuroImage*, *224*, 117408. https://doi.org/https://doi.org/10.1016/j.neuroimage.2020.117408

Fernandino, L., Tong, J.-Q., Conant, L. L., Humphries, C. J., & Binder, J. R. (2022). Decoding the information structure underlying the neural representation of concepts. *Proceedings of the National Academy of Sciences*, *119*(6), e2108091119. https://doi.org/doi:10.1073/pnas.2108091119

Grisoni, L., Tomasello, R., & Pulvermüller, F. (2021). Correlated Brain Indexes of Semantic Prediction and Prediction Error: Brain Localization and Category Specificity. *Cerebral Cortex*, *31*(3), 1553-1568. https://doi.org/10.1093/cercor/bhaa308

Pulvermüller, F., Kujala, T., Shtyrov, Y., Simola, J., Tiitinen, H., Alku, P., Alho, K., Martinkauppi, S., Ilmoniemi, R. J., & Näätänen, R. (2001). Memory Traces for Words as Revealed by the Mismatch Negativity. *NeuroImage*, *14*(3), 607-616. https://doi.org/10.1006/nimg.2001.0864

Keywords: verbs, ERPs, EEG, semantics, semantic categories, Language Processing

The Cognitive Cost of Negation: Effects on Veracity and Statement Memory

Daria Ford*†[1]

[1]University of Mannheim – Germany

Abstract

In an era of widespread false information, accurately recalling information's veracity is crucial for informed decision-making. Remembering whether information is true or false (veracity memory) is key to informed decisions. Studies show that the format of statements influences veracity memory (Nadarevic, 2025). This study investigated how presenting a statement as either affirmative or negative influences statement memory, veracity memory, and guessing bias. Participants ($N = 63$) were asked to memorize four different types of trivia statements: affirmative vs. negative and true vs. false, and were later tested on how well they memorized them. By using the multinomial processing tree source (veracity) memory model (Keefe et al., 2002), we estimated memory for the statements and their veracity status, as well as guessing bias. Results revealed an effect of statement type on veracity memory: affirmative trivia statements were associated with significantly better veracity memory than negative ones, regardless of whether the statement was associated with true or false feedback. Although a descriptive trend suggested that truth was remembered better than falsity for affirmative statements, this trend diminished for negative ones. Importantly, there were no significant differences in statement memory, suggesting that only memory for veracity status was influenced by the presence of negation. This study applies the multinomial processing tree source memory model for the first time to shed light on the influence of negation on different memory processes and guessing biases. Results indicate that differentiating between memory for the statements themselves and the veracity status seems to be relevant in studying negation.

Keywords: episodic memory, source memory, negation, veracity, multinomial processing tree model

*Speaker

†Corresponding author: daria.anna.ford@gmail.com

Vocabulary knowledge and perfectionism as context-sensitive predictors of spoken language production

Małgorzata Korko*[1]

[1]The Maria Grzegorzewska University [Warsaw] – Poland

Abstract

Vocabulary knowledge is a critical component of language proficiency, and adults' native-language vocabularies can vary significantly due to differences in life experiences, interests, and expertise (Brysbaert et al., 2016). These variations in lexical knowledge are expected to influence the efficiency of language use. Yet, surprisingly little research has examined the direct relationship between L1 vocabulary and speech patterns in native adult speakers. Existing studies have primarily investigated the role of vocabulary knowledge in lexical decision tasks (Mainz et al., 2017) and verbal fluency tasks (Unsworth et al., 2010), likely due to the lower scoring demands of these tasks compared to picture naming or sentence generation. This study is possibly the first to assess the contribution of vocabulary knowledge to single-word production. Sixty-nine native Polish speakers completed a picture-naming task and a standardized synonym test to measure their L1 vocabulary. Naming reaction times, accuracy, and fluency were analyzed. Vocabulary was found to be a significant predictor of both naming speed and accuracy. Individuals with larger vocabularies named pictures more quickly, explaining approximately 9% of the variance in reaction times. They also made fewer omissions in the naming task, with the model accounting for about 14% of the variance in omissions. These results are interpreted in light of the language exposure and lexical entrenchment hypothesis (Diependaele et al., 2013). Additionally, a subset of participants completed an adapted version of the Frost Multidimensional Perfectionism Scale (FMPS; Frost et al., 1990). Individuals with higher personal standards exhibited slower spoken production, likely due to increased monitoring in high-stakes communicative contexts.

Keywords: vocabulary knowledge, perfectionism, picture naming, context, sensitivity, spoken performance

*Speaker

A helping hand when learning new words? The intersection of gesture, vocabulary and memory

Elisabeth Knight*†[1], Gabriella Vigliocco[2], Luca Onnis*[3], Claudia Von Bastian[4], and Alicia Forsberg[5]

[1]School of Psychology, University of Sheffield – United Kingdom
[2]Department of Psychology, University College London – United Kingdom
[3]University of Oslo – Norway
[4]School of Psychology, University of Sheffield – United Kingdom
[5]School of Psychology, University of Sheffield – United Kingdom

Abstract

Iconic gestures (body movements that imagistically depict properties of referents) are frequently used when new information is communicated. Research suggests that individual differences in working memory and vocabulary interact with multimodal communication suggesting that gestures may support learning differently for diverse individuals (e.g., Cabiddu et al., 2024). Whether gestures co-occur with novel words, or occur after word onset, may also impact word learning (Wang et al., 2023). In this pre-registered study, we investigated effects when young children (N = 51, ages 36 - 54 months) observed iconic gestures in the context of learning about new real-world words and concepts. After playing with toys representing unfamiliar animals and tools, children watched short explanatory videos in which the presence (present/ absent) and timing (concurrent/ subsequent) of iconic gestures relating to target words were manipulated. Immediately after, we measured word-object mapping, and the children's conceptual understanding of the novel items using novel tasks in which children were asked about a semantic property (e.g., "where does the eel go?") and to categorise items as "animals" or "things". Our initial analyses show that children successfully learnt in the task, as indicated in their accuracy levels in both word-mapping and conceptual understanding tests, and that vocabulary strongly affected their performance. Analyses including the potential impact of gestures, and their timing, are currently underway and will be completed within the next month. The full results will be presented at the conference.

Keywords: iconic gesture, learning, working memory, vocabulary, cognitive development

*Speaker
†Corresponding author: EDKnight2@sheffield.ac.uk

Session 1: Abstract Concepts & Embodiment

Chair: Daria Goriachun

Abstract concepts are more represented in episodic contexts via attention and memory binding

Guyu Shen*[1], Amy Atkinson[2], and Bo Yao†[2]

[1]Department of Psychology [Lancaster] – United Kingdom
[2]Department of Psychology [Lancaster] – United Kingdom

Abstract

Unlike concrete concepts that are directly mapped to sensory experiences, abstract concepts like "freedom" may depend more on contextual associations drawn from episodic experiences. These experiences may be selected by attention and bound together through episodic memory processes to represent abstract concepts.

Study 1 examined whether abstract concepts rely more on contextual features (i.e. those describing events or situations) than constituent features (i.e. those describing inherent properties) in a feature generation task. Abstract concepts generated significantly more contextual features than concrete concepts. Feature generation for both concept types was organised around topic clusters, with sensorimotor similarity predicting the generation of collective feature clusters rather than individual features. However, for abstract concepts, contextual feature generation followed stronger sensorimotor associations between consecutive features compared to constituent feature generation. Our results suggest that thematic relational simulation might provide grounding for abstract concepts.

Building on these findings, Study 2 investigated whether these diverse contextual features would rely more on episodic memory's associative binding. We found that semantic interference (concurrently displaying a concrete object in the background) selectively disrupted concrete word judgments, whereas episodic interference (encoding and maintaining a list of words) affected abstract word judgements in participants using more associative memory strategies. These findings reveal that concrete concepts rely more on the semantic memory system's established knowledge structures, while abstract concepts rely more on the episodic memory system's associative binding.

Finally, Study 3 explored whether a broader attention style (i.e. attending to broader scope rather than narrow details) facilitates abstract concept generation from a set of features. Individuals with broader attention styles were more likely to generate abstract concepts, partly mediated by more semantically diverse feature sampling. Together, this project demonstrates that contextual information serves as the source of grounding for abstract concepts, potentially supported by two mechanisms: episodic memory processing and broad attention.

Keywords: Abstract concepts, Contexts, Episodic memory, Broad attention

*Speaker
†Corresponding author: b.yao1@lancaster.ac.uk

Neurophysiological evidence for abstract concept embodiment in bilinguals: The role of L2 proficiency and self-relevance

Yufen Wei*[1] and Guillaume Thierry*[2]

[1]Bangor University – United Kingdom
[2]Bangor University – United Kingdom

Abstract

Theories of conceptual representation propose that abstract concepts are grounded via metaphorical mapping to sensorimotor experience and social interactions. In bilinguals, however, it is unclear how such grounding plays out across two languages. Here, we investigated the neurophysiological basis of perceived power embodiment in Chinese-English bilinguals when they categorised power words (e.g., editor) and control words (e.g., article) as being printed in large or small font, considering proficiency as a modulating factor.
Behaviourally, participants responded faster and more accurately to words presented in smaller fonts overall, yet this effect emerged exclusively for control words. The pattern suggests a "hidden" congruency effect whereby metaphorical alignment between power and physical size offsets the typical processing costs associated with larger fonts. Neurophysiological measures showed that larger words elicited enhanced P3 and late positive component (LPC) amplitudes compared to smaller words, with significantly stronger effects observed for power words than control words. We interpret this interaction as indicating selective embodiment for power-related concepts, reflecting both metaphorical congruency and differential levels of self-relevance. Indeed, power words are thought to activate representations relating to social status and personal identity that carry greater personal significance than control words.
Regarding cross-linguistic differences, the font-size effects in P3 and LPC ranges were comparable between L1 and L2, suggesting that spontaneous metaphorical mapping concerns both languages. However, L1 power words elicited enhanced N400 amplitudes, indicating access to richer social-conceptual representations in the native language, which has greater self-relevance. Most importantly, L2 proficiency positively correlated with the magnitude of embodiment effects across late ERP components, providing evidence that abstract concept embodiment in L2 depends on second language mastery.

Keywords: grounded cognition, embodiment, abstract concept, bilingualism, self relevance, ERP

*Speaker

What is so difficult about abstract words, anyways? A neuromechanistic explanation using brain-constrained neural network models

Fynn Dobler*†[1,2], Lorenzo Stroppa[2,3], and Friedemann Pulvermüller‡[1,2,3,4]

[1]Einstein Center for Neurosciences [Berlin] – Germany
[2]Brain Language Laboratory – Germany
[3]Berlin School of Mind and Brain [Berlin] – Germany
[4]Cluster of Excellence 'Matters of Activity. Image Space Material', Humboldt Universität zu Berlin – Germany

Abstract

It is well known that young infants first learn words with concrete meaning, whereas abstract ones are typically acquired later. To obtain clues about the underlying causes and mechanisms, a brain-constrained neural network model with spiking neurons and Hebbian learning was trained on instances of concrete and abstract concepts. Before word learning, concrete and abstract concept formation was simulated based on the similarity structure of objects, actions and scenes exemplifying instances of the concept. Subsequently, conceptual instances were co-presented with word forms to establish semantic links and direct grounding of symbols in the world. Already at the conceptual learning stage, we observed substantial delays of the formation of abstract concepts as compared to concrete ones. The neural representations of abstract concepts lacked solidity and showed functional deficits in maintaining activity for some time, a working memory feature emerging spontaneously for concrete concepts. Still, when learning words for the conceptual types, abstract symbols quickly developed fully functional neural circuits comparable with those of concrete terms. Superficially, just a delay in forming symbol representations for abstract relative to concrete terms was visible. Our results suggest that the well-known differences in developmental trajectories of different symbol types are caused by structural dissimilarities between the real-world events these symbols are used to speak about. We elaborate on the underlying neural mechanisms and the psychological and linguistic implications they suggest.

Keywords: concept learning, abstract concept, computational modelling, neural network model, developmental trajectory

*Speaker
†Corresponding author: fynn.dobler@fu-berlin.de
‡Corresponding author: friedemann.pulvermuller@fu-berlin.de

Session 2: Vision in Language Processing

Chair: TBA

A Processing Advantage for Visually-Situated Ellipsis Resolution: A Self-Paced Reading Study of English Verb Phrase Ellipsis

Kohei Haneda*†[1], Anja Schüppert[1], and Roel Jonkers[1]

[1]University of Groningen [Groningen] – Netherlands

Abstract

While a substantial body of research shows that extralinguistic cues-such as vision-immediately impact language processing, the extent to which these cues can be utilized by the language system remains underexplored. The current study aims to delineate the capacity of extralinguistic cues (vision) to influence real-time language processing by testing whether the human language parser can utilize visual inputs in lieu of linguistic inputs to comprehend elliptical constructions. A general consensus is that comprehenders require some form of syntactic antecedent stored in the working memory, which can later be retrieved to fill the elliptical gap for successful interpretation. What if this syntactic antecedent is replaced with visual information such as an image depicting an action? Can comprehenders still integrate the visual cue with the unfolding linguistic information and resolve the ellipsis? Sixty L1 English readers viewed images depicting actions followed by sentences with elliptical gaps in a Self-Paced Reading experiment. Participants were first shown a sentence fragment such as "Last Friday afternoon, Joanna was", followed by an image of a woman knitting a scarf. Subsequently, a sentence with an elliptical gap was displayed "Elise was too because...". Participants' reading times at the ellipsis sites ("was too") and spillover regions were compared to those of the controls to examine whether the elliptical resolution with a visual antecedent was successful. The results show that visually-situated processing of ellipsis appears to have some processing advantage over its linguistic counterpart–but not at the ellipsis region itself, but rather at the subsequent spillover regions, suggesting that mental representations constructed multimodally may be less cognitively taxing than purely linguistic representations. To further verify the effects cross-linguistically, a replication study with the Dutch Sluicing construction, as well as two eye-tracking experiments in English and Dutch, are currently underway, the findings of which will be presented at the conference.

Keywords: Embodied Cognition, Visually Situated Language Processing, Ellipsis, Visual cues, Sentence processing, Language comprehension, Multimodality

*Speaker

†Corresponding author: k.haneda@rug.nl

Morphosyntactic sensitivity predicts reliance on visual scenes for thematic-role comprehension

Carlotta Isabella Zona*†[1]

[1]University of Potsdam = Universität Potsdam – Germany

Abstract

Recent research has shown that comprehenders tend to re-assign visually inspected thematic roles to the same referents during comprehension of temporally coordinated utterances (recent-role preference, RRP). Individual sensitivity to morphosyntactic cues has been found to modulate RRP effects, with low-sensitivity comprehenders exhibiting greater reliance on visual-scene information for thematic-role assignment. The evidence so far is however limited to implicit, delayed agent-identification tasks, bringing its generalizability into question. We asked whether the RRP and its modulation by morphosyntactic sensitivity extend to explicit agent-identification tasks with and without temporal delays between stimulus and probe. We further sought to establish the direction of RRP effects (i.e., whether congruent scenes aid and/or incongruent scenes hamper comprehension vs. a neutral baseline).
First-language speakers of German listened to subject- and object-extracted relative clauses in German presented either in isolation (baseline) or alongside visual scenes portraying the same (congruent) or the opposite (incongruent) action direction as the sentence. Participants identified the agent in the sentence through keypress either while (Exp. 1, n=45) or after the sentence unfolded (Exp. 2, n=48).

The results showed robust RRP effects in accuracy of explicit agent-identification regardless of temporal delays, extending the generalizability of the RRP across task settings. Participants with lower morphosyntactic sensitivity exhibited greater interference from incongruent scenes when comprehending dispreferred object-extracted (vs. preferred subject-extracted) clauses. This closely replicated previous evidence for a negative association of reliance on morphosyntactic versus visual information for spoken comprehension at the individual level. Finally, the RRP was found to affect thematic-role assignment in both directions, as congruent scenes benefited comprehension and incongruent scenes hampered it compared to sentences in isolation.
These results provide support for the RRP, extending its generalizability and contributing to defining its boundary conditions. Further, the findings advance current efforts to quantify the sources of inter-individual variability in spoken-sentence comprehension.

Keywords: situated sentence comprehension, thematic role assignment, visual scenes, individual differences, recent role preference

*Speaker
†Corresponding author: carlotta.zona@gmail.com

The eye pupils adjust to implied luminance when reading narratives

Jakob Scherm Eikner*†[1], Luca Onnis[1], and Bruno Laeng[1]

[1]University of Oslo – Norway

Abstract

The eye's pupil typically adjusts to changes in light energy stimulating the retina. However, the pupils also adjust to imagined and illusory changes in brightness and darkness. Additionally, research has shown that the pupil adjusts differently when reading single words associated with darkness or brightness, as if anticipating actual changes in ambient light. One possible explanation is that reading a word automatically elicits a mental image or sensory-motor simulation of its meaning, which provides feedback to the oculomotor control system to adjust pupil diameter to the expected level of luminance.
To further test this idea, the present study employed eye tracking and pupillometry in a more ecological situation, such as reading a story. Participants (n=51) completed a simple reading task consisting of four short stories that included key words referencing either bright or dark scenarios. We measured relative pupil changes during reading to investigate the extent to which sensory-motor simulations of these scenarios reflected comprehension of an extended narrative.
We computed average pupil changes in each scenario and used a paired samples t-test to assess the effect of the bright and dark conditions. The results indicated that pupils constricted more in response to bright scenarios compared to dark ones. For example, pupils were larger when reading about driving into a tunnel but smaller when reading about driving on a sunny day. Using linear mixed effect models, we found that the perceived vividness of the scenes experienced modulated the effect of brightness and darkness. In essence, being immersed in a story with high vividness led to more intense pupil responses. This suggests that language input can activate sensory responses to meaning, highlighting the role of simulations and mental imagery during language comprehension.

Keywords: pupillometry, reading task, language comprehension, mental imagery, simulation, vividness, linear mixed effect model

*Speaker
†Corresponding author: eiknerj@gmail.com

Session 3: Motor & Action Representation

Chair: Luciano Fadiga

Grip Force Modulation by Action Language in Aphantasia

Melisa Yavuz*†[1,2], Florentin Vandeville[3], Camille Mignard[1], Jacques Jayez[4,5], and Olivier Capra[3]

[1]Université de Lille – Univ. Lille, CNRS, UMR 9193 - SCALab - Sciences Cognitives et Sciences Affectives, F-59000 Lille – France
[2]Aix Marseille Université – Aix Marseille Univ, CNRS, CRPN-UMR 7077, ILCB, Marseille – France
[3]Université Catholique de Lille – NEURETHIC-LAB – ETHICS EA 7446, Université Catholique de Lille, F-59000 Lille – France
[4]Université de Lorraine – LORIA lab (French National Research Institute for Digital Science and Technology, CNRS and Université de Lorraine) – France
[5]École normale supérieure de Lyon – CNRS-ENS Lyon – France

Abstract

Understanding how (conscious) mental imagery relates to embodied language processing remains a central question in cognitive science. Action language reliably recruits motor brain regions, yet the role of imagery in this process is debated. We tested whether people with aphantasia-who lack voluntary visual imagery-show motor responses to action language comparable to typical imagers.
We used grip force modulation as an index of language-induced activation in the brain's motor system. Participants performed a reading task (rapid serial visual presentation; RSVP) with action sentences (e.g., *"Marie **laces** her shoes"*) and non-action sentences (e.g., *"Martin **deceives** his colleagues"*) while continuously holding a grip force sensor, allowing us to record subtle force changes on-line.

Control participants showed the expected pattern: significantly stronger grip force for action than for non-action sentences. Critically, participants with aphantasia exhibited the same motor activation pattern, with comparable increases for action sentences despite their inability to consciously visualize the described action. We also examined aspectual constructions (e.g., *"begins to"*), which highlight action initiation. Both groups showed reduced motor responses in this condition, confirming that linguistic structure modulates embodied simulation independently of imagery ability.
These findings support embodied cognition theories while demonstrating that conscious mental imagery and automatic motor simulation are related but separable processes. Motor–language links appear to arise from shared sensorimotor and linguistic experiences during acquisition, leading to comparable motor-language mappings in people with and without aphantasia.

Keywords: motor simulation, embodied language processing, grip force, aphantasia

*Speaker
†Corresponding author: melisa.yavuz@cnrs.fr

Uncovering the role of expertise and sensorimotor impairments in shaping action representation via language

Fortunata Romeo*[1,2], Chiara Barattieri Di San Pietro†[3], Paolo Canal‡[3], Lorenza Sola[4], Marco Rigoni[5], Marina Zernitz[6], and Valentina Bambini[1]

[1]University School for Advanced Studies IUSS, Laboratory of Neurolinguistics and Experimental Pragmatics (NEP), Pavia – Italy

[2]Centro Studi di Riabilitazione Neurocognitiva "Villa Miari" – Italy

[3]University School for Advanced Studies IUSS, Laboratory of Neurolinguistics and Experimental Pragmatics (NEP), Pavia – Italy

[4]Università degli studi di Torino = University of Turin – Italy

[5]Centro di Riabilitazione Neurocognitiva "Villa Miari" Santorso – Italy

[6]Centro di Riabilitazione Neurocognitiva "Villa Miari", Santors0 – Italy

Abstract

Embodied cognition suggests that language, grounded in bodily experience, serves as a proxy for action representations, shaped by experience and task demands. We hypothesize that semantic and metaphorical usage reflects affective, cognitive, and perceptual variations in action representations, with distinct patterns linked to motor impairments and medical expertise, effects amplified by motor imagery. To test this hypothesis, we administered a semi-structured interview to neurotypical adults (CTR, N=32, M age=55), physiotherapists (N=30, M age=46), and patients with hemispheric motor impairments (N=32, M age=56) and analyzed descriptions of six actions (e.g. washing hands, walking) , imagined and enacted, for lexico-semantic features (via Natural Language Processing) and metaphorical properties as creativity, valence, and source domain (via manual tagging). Linear mixed-models tested the interaction between group and type of action: for imagined actions, patients produced shorter descriptions (-66.09vs-16.59, t=-7.88, p< .001), and used fewer cognitive terms (-1.45vs +0.09, t=-3.42, p< .001) than CTR. Moreover, patients used reduced perceptual language (-0.73, t=-2.68, p=.009). and significantly more words related to the body when describing both imaged and acted actions (+0.89, t=3.21, p=.002). Physiotherapists also showed higher body words but only for imagined actions (+0.91vs +0.18, t=1.98, p=.048). Compared to CTR, patients also produced fewer (M=1.44vs2.84), more negative (65%vs34%), and less creative (55%vs39%) metaphors, with more object-based source domains (34%vs2%). Patients' limited use of cognitive and perceptual language may reflect impairments in action planning and in perception-action integration. Conversely, higher body-related words might indicate body as a concern and as an object, suggesting a loss of agency also evident in the prevalence of object-based metaphors. In contrast, physiotherapists' high use of body language is possibly due to their medical knowledge, yet their high

*Speaker

†Corresponding author: chiara.barattieridisanpietro@iusspavia.it

‡Corresponding author: paolo.canal@iusspavia.it

perceptual content indicates vivid body representation. These results support the analysis of language as a proxy of body-action representation, aiding motor rehabilitation beyond the biomechanical approach.

Keywords: embodiment, language, motor imagery, action representations, sensorimotor impairments, motor rehabilitation

Poster Session 2: Embodiment, Learning, and Interaction in Language

Grounding the arbitrary: Acquired embodiment of grammatical gender

Luca Onnis*†[1] and Alfred Lim[2]

[1]University of Oslo – Norway
[2]University of Nottingham Malaysia – Malaysia

Abstract

Grounded cognition and distributional semantics suggest that language learning draws on both embodied experience and statistical regularities. Through acquired embodiment, abstract concepts can become associated with sensorimotor representations via contextual links. This study tests whether such mechanism supports second language (L2) acquisition of grammatical gender (GG). In many of the world's languages GG is an arbitrary and semantically opaque but obligatory feature of language, which applies to thousands of inanimate nouns. GG assignment is notoriously difficult to learn in a second language (L2), yet it is unclear how such difficulties can be overcome.

This study investigates whether introducing semantically meaningful GG relations-via biologically gendered animate nouns-can facilitate the subsequent distributional learning of opaque and arbitrary GG patterns in inanimate nouns. Malay-speaking adults are exposed to a miniature Italian grammar across two consecutive sessions. The experimental group first learns animate noun phrases with transparent gender cues, followed by inanimate phrases with opaque GG assignment. A control group experiences only inanimate GG learning. Learning is tracked trial-by-trial using a training-to-criterion approach, and inferential analyses include mixed-effects modeling and Bayes Factor model comparisons.

We predict that grounding initial exposure in meaningful gender relations supports the emergence of acquired embodiment, accelerating and enhancing GG acquisition in opaque contexts. If confirmed, these results would support the role of hybrid theories of language that integrate embodied and distributional perspectives, and inform L2 instruction methods. This study is under review at a journal as a Registered Report.

Keywords: grounded cognition, distributional semantics, acquired embodiment, grammatical gender, second language acquisition

*Speaker
†Corresponding author: lucao@uio.no

Grounding language in space and time

Luca Onnis*†[1] and Michael Spivey[2]

[1]University of Oslo – Norway
[2]University of California, Merced – United States

Abstract

The acquisition of non-adjacent dependencies (NADs) is pivotal in language learning, as evidenced by grammatical structures involving separated elements, such as auxiliaries and inflectional morphemes. Despite their prevalence, it remains unclear how learners navigate these dependencies without explicit instruction. Our research harnesses eye-tracking technology to probe learning in adults across three innovative experiments, utilizing miniature languages (MLs) embodying NAD grammatical structures.
Experiment 1 measures fixations while participants listen to a novel miniature language (ML) with words visually mapped onto specific screen locations. The ML requires learning NADs between the first and last word in each sentence (e.g., "pel _ jic" in "pel kicey jic"). Anticipatory looks to the correct screen locations before the last word appears can reveal implicit non-adjacent learning without explicit tasks.

Experiment 2 uses a blank screen paradigm to test whether grammar learning can be grounded in visual perception. We analyze spontaneous eye movements while participants listen to the same auditory ML without visual mappings. We expect participants to develop eye movement trajectories to specific screen locations if they learn the NADs.

Experiment 3 combines both paradigms to investigate whether learning the ML with spatial support first (auditory + visual modalities) benefits subsequent learning of a second ML presented only in the auditory modality.
Collectively, our study tests the hypothesis that abstract aspects of grammar can be perceptually grounded in the visual modality. These findings aim to enrich our understanding of language acquisition processes and the dynamic role of eye movements, providing implications for enhancing educational methodologies and refining theoretical models of grounded cognition. Data collection is ongoing and will be completed in the summer.

Keywords: blank screen paradigm, nonadjacent dependencies, artificial grammar learning, eye, tracking, visual grounding

*Speaker
†Corresponding author: lucao@uio.no

Methodological Updates for the Grip Force Paradigm

Florentin Vandeville[1] and Olivier Capra[*†2]

[1]Université Catholique de Lille – NEURETHIC-LAB – ETHICS EA 7446, Université Catholique de Lille, F-59000 Lille, France – France

[2]Université Catholique de Lille – NEURETHIC-LAB – ETHICS EA 7446, Université Catholique de Lille, F-59000 Lille – France

Abstract

The Grip Force paradigm is a reliable and accessible method for investigating cognitive processes, particularly in embodied language. Yet methodological variability still constrains cross-study comparability. Here, we present three contributions to strengthen this approach. First, we provide a physical characterization of force sensors to enable more consistent comparisons across devices. Second, we improve experimental synchronization by integrating Lab Streaming Layer (LSL) for network-based stimulus delivery and data acquisition, ensuring precise temporal alignment. Third, we introduce a Bayesian and graphical framework for time-series analysis, allowing clearer comparisons across conditions. Together, these advances enhance the robustness, reproducibility, and interpretability of Grip Force studies, fostering their broader application in cognitive neuroscience, including embodied numerical processing and human–computer interaction (HCI).

Keywords: grip force, embodied language, methodology, bayesian approach

*Speaker

†Corresponding author: olivier.capra@univ-catholille.fr

What if "mooff" is round and "mottie" small? Computational insight into sound symbolism in pseudowords

Iva Šaban*[1], Luca Rinaldi , and Marco Marelli

[1]University of Milano-Bicocca – Italy

Abstract

Sound symbolism is the phenomenon in which certain letters or phonemes are associated with specific physical or perceptual features. It is often considered a vocal form of iconicity, which assumes non-arbitrary relationship between form and meaning. Experimental work in this domain investigated whether artificial stimuli and out-of-vocabulary strings (i.e., pseudowords) intuitively resemble aspects of meaning, based on the letters/phonemes they contain.
Apart from identifying such associations, researchers are also interested to know whether these patterns occur more often that would be expected by chance. This approach, known as systematicity, investigates statistical relationship between word's form and grammatical/semantic category. Humans are able to detect systematic and statistical regularities in their linguistic environment, which appear to be indicative of meaning. In this study, we aim to explore whether sound symbolism can be reflected through systematicity.

Previous works show that the meaning of pseudowords can be predicted from computationally-defined semantic vectors of their sub-lexical units – an approach implemented in the fasttext model. Using two fasttext models, we derived semantic representations for a set of pseudowords evaluated along three target semantic dimensions - size, gender and shape - obtained from a larger dataset of human judgements collected by Westbury and colleagues (2018).
We extracted pseudowords that had consistent human ratings on six anchors (small, large, feminine, masculine, round, sharp). We then computed their semantic similarity to existing words that represent these dimensions, producing an index for each of them (i.e., size, gender and shape index). We observed significant effects for gender and shape, indicating that human intuition about the features of the pseudowords in these categories align with model predictions. However, only the model which considers shorter sub-lexical chunks allowed to detect such alignment. These findings could be explained by a combination of perceptual and linguistic factors.

Keywords: pseudowords, sound symbolism, systematicity, semantic representations

*Speaker

Learning abstract concepts in social interaction: an investigation of behavioural and brain dynamics.

Gal Rozic , Sara De Felice , Antonia Hamilton , and Gabriella Vigliocco*[1]

[1]Cognitive, Perceptual and Brain Sciences University College London (UCL) – 26 Bedford Way London WC1H OAP, United Kingdom

Abstract

Abstract concepts like "fraud" and "inflation", detached from concrete physical experience, are crucial for advanced reasoning and the exploration of phenomena beyond immediate sensory perceptions. These concepts are typically learned during middle childhood in rich, dynamic face-to-face communication with more knowledgeable people, such as caregivers and teachers. Thus, learning abstract concepts is a fundamentally social and embodied process. Recent advances in neuroimaging, particularly fNIRS hyperscanning, enable the study of such interactive, social language learning in more naturalistic contexts. Adopting an embodied approach to social neuroscience, we investigate how verbal and non-verbal behavioral coordination and brain-to-brain synchronisation that occur in interactive dyads of caregivers and children support the learning of abstract concepts. In a multimodal fNIRS hyperscanning study, 29 caregiver-child dyads (children aged 8-9) participated in a novel interactive abstract concept learning task. Preliminary findings suggest that longer durations of mutual gaze and greater brain-to-brain synchronisation over the left MTG during the caregiver-child interaction significantly predicted children's abstract concept learning. In our talk, we will present the full analysis revealing the links between behavioural coordination, brain-to-brain synchronisation and abstract concept learning.

Keywords: abstract concepts, development, hyper scanning, social interaction

*Speaker

Meta-Analysis of Motor Compatibility Effects in Embodied Language Research: Work in Progress

Alice Winter*[1], Barbara Kaup[1], Carolin Dudschig[1], and Michael Kaschak[2]

[1]Eberhard Karls Universität Tübingen = University of Tübingen – Germany
[2]Florida State University [Tallahassee] – United States

Abstract

Compatibility effect paradigms are an important behavioral method for investigating embodied accounts of language comprehension. The core assumption of these paradigms is that there is (in)compatibility between sensorimotor features of the linguistic stimuli and the action physically performed to make responses during the experiment. Key elements of embodied theories have been developed and probed using compatibility effect paradigms. Significant compatibility effects (faster and more accurate responses in compatible versus incompatible trials) have been found across various meaning dimensions (e.g., toward–away, clockwise–counterclockwise, precision–power grip, up–down), using diverse motor responses and linguistic stimuli (e.g., nouns, verbs, word pairs, and sentences). Although compatibility effect paradigms remain popular in the literature, a growing body of literature has questioned whether embodied compatibility effects can be reliably observed. Variations in experiment parameters such as timing, salience, or task difficulty have been shown to influence both the occurrence and the magnitude of these effects. This work-in-progress presents the conceptual foundation and design of a planned meta-analysis aimed at systematically compiling studies on motor compatibility effects within the context of embodied language processing. In addition to aggregating overall effect sizes, the project will explore the moderating roles of experimental features across different meaning dimensions. The current stage of the project includes database searches, pilot coding, and protocol registration. Subsequent stages will complete extraction of moderator variables and quantitative synthesis. This meta-analysis offers initial insights into the range of existing compatibility studies and methodological influences on compatibility effects and invites feedback on proposed moderator variables, analytic strategies and open dialogue around unpublished findings and studies.

Keywords: meta analysis, compatibility effect, language comprehension, embodiment

*Speaker

Well, it depends: How spatial distance influences mental representations

Lilian Levinh*†[1], Karin Bausenhart[1], Hanspeter Mallot[1], Rolf Ulrich[1], and Barbara Kaup[1]

[1]University of Tübingen – Germany

Abstract

Mental representations can be broadly classified as modal, concrete representations grounded in physical sensations, or amodal, referring to more abstract symbolic concepts independent of specific sensory modalities. This distinction has been central to language comprehension research, although the exact conditions determining which type of mental representation is used remain under discussion. Our work investigates the hypothesis that psychological distance to what is being represented plays an important role. For instance, when imagining a known but occluded location, a person's relative position to the imagined space can introduce an egocentric bias. However, this egocentric bias is expected to weaken with increasing distance to the location, possibly being substituted for a more amodal view-independent representation. Our experiment studies how spatial distance can influence spatial mental representations. We are using a virtual reality environment featuring an indoor apartment, which participants first explore. They are then asked to memorise an object array within the central room of the apartment. Participants will then be tested in other rooms, either adjacent or farther away, both on an object recognition task and an array recreation task. For the object recognition task, we expect reaction times to increase and accuracy to decrease if the presented objects are shown from a different orientation than the one aligned with the participant's perspective during testing. We also expect participants to show an egocentric bias in their array recreations. We hypothesise the egocentric bias to decrease in both tasks as distance to the central room and target array increases. The study is currently in progress, and results will be presented at the conference. If our predictions are confirmed, the results will point to an interplay of modal and amodal mental representations influenced by distance. The experimental setup will also provide an ideal testing ground for investigating distance-dependent representational formats in language comprehension.

Keywords: Mental Representation, Spatial Cognition, Modal and Amodal Cognition

*Speaker

†Corresponding author: lilian.le-vinh@uni-tuebingen.de

Eyes on the prize: gaze-guided learning of foreign words in social VR interactions

Ana Zappa*[1]

[1]University of Barcelona – Spain

Abstract

Our sensitivity to where others direct their gaze is a fundamental component of social interaction. Accordingly, gaze-following significantly supports language acquisition in children, but it remains unclear whether this mechanism persists into adulthood. Here we investigated whether gaze-following helps adults to map new words to objects and facilitates foreign language learning in social contexts. To this end, we developed a novel immersive virtual reality (VR) paradigm in which participants learned foreign words from virtual teachers whose gaze behavior varied in referential informativeness. Learning was supported by explicit feedback throughout, making it possible to assess how referential gaze influenced learning beyond instructional content. Behavioral and eye-tracking data revealed that participants consistently learned more effectively when the teacher's gaze reliably indicated the intended referent and when they followed his gaze. This advantage emerged early and was sustained across learning phases, suggesting that gaze-related social mechanisms supported initial word learning. This novel VR study provides evidence that adults, like children, can make use of social cues to build new word-to-meaning associations.

Keywords: second language learning, social cues, eye, tracking, virtual reality

*Speaker

Turn-taking in Singaporean Multilingual Parent-child Dyads

Vivian Hanwen Zhang*†[1], Luca Onnis[2], and Shimon Edelman[1]

[1]Cornell University [Ithaca] – United States
[2]University of Oslo – Norway

Abstract

Quick conversational turn-taking is robustly observed in early childhood across linguistic and cultural contexts. These highly-coordinated vocal exchanges occur within half a second of each other, but tend not to overlap (Stivers et al., 2009). How does multilingualism, which has been linked to cognitive flexibility (e.g., Cedden et al., 2024), influence the timing of children's turn-taking with parents? To understand this question, we audio-recorded 66 Singaporean multilingual parents reading a book with their two-year-old children (M = 20.02 months, SD = 5.86 months). We annotated the onset and offset of parent and child speech. Turn transition latency was calculated as onset (t) – offset (t-1). We ran autocorrelation analyses on sequences of turn transition latencies (Pouw & Holler, 2022). A lag-k autocorrelation is the correlation between latency at turn t and latency at turn t-k. Since parent-child dyads alternated turns (e.g., child-parent-child-parent), a lag-2 autocorrelation would show whether the timing of a turn is correlated with the party's own previous turn. Parents filled in detailed language questionnaires and reported using diverse languages, including Mandarin, Tamil, and Malay. To capture the variation in the dyads' multilingual experience, we calculated understanding and speaking language entropy (Gullifer & Titone, 2019). Compared to discrete categories like monolingual or multilingual, entropy characterizes individual differences as a continuous variable (between 0 and 2 in this study). We found that the dyads' lag-2 autocorrelation coefficients were positively correlated with the child's language speaking entropy ($r = 0.27$, $p = 0.03$). This result suggests that dyads with more linguistically diverse children tended to take turns at a more consistent pace within themselves. We did not find parent language entropy measures to be correlated with autocorrelation scores. We plan to further explore whether parent and child language entropy predicts the timing, interruptions, gaps, and turn contents in parent-child conversations.

Keywords: multilingual, turn taking, naturalistic, language entropy, child language development

*Speaker
†Corresponding author: hz524@cornell.edu

Session 4: Embodiment: Benefits, Extension, Limits

Chair: Kristof Strijkers

Can we ground novel words? Mapping perceptual features from language-based representations to human intuitions

Giulia Loca*†[1], Simona Amenta[1], and Marco Marelli[1]

[1]Università degli Studi di Milano-Bicocca = University of Milano-Bicocca – Italy

Abstract

Embodied theories of cognition propose that conceptual representations are grounded in sensorimotor experience. However, such experience can also be activated for referents we have never directly experienced, such as abstract concepts. Recent studies suggest that even novel unattested words, for which a referent is not available, can elicit activation in semantic memory, suggesting that experiential features might be predicted from language alone. Here, we investigate whether novel words evoke experiential features across various perceptual modalities and whether humans can reliably assign such features to novel words.

To investigate this, we trained a mapping model to predict perceptual features of novel words using a data-driven approach. Semantic vector representations for 39,707 English words were obtained using *fastText*, which can also approximate the meaning of novel words using subword information. Perceptual ratings were obtained from the Lancaster Sensorimotor Norms. Ridge regression models were trained to predict ratings across six perceptual modalities (vision, touch, hearing, smell, taste, and interoception) using fastText embeddings as input and perceptual ratings as output. Perceptual ratings for 27,136 novel words, retrieved from the British Lexicon Project, were then predicted for each dimension by feeding the model their corresponding *fastText* embeddings to generate the model-predicted estimates. To evaluate whether these predictions align with human intuitions, we collected perceptual ratings for a subset of 215 novel words in six different experiments (one per modality) using Best-Worst Scaling from 240 participants. Participants' judgments were then correlated with model-predicted estimates.

Pre-registered analyses show the strongest positive correlation for interoception, followed by taste and hearing. While the mapping process shows that language implicitly encodes perceptual experiences through sub-lexical distributional cues, human perceptual intuitions of novel words vary across modalities. These results suggest that, in the absence of semantic knowledge, humans rely more on the linguistic form to infer meaning.

Keywords: novel words, distributional semantics, sensorimotor information, grounded cognition.

*Speaker

†Corresponding author: g.loca1@campus.unimib.it

Challenging Embodied Cognition: Insights from Human and ChatGPT Language Evaluations

Elisa Scerrati*†[1], Giuseppe Riva[2,3,4], James Hampton[5], and Claudia Repetto[6]

[1]Università Telematica Pegaso – Italy
[2]Department of Psychology, Università Cattolica del Sacro Cuore – Italy
[3]IRCCS Istituto Auxologico Italiano – Italy
[4]Humane Technology Lab, Università Cattolica del Sacro Cuore – Italy
[5]City St George's, University of London – United Kingdom
[6]Dept. of Psychology, Università Cattolica del Sacro Cuore, Milano – Italy

Abstract

The proliferation of Large Language Models (LLMs) has sparked intense debate about their ability to replicate human-like cognition, especially within embodied cognition frameworks. This study investigates whether ChatGPT can approximate human perfomance in evaluating sensorimotor and abstract language dimensions.
We systematically compared human and ChatGPT-generated ratings for 959 Italian words across embodied dimensions (six sensory modalities: vision, hearing, touch, smell, taste, interoception; five action effectors: mouth/throat, hand/arm, foot/leg, head excluding mouth/throat, torso) and more abstract dimensions (dominance). Drawing on embodied cognition theory, which posits that language is grounded in sensory-motor experiences, we hypothesized that ChatGPT would show poor alignment with human judgments for embodied dimensions but potentially better correspondence for abstract dimensions like dominance.

Results strongly supported our predictions. Correlations between human and ChatGPT ratings were negligible across all sensory modalities, and the AI failed to generate meaningful action effectors ratings. These findings suggest that without direct bodily experience, LLMs cannot authentically simulate the sensorimotor grounding that characterizes human language processing.

However, dominance ratings revealed a significant, albeit modest, correlation, indicating that ChatGPT can partially approximate human performance for certain abstract dimensions that are less dependent on direct bodily experience. This dissociation between embodied and abstract features of words provides compelling evidence for the involvement of sensorimotor grounding in human cognition.
Our findings have important implications for understanding both artificial and human representations. While LLMs demonstrate remarkable linguistic competence, their inability to replicate human-like embodied representations highlights fundamental constraints in current AI architectures. This study highlights the centrality of sensory-motor experience in human cognition and suggests that emulating it may require more than sophisticated pattern recognition in linguistic data. These insights contribute to ongoing debates about the nature of

*Speaker
†Corresponding author: elisa.scerrati@unipegaso.it

meaning, the role of embodiment in cognition, and the future development of cognitively plausible artificial intelligence systems.

Keywords: Large Language Models (LLMs), Embodied cognition, sensorimotor dimensions, dominance, language processing

When sensorimotor grounding is unhelpful: A registered report on word memory

Louise Connell*[1] and Agata Dymarska[2]

[1]Department of Psychology, Maynooth University, Ireland – Ireland
[2]Adam Mickiewicz University, Poznań, Poland – Poland

Abstract

Sensorimotor grounding of semantic information elicits inconsistent effects on word memory, depending on which type of experience is involved, with some aspects of sensorimotor information facilitating memory performance while others inhibit it. In particular, information relating to the body appears to impair word recognition memory by increasing false alarms, which may be due either to an adaptive advantage for survival-relevant information (whereby words pertaining to the body spread activation to other concepts and generate a confusable memory trace) or to a somatic attentional mechanism (whereby words pertaining to the body activate a false sense of touch that renders their representations less distinctive as memory trace and retrieval cue). We set out to adjudicate between these explanations using a surprise (incidental) memory task, where participants study the words under a guise of a lexical decision task, which allowed us to examine how participants form a memory trace for words grounded in bodily experience. We found support for the somatic attentional account, as body-related words increased false alarms even when attention was not directed to them at the study phase. Overall, the results provide further evidence for the importance of distinctiveness in word memory, and suggest a reinterpretation of the role of semantic richness in word memory.

Keywords: sensorimotor, grounding, bodily experience, word memory, registered report

*Speaker

Session 5: Word Learning & Interactive Processes

Chair: Ana Zappa

Learning new words and concepts in interaction: the role of verbal and non-verbal behaviours

Gabriella Vigliocco*[1], Christopher Edwards , and Francesco Cabiddu

[1]Cognitive, Perceptual and Brain Sciences University College London (UCL) – 26 Bedford Way London WC1H OAP, United Kingdom

Abstract

We learn new words and new concepts throughout our lives, often in informal conversations with more knowledgeable individuals. Here we look at learning of new words and concepts in situated dyadic interaction and we explore the role of verbal and non-verbal behaviours produced by the more knowledgeable person in supporting learning, in combination with the cognitive abilities of the learner.
We used data taken from the ECOLANG corpus (Gu et al., 2025, https://www.ucl.ac.uk/brain-sciences/pals/research/language-and-cognition/language-and-cognition-lab/research/ecolang-corpus) of dyadic semi-naturalistic interaction between English speaking individuals (n = 64) engaged in 40 mins conversation about a series of objects (e.g., axolotl, cassowary) usually unknown to the adult population. One of two partner (designated as the teacher), learnt about these objects watching documentary-style videos the day before the interaction (they were instructed to watch the videos so that they could talk about these objects to their partner). The interaction was videorecorded. Speech by the teacher was transcribed and non-verbal behaviours (pointing, representational gestures, manipulation of objects and gaze to the object) annotated following the ECOLANG manual (https://osf.io/4rv7n). After the interaction, learners were tested for their learning of (a) the label (they were presented with a picture of the object and asked to name it); (b) semantic features of the corresponding concept (they were asked to report everything they remembered about the object). We carried out separate mixed-effects regression analyses for word and concept learning. Each analysis included verbal (including mean length of utterance, lexical diversity, pitch and speaking rate), non-verbal predictors (points, representational gestures, object manipulations, gaze), individual characteristics of the learner (vocabulary, working memory) and their interactions. Results show that learning of both word and concept is supported by combinations of verbal and non-verbal factors, many of which are the same as observed in caregiver-child interaction.

Keywords: learning, situated social interaction

*Speaker

Learning words through interaction: Verbal coordination in child-caregiver dyads

Greg Woodin*[1], Yan Gu[2,1], Abdellah Fourtassi[3], Stefano James[1], and Gabriella Vigliocco[1]

[1]University College London (UCL) – United Kingdom
[2]University of Essex – United Kingdom
[3]Aix-Marseille University – Aix-Marseille Université - AMU – France

Abstract

Children learn language in situated, face-to-face interactions with their caregivers, during which they perceive and produce a range of verbal behaviours (e.g., word repetitions, changes in prosody). While many studies have reported that caregiver behaviours can influence language learning (e.g., Slone et al., 2023), few have considered the joint, coordinated behaviours between the caregiver and the child. Coordinated behaviours involve interactants converging on measures including semantic similarity, turn latency, and speech rate. The few studies investigating coordinated behaviours have mostly focused on how caregivers initiate coordination (e.g., caregivers aligning to children, Fusaroli et al., 2023), within a general theoretical framework emphasising parental responsiveness. However, much less is known about how children themselves coordinate with caregivers in ways that may facilitate language learning (see Nikolaus & Fourtassi, 2023). In this preregistered study (see https://osf.io/rjdqb/), we analyse 38 dyads from the ECOLANG corpus (Gu et al., 2025) between caregivers and their 3–4-year-old children, (English native speakers). These dyads discuss various objects unknown to the child (e.g., flamingo, wrench), after which the child's learning of the unknown objects' labels is assessed using a picture-word matching task. Our planned analyses will use mixed effects modelling to predict immediate word learning based on individual characteristics (e.g., child's age and vocabulary), linguistic properties of both the caregiver's utterances (e.g., lexical diversity, prosodic modulation) and the child's (e.g., question-asking, label repetition), and, crucially, child-caregiver coordination (e.g., lexical alignment, F0 alignment), all within a single model. Our findings will offer new insight into how word learning emerges from the dynamic interplay of child and caregiver behaviours, contributing to a more socially grounded account of early language acquisition.

REFERENCES
Fusaroli, R., Weed, E., Rocca, R., Fein, D., & Naigles, L. (2023) Caregiver linguistic alignment to autistic and typically developing children: A natural language processing approach illuminates the interactive components of language development. Cognition, 236, 105442.
Gu, Y., Donnellan, E., Grzyb, B., Brekelmans, G., Murgiano, M., Brieke, R., Perniss, P., & Vigliocco, G. (2025). The ECOLANG Multimodal Corpus of adult-child and adult-adult Language. Sci Data, 12, 89.
Nikolaus, M., & Fourtassi, A. (2023). Communicative Feedback in language acquisition. New Ideas Psychol., 68, 1–11.
Slone, L. K., Abney, D. H., Smith, L. B., & Yu, C. (2023). The temporal structure of parent talk to toddlers about objects. Cognition, 230, 105266.

*Speaker

Keywords: linguistic alignment, child, directed speech, situated language use, early language development, developmental psychology, social interaction

Playing with Gestures: Evidence of L2 grammatical morpheme learning?

Natasha Janzen Ulbricht*[1]

[1]Department of Philosophy and Humanities, Freie Universität Berlin – Germany

Abstract

Michael Tomasello proposes a usage-based approach to language acquisition, asserting that children possess two sets of cognitive abilities: intention reading and pattern finding (2009, 2015). Language learning involves determining structure from usage (Ellis, 2015), however, 'usage' may come in many modalities and forms. Since L2 speakers frequently struggle with grammatical morphemes like the plural and 3rd person possessive {-s} in English, and predictive processes play an important role in pattern finding (Grisoni et al., 2017), it is unsurprising that researchers have called for experiments about which gestures will support learning (Cook, 2018; Tellier, 2008) and have mentioned linguistic units as relevant (Gullberg, 2013, p. 1872). The present study (N = 19) was conducted to better understand if gestures which embody grammatical morphemes can contribute to pattern learning. The speeded-fragment-completion-task (Heyman et al., 2015) was adapted for gesture and used to assess changes in response time before and after learning. In week 1 and 3 in a silent self-paced task children completed 32 phrases such as the car's wind_w (window) or the cars cr_sh (crash). All phrases were completed in both a two-gesture (showing different plural and possessive {-s} gestures) and a one-gesture condition (with a single {-s} gesture). In week 2 training consisted of four hours of classroom activities aimed at encouraging learners to create mental representations of these same L2 constructions. Some activities, such as performing gestures for word-picture pairs, took place in one large group. Other games such, as gesture memory, were played in small groups.

A linear-mixed-effects model fit to participants' button-press latencies shows a decrease in mean response times after instruction in the two-gesture test condition (p = .039*). This decrease suggests that learners can benefit from instruction which visually differentiates between grammatical morphemes which differ in meaning but sound the same (Janzen Ulbricht, 2023).

Keywords: gesture, pattern, finding, morphology, linguistic units, testing procedures

*Speaker

Session 6: Language in Context: From Emotion to Communication

Chair: TBA

The Unique Role of Language in Reshaping Perceptual Discrimination: Evidence from Comparative Learning Paradigms

Tally Mccormick Miller*†[1] and Friedemann Pulvermüller[1]

[1]Brain Language Laboratory – Germany

Abstract

Recent theoretical work in cognitive linguistics suggests that language may fundamentally alter our perceptual capabilities, yet much previous research has focussed on amplifying or attenuating *existing* perceptual distinctions. Here, we look at whether language, and language alone, can actually help create entirely new perceptual discriminations that were previously unavailable to the senses. By looking at novel experimental evidence demonstrating that language holds a privileged position in enhancing perceptual discrimination, we offer a critical extension of linguistic relativity frameworks, and explore the neurobiological mechanisms underlying this language-perception interface.
Using a within-subject vocabulary learning design, we investigated whether associating difficult-to-discriminate tactile patterns with either pseudowords or matched musical sequences would differentially affect participants' ability to discriminate these patterns. Over five days, participants learned associations between tactile stimuli and either linguistic or musical labels, with stimuli counterbalanced to control for acoustic, linguistic, and cultural factors while eliminating group differences, increasing statistical power while avoiding potential confounds from using speakers of different native languages. We then measured using a two-alternative forced-choice task where participants discriminated between pairs of tactile patterns both before and after training. Crucially, only tactile patterns associated with language showed post-learning discrimination scores were significantly higher than the pre-learning scores, indicating a significant improvement in discrimination accuracy for these patterns. The same subjects showed no such enhancement for similar patterns with the same exposure when they were paired with musical sequences.

This finding provides compelling evidence for language's unique role in perceptual learning, which we will explain through neurobiological principles of Hebbian learning and multimodal integration. Drawing on the cell assembly framework, we will demonstrate how language-mediated learning enhances perceptual discrimination through:

- Formation of distributed cell assemblies that connect neurons distributed in both language and sensory cortices, following Hebb's principle that "neurons that fire together, wire together".
- Reduction of representational overlap between similar tactile patterns through binding with maximally dissimilar verbal labels.

*Speaker
†Corresponding author: tally.miller@fu-berlin.de

• Advantage of language's inherent multimodality, as verbal stimuli activate widely distributed networks across auditory, articulatory, and motor systems, providing stronger cortical feedback to perception than unimodal (musical) stimuli. These mechanisms extend beyond previous theoretical accounts by providing a neurobiologically constrained explanation based on specific neural circuits and Hebbian learning principles.

Keywords: linguistic relativity, perceptual learning, cross, modal integration, embodied cognition, categorical perception

N400 modulation by emotional context in motion-based conceptual time metaphors

Rosa Illán Castillo*†[1], Jennifer Krzonowski[1], Alice Roy[1], and Véronique Boulenger[1]

[1]Laboratoire Dynamique Du Langage UMR5596 – Centre national de la recherche scientifique - CNRS (France) – France

Abstract

Temporal experience is often understood and expressed through motion-based metaphors (e.g., *Time flies*, *The week dragged by*). These expressions reflect underlying mappings between space, motion, and time that are central to embodied cognition. This EEG study examines the interplay between emotional valence and semantic processing of time metaphors involving motion verbs. Specifically, we explore whether the N400 component-a neural marker of semantic integration difficulty-is sensitive to congruency between the emotional tone of a context sentence and the manner-of-motion expressed in a subsequent temporal metaphor.
Healthy English native participants read two-part sentences in which the first clause establishes an emotional frame (e.g., *We had fun at the beach*), followed by a metaphorical sentence about time using either a **manner-of-motion verb** (e.g., *The day flew by*) or a **path verb** (e.g., *The day passed by*). Crucially, for manner-verbs, the emotional frame was congruent with the meaning conveyed by the verb in half of the trials, whereas for the other half, the two were incongruent (e.g., *We had fun at the beach. The day dragged by).* EEG data, acquired with a 64-electrode Biosemi system, were preprocessed and analyzed using EEGlab. The N400 was examined in a time-window (300-500 ms) based on the grand averages.

We hypothesize that incongruent sentence pairs with **manner verbs** will elicit larger N400 amplitudes compared to congruent ones, reflecting increased difficulty in integrating incongruent metaphorically-induced emotional content. In contrast**, no** N400 difference between conditions should be observed for path verb sentences, suggesting that emotional interpretation in temporal metaphors is specifically tied to the manner component.
This study will clarify the role of verb semantics in shaping how we construe abstract experiences like the passage of time, thus contributing to our understanding of the embodied nature of language.

Keywords: time, motion, emotion, conceptual metaphor, n400

*Speaker
†Corresponding author: maria-del-rosario.illan-castillo@cnrs.fr

Understanding cetacean vocal behaviour, a case study with long-finned pilot whales

Paul Best*†[1,2], Lise Habib-Dasetto[1,2], Jules Cauzinille[1,2,3], Thierry Legout[4], Fabienne Delfour[5], Lilian Haristoy[6], Ricard Marxer[3], and Marie Montant[1,2]

[1]Centre de Recherche en Psychologie et Neurosciences – Aix Marseille Université, Centre National de la Recherche Scientifique – France

[2]Institute of Language, Communication and the Brain – Aix Marseille Université, Centre National de la Recherche Scientifique – France

[3]Laboratoire d'Informatique des Systèmes – Aix-Marseille Université - AMU – France

[4]Laboratoire Parole et Langage – Aix Marseille Université, Centre National de la Recherche Scientifique, Centre National de la Recherche Scientifique : UMR7309, Aix Marseille Université : UMR7309, Centre National de la Recherche Scientifique : UMR7309 /UMR6057 / ESA6057 / ERS164/ URA261 – France

[5]Ecole Nationale Vétérinaire de Toulouse – Institut National Polytechnique (Toulouse) – France

[6]Biskaya Exploration – Biskaya Exploration – France

Abstract

Long-finned pilot whales (*Globicephala melas*), as many toothed cetaceans, are both highly vocal and social animals. Their communication system comprises large vocal repertoires that are learnt and dialectic. Also, their matrilinear social groups are hierarchically structured in pods (usually around a dozen individuals) and clans (often reaching over hundreds of individuals). To some extent, these characteristics are shared with the human species. In practice however, the underwater environment in which they evolve, as well as their physiology, are obviously radically different from ours. In consequence, the species uses its vocal apparatus in a way that hardly resembles any form of human communication, making it a challenging but interesting point of comparison. By diving with wild pilot whales and collecting underwater video-acoustic data, we hope to better understand what type of information they might exchange when they vocalise. To do so, we contextualise vocal activity with behavioural context, and identify emitters via sound source localisation. Preliminary results suggest that pilot whales could use individual signatures (like some other cetacean species), thus somehow prioritising emitter identity over semantic content. We discuss how this behaviour might emerge from the specific socio-environmental constraints of pilot whales.

Keywords: bioacoustics, cetaceans

*Speaker

†Corresponding author: paul.best@univ-amu.fr

Session 7: Inner Processes & Social Cognition

Chair: TBA

The Silent Guide: How Inner Speech Shapes New Action Learning and Performance

Angelo Mattia Gervasi*[1], Claudia Mazzuca[2], Anna Borghi[3], and Claudio Brozzoli[4]

[1]Sapienza University of Rome - Lyon Neuroscience Research Center, INSERM U1028, UCBL1 – Equipe IMPACT, Centre de Recherche en Neurosciences de Lyon (CRNL), CNRS UMR 5292, INSERM UMRS 1028, Université Claude Bernard Lyon 1, Lyon, France. – France

[2]Sapienza - University of Rome – Italy

[3]Sapienza University of Rome - ISTC, CNR – Italy

[4]Lyon Neuroscience Research Center, INSERM U1028 – Equipe IMPACT, Centre de Recherche en Neurosciences de Lyon (CRNL), CNRS UMR 5292, INSERM UMRS 1028, Université Claude Bernard Lyon 1, Lyon, France. – France

Abstract

The growing evidence on the role of inner speech (IS) as a tool able to modulate cognition invites to reconsider the marginal role attributed to language in motor learning. IS may indeed also play a role in learning novel actions. In this preregistered study, we tested the hypothesis that limiting access to IS, by asking participants to perform an articulatory suppression task, would impair action learning.
A total of 104 healthy participants were randomly assigned to one of two groups. In the Articulatory Suppression group, participants continuously repeated the meaningful syllable "SA" during the observation of two novel actions composed by four motor sequences each, thereby interfering with the phonological loop and IS access. In the Dual-Task Control group, participants performed a finger-tapping task matched in rhythm with the Articulatory Suppression to control for the dual-task cognitive demand. In both groups, participants were instructed to observe the sequences with the intention of reproducing them afterwards.

During the recall phase, participants in the Articulatory Suppression group showed significantly poorer performance, both in terms of action accuracy and execution quality. Moreover, this group exhibited a higher incidence of non-learners-participants who completely failed to learn and reproduce actions. Self-reports confirmed reduced inner speech use during the learning phase, compared to the execution phase, in the Articulatory Suppression group, indicating the manipulation was successful in limiting inner speech access.
These results provide novel evidence for the involvement of IS in learning motor sequences. The findings highlight a cross-domain function of inner speech, extending its known influence beyond abstract cognition into motor domains. This work emphasizes the importance of considering linguistic processes-especially covert ones like IS-as integral components of action learning and broader cognitive functioning.

Keywords: Language, cognition, action, learning

*Speaker

Testing primed associations of gendered political charisma using high-fidelity virtual avatars

Scott Kunkel*†[1], Diego Frassinelli[2], Alec Gallo[1], Philine Link[3], Alejandra Quiros Ramirez , Susumu Shikano[1], Stephan Streuber[4], and Tamara Rathcke[1]

[1]Universität Konstanz – Germany
[2]Ludwig-Maximilian University of Munich – Germany
[3]Utrecht University – Netherlands
[4]Coburg University of Applied Sciences and Arts – Germany

Abstract

Exposure to a stimulus can facilitate recognition of a semantically related concept, a phenomenon known as semantic priming (Neely, 1977). For example, *nurse* is recognized faster when preceded by *doctor* than by *teacher*, suggesting that semantically associated concepts share conceptual representations and activation patterns. Similar effects occur with gendered roles, such that stereotypically gendered words (e.g., *doctor* vs. *nurse*) facilitate categorization of gender-congruent stimuli (e.g., *he* vs. *she*; Banaji & Hardin, 1996). However, it remains unknown whether gendered priming extends to abstract evaluative traits like charisma, which is typically male-associated (e.g., Hamstra, 2014). This study examined this question within a political context, testing whether charisma-related primes facilitate categorization of male- and female-associated words differently. We further explored whether word recognition is enhanced when speakers' gender aligns with masculine associations of political charisma, using embodied speech from high-fidelity virtual avatars.
In an online experiment, 320 British English speakers completed a 2AFC task in which they categorized written words as either male-associated (e.g., *sir*, *boy*) or female-associated (e.g., *madam*, *girl*). Before categorizing each word, participants were primed with a sentence expressing a view on political charisma (e.g., *Charismatic politicians are masters of persuasion*) or else shown a generic political statement without mention of a human agent (e.g., *Today's politics must emphasize sustainability*). Sentences were produced by eight speakers (four women, four men), each paired with an avatar designed to resemble a male or female speaker. Reaction times in correctly categorized trials were analyzed using Bayesian linear mixed-effects regression modeling. Contrary to expectations, results showed charisma-related sentences to facilitate categorization of female- but not male-associated words. Additionally, this effect was found for sentences produced by female but not male avatar speakers. These results not only challenge the notion of political charisma as primarily male-gendered, but also highlight a complex interplay between charismatic messaging and speaker gender.

References

Banaji, M. R., & Hardin, C. D. (1996). Automatic stereotyping. *Psychological science*, *7*(3), 136-141.

*Speaker
†Corresponding author: scott.kunkel@uni-konstanz.de

Hamstra, M. R. (2014). 'Big' men: Male leaders' height positively relates to followers' perception of charisma. *Personality and Individual Differences*, *56*, 190-192.
Neely, J. H. (1977). Semantic priming and retrieval from lexical memory: Roles of inhibitionless spreading activation and limited-capacity attention. *Journal of experimental psychology: general*, *106*(3), 226.

Keywords: semantic priming, gender stereotypes, embodied speech, political charisma

Grounding the Breakdown: Central and Autonomic Correlates of L2 Listening Obstacles

Triscia Biagiotti*†[1], Davide Spinelli*[2], Emilie Cousin[3], Monica Masperi[1], and Chantal Delon-Martin[4]

[1]LInguistique et DIdactique des Langues Étrangères et Maternelles – Université Grenoble Alpes : EA609, Université Grenoble Alpes – France

[2]Università degli Studi di Siena = University of Siena – Italy

[3]IRMaGe, Grenoble, France 4 Laboratoire de Psychologie et Neurocognition CNRS UMR 5105 – CNRS – France

[4][GIN] Grenoble Institut des Neurosciences – Université Grenoble Alpes, Institut National de la Santé et de la Recherche Médicale - INSERM – France

Abstract

Listening comprehension involves complex cognitive processes that play a central role in language acquisition. Decoding a verbal message from the speech stream-whether in L1 or L2-requires the activation of different cognitive processes that enable the listener to connect perceived phonetic input with prior knowledge (Cutler & Clifton, 1999; Field, 2013; Zoghlami & Hilton, 2021). Depending on the learner's proficiency and the automatization of certain processes (Satori, 2021; Field, 2024), L2 listening may involve higher or lower cognitive load (Buck, 2001; Roussel, 2021).

This study reports preliminary findings from an interdisciplinary project in language didactics, linguistics, and cognitive neuroscience. The goal of the project is to observe neurophysiological responses during an L2 Italian listening task, carried out with intermediate and advanced French-speaking learners. fMRI data allowed us to identify neural networks involved in linguistic processing in both L1 and L2. Simultaneously, autonomic responses-electrodermal activity (EDA) and pulse plethysmography (PPG), which reflects heart rate-were recorded. This multimodal setup enables us to examine how L2 comprehension is shaped by the interplay between central (CNS) and autonomic nervous system (ANS) activity.

In this presentation, we focus on two preliminary findings: first, the brain regions most actively engaged when comprehension breaks down, particularly in the presence of linguistic obstacles; second, how these neural patterns may be influenced by autonomic responses. In doing so, we suggest an embodied perspective on what occurs when comprehension fails in L2, highlighting the dynamic interplay between cognitive and physiological systems during language processing.

References

*Speaker

†Corresponding author: triscia.biagiotti@univ-grenoble-alpes.fr

Buck, G. (2001). *Assessing listening.* Cambridge: Cambridge University Press. Cutler, A., & Clifton, C. (1999). Comprehending spoken language: a blueprint of the listener. In C. Brown & P. Hagoort (Eds.), *The Neurocognition of language.* Oxford: Oxford University Press, 123-166. Field, J. (2024). Cognitive Insights Into First And Second Language Listening. In E. Wagner, A. O. Batty, E. Galaczi (Eds.), *The Routledge Handbook of Second Language Acquisition and Listening.* New York: Routledge, 13-28. Field, J. (2013). Cognitive validity. In A. Geranpayeh & L. Taylor (Eds.), *Examining listening.* Cambridge: Cambridge University Press, 77-151. Roussel, S. (2021). *L'approche cognitive en didactique des langues.* Louvain-la-Neuve : De Boeck Supérieur. Satori, M. (2021). Effects of working memory on L2 linguistic knowledge and L2 listening comprehension. *Applied Psycholinguistics, 42*(5), 1313-1340. Zoghlami, N., Hilton, H. E. (2021). La compréhension de l'oral en langue étrangère. In P. Leclercq, A. Edmonds, E. Sneed German (Dir.), *Introduction à l'acquisition des langues étrangères.* Louvain-la-Neuve : De Boeck Supérieur, 145-161.

Keywords: second language acquisition, listening processes, EDA, HRV, HR, fMRI