Embodied & Situated Language Processing Conference 2013

University of Potsdam, Germany
July 29 – July 31, 2013

Universität Potsdam

Welcome to the sixth annual conference on Embodied and Situated Language Processing (ESLP). The meetings aim to bring together researchers working on the interaction of language and visual/motor processing in embodied, situated, and language-for-action research traditions. A further goal is to unite converging and complementary evidence from behavioral, neuroscientific, computational, and neuropsychological methods.

Previous ESLP meetings

2007 Saarbrücken, GER

2009 Rotterdam, NL

2010 San Diego, USA

2011 Bielefeld, GER

2012 Newcastle Upon Tyne, UK

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Monday, 29 July 2013

9:00 – 10:00 **Barbara Kaup**

The role of sensorimotor processes in meaning composition

10:15 – 11:15 **Oral Session 1**

Gianelli: *How social context enhances the link between linguistic stimuli and motor behaviour (11)*
Klepp: *Interference of action verb processing with motor responses is modulated by imageability (12)*
Cuccio: *Context, motor simulation and the construction of meaning (13)*

11:15 – 11:45 Coffee Break

11:45 – 12:45 **Oral Session 2**

Guerra: *Spatial distance effects on real-time interpretation of social relations: evidence from eye tracking (14)*
Becker: *Eye-tracking reveals tense-response compatibility and incompatibility effects: The role of task and working memory (15)*
Münster: *Can a dynamic emotional face prime the semantic interpretation of an utterance? Comparing older and younger adults (16)*

12:45 – 13:30 Lunch

13:30 – 14:15 **Poster Session 1**

14:15 – 15:15 **Oral Session 3**

Carstensen: *Using bayesian models to discriminate theories of magnitude and metaphor (17)*
Howell: *Grounding words in meaning indirectly – A connectionist model of the propagation of grounding (18)*
Matsuyama: *SCHEMA: A framework of embodied conversational robots facilitating small groups (19)*

15:15 – 15:45 Coffee Break

15:45 – 16:45 **Oral Session 4**

Scorolli: *Learning abstract words: The key brick of language (20)*
De La Vega: *Being someone's right hand doesn't always feel right: Bodily experiences influence the processing of metaphoric language (21)*
Milhau: *Emotion from action: effect of lateral movements on the affective evaluation of neutral, positive and negative words (22)*

17:00 – 18:00 **Friedemann Pulvermüller**

Brain mechanisms of embodiment and disembodiment

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Brain mechanisms of embodiment and disembodiment

Tuesday, 30 July 2013

9:00 – 10:00 **Gabriella Vigliocco**

What if... the study of language started from signed, rather than spoken, languages?

10:15 – 11:15 **Oral Session 5**

Rinaldi: *An interactive account of visuo-spatial asymmetries: visuo-motor exploration is situated between biological and cultural determinants (23)*
Cohen: *Finger-counting and subitizing in the tactile modality (24)*
Winter: *How do people talk and gesture about numbers? Evidence from TV news casts (25)*

11:15 – 11:45 Coffee Break

11:45 – 12:45 **Oral Session 6**

Post: *Effect of instructional animations with and without gesture observation on grammar acquisition (26)*
Eberhard: *Mental simulation of action sentences in one's native vs. second language (27)*
Vukovic: *Corpses in lakes and messy knives: evidence for automatic perceptual simulation during bilingual L2 sentence processing (28)*

12:45 – 13:30 Lunch

13:30 – 14:15 **Poster Session 2**

14:15 – 15:00 **Oral Session 7**

Knott: *An embodied account of the syntactic domain of verbs (29)*
Flecken: *Event-duration estimations are modulated by grammatical aspect (30)*

15:00 – 15:30 Coffee Break

15:30 – 16:30 **Tatjana Nazir**

Interpreting the role of language-induced sensorimotor activity for the understanding of words

18:00 **Social Event**

Wednesday, 31 July 2013

9:00 – 10:00 **Anna Borghi**

Abstract concepts and words: The role of social acquisition

10:15 – 11:15 **Oral Session 8**

Egorova: *Neurobiology of speech act processing (32)*
Taylor: *The motoric basis of 'inner' speech (33)*
Kok: *Talking about tasting tea twists the tongue: Content-related motor interference in language production (34)*

11:15 – 11:45 Coffee Break

11:45 – 12:45 **Oral Session 9**

Moseley: *Sensorimotor semantics in autism: disembodiment and category specific impairments (35)*
Lewis: *Say it like you mean it: Lexical meaning influence prosody (36)*
Myachykov: *Attention, language, and manipulation affordances (37)*

12:45 – 13:15 **Concluding remarks & announcements**

Poster Sessions

Monday

Bergmann: Fictive motion in action: Gestures and visual representations co-occurring with fictive motion sentences in TV news (51)

Bianco: What is beyond a pianist's hand? Syntax in musical motor acts. (52)

Caroline: Memory for action: Does semantic relation between word and action is a necessary condition to enhance memory performance? (53)

Coello: The mutual roles of action representations and spatial deictics in French language (54)

Derix: Investigating situated language in real-life discourse using electrocorticography (55)

Dutriaux: Mental simulation of action and weight in language understanding and memory (56)

Hohenstein: Eye movements are influenced by the extraction of meaning from parafoveal words in reading (57)

Kacinik: Small elephants and big needles: Can perceptual information affect memory and judgments about the meaning of words? (58)

Lachmair: Embodiment in numerosity and language and their interaction with space: Is there a common embodied representation of space? (59)

Lam: A task comparison of motor activation in online sentence comprehension (60)

Lindemann: Spatial interference in mental arithmetic (61)

Speed: Do speed verbs affect low-level speed discrimination processes? (62)

Stocker: Do our eyes look along the mental time line? (63)

Vinson: Visuospatial memory's sensitivity to language and image orientation (64)

Winter: Reasoning about similarity and proximity (65)

Tuesday

Aravena: The context-driven meaning construction effects on language induced motor activity: Grip-force study of linguistic focus and lexical anticipation (71)

Citron: Powerful and positive words are up only when metaphor is primed (72)

Eberhard: Perspective-taking strategies for grounding spatial reference in a situated directive task (73)

Feldmeth: Identification depends on individual characteristics - A new perspective on perspective in simulated actions (74)

Festman: Using Xbox Kinect to explore spatial-numerical association of arm movements in parity judgments (75)

Guerra: Is conjunction meaning grounded in spatial representations? (76)

Hatfield: Gesture tracking on tablet devices as an experimental platform (77)

Huang: Up/North is not always good: Metaphorical associations between cardinal direction and valence are different in Hong Kong and in the United States (78)

Iljina: An investigation into real-world speech production and perception by means of ECoG (79)

Lachmair: The influence of number magnitude on words with implicit location information (80)

Minaew: The early ups and downs of morality: Evidence for embodied moral evaluation in 24-month olds (81)

Philipp: Modality compatibility in a semantic categorization task (82)

Roman: The role of reading direction in mental model construction during auditory language comprehension (83)

Sidhu: Suppressing sound symbolism: The role of embodiment in the Bouba/Kiki effect (84)

Zloteanu: The effect of body posture and empathy on the recognition of facial expressions of emotions and deception detection (85)

de Nooijer: When left is not right: Handedness effects on learning object-manipulation words using pictures with left or light-handed first-person perspectives (86)

Invited Speaker

The role of sensorimotor processes in meaning composition

BARBARA KAUP

University of Tübingen/Germany

According to the embodied-cognition framework of language comprehension, sensorimotor processes play an important role for meaning composition: During language processing, comprehenders are assumed to mentally simulate the objects, situations and events referred to in the linguistic input. More specifically, it is usually assumed that words automatically activate experiential traces in the brain that stem from the comprehenders' interactions with the referents of these words. When words appear in larger phrases or sentences, the activated experiential traces are presumably combined to yield an experiential simulation consistent with the meaning of the larger phrase or sentence. Abstract concepts are assumed to be captured in these simulations by being metaphorically mapped onto more concrete experiential dimensions, and linguistic operators such as negation or disjunction are typically considered to function as cues controlling specific integration processes.

I will report on-going research projects investigating these assumptions. In addition, I will present some preliminary results from experiments investigating developmental aspects, as well as from studies looking at second language processing, which shed further light on the embodied-cognition framework.

Brain mechanisms of embodiment and disembodiment

FRIEDEMANN PULVERMÜLLER

Freie Universität Berlin, Germany

How brain structures and neuron circuits mechanistically underpin symbolic meaning has recently been elucidated by neuroimaging, neuropsychological and neurocomputational research. Modality-specific "embodied" mechanisms anchored in sensorimotor systems appear to be relevant as are "disembodied" mechanisms in multimodal areas [1-3]. Four semantic mechanisms are proposed and spelt out at the level of neuronal circuits: (a) referential semantics establishing links between symbols and the objects and actions they are used to speak about, (b) combinatorial semantics allowing the learning of symbolic meaning from context, (c) emotional-affective semantics establishing links between signs and internal states of the body, and (d) abstraction mechanisms generalizing over a range of instances of semantic meaning. Referential, combinatorial, emotional-affective and abstract semantics are complementary mechanisms each necessary for processing meaning in mind and brain [1,4].

[1] Pulvermüller, F. 2013. How neurons make meaning: Brain mechanisms for embodied and abstract-symbolic semantics. Trends in Cognitive Sciences, in press.

[2] Pulvermüller, F. 2013. Semantics embodiment, disembodiment, and misembodiment: In search for meaning in modules and neuron circuits. Brain and Language, in press.

[3] Kiefer, M., & Pulvermüller, F. 2012. Conceptual representations in mind and brain: Theoretical developments, current evidence and future directions. Cortex, 48 (7), 805-825.

[4] Pulvermüller, F. 2012. Meaning and the brain: The neurosemantics of referential, interactive, and combinatorial knowledge. Journal of Neurolinguistics, 25 (5), 423-459.

What if... the study of language started from signed, rather than spoken, languages?

GABRIELLA VIGLIOCCO

University College London, UK

Our understanding of the cognitive and neural underpinning of language learning and processing has been highly influenced by the fact that empirical research and theoretical development has been solidly based on spoken languages. Since the 70s, researchers have begun to recognise the importance of investigating signed languages in order to determine which aspects of language can be considered to be universal and which, instead, ought to be regarded as modality-specific. However, the study of sign languages has been in large part completely driven by the theoretical ideas developed for spoken languages.

In the talk, I will challenge this approach focusing on "iconicity" (namely, the presence of a transparent link between linguistic form and meaning). Theories of language acquisition and processing are dominated by the idea that the link between linguistic form and meaning is arbitrary; non-arbitrary mappings are often dismissed as coming only from extremely narrowly constrained domains like onomatopoeia and baby-talk. Yet in sign languages (taking advantage of the possibility of mapping visual forms into hand, mouth and body shapes) iconicity is the norm, rather than the exception, nonetheless because sign languages have been predominantly analysed using the theories developed for spoken languages, these iconic mapping have not traditionally been considered as important. Thus, we may ask whether iconicity would be incorporated in theories if we started from sign languages.

I will present behavioural work that shows that iconicity plays a role in language processing and language development in British Sign Language (BSL) with iconic signs being processed more effectively and learnt earlier than non-iconic signs. I will then present a theoretical proposal according to which iconicity and arbitrariness both would come about because of critical constraints such as the need for the signal to be discriminable (which would favour arbitrariness) and the need for linguistic form to refer to the world (which would favour iconicity). Thus, iconicity would play a critical role in bridging between linguistic form and human experience (establishing reference), rendering language embodied.

Interpreting the role of language-induced sensorimotor activity for the understanding of words

TATJANA NAZIR

L2C2-CNRS (National Center for Scientific Research), France

Given the systematic involvement of the brain's motor structures in processing language that refers to motor actions, the coupling of neural networks underlying action and language processing is no longer a matter of debate. However, the interpretation of this data still confronts theoretical positions regarding the function of the mo-

tor system in language understanding. Traditional discussions in this domain have been centered on the question about whether such language-induced motor activation should be considered as part of the "low-level" lexical access or as the result of the ensuing "higher-level" process of meaning integration. Answering this question has been considered as responding to the question about the functional or epiphenomenal status of sensorimotor structures in language. Yet, since psycholinguistic studies have challenged the separation of the language comprehension process into two steps ("lower" and "higher" levels), the functional role of sensorimotor structures should perhaps not be discussed in terms of their contribution to an initial step of context-free lexical access. By presenting action words within sentences we will demonstrate how the sentential context coordinates the recruitment of motor structures. Based on these data alternative views of the role of language-induced motor activity will be discussed.

Abstract concepts and words: The role of social acquisition

ANNA M. BORGHI

University of Bologna/ Institute of Cognitive Sciences and Technologies, CNR, Rome

I will outline a theoretical proposal on abstract concepts and words, called WAT: Words As social Tools (Borghi & Cimatti, 2009; 2012; Borghi, in press). The proposal has four central principles: 1) embodiment and grounding. both concrete and abstract concepts are embodied and grounded; 2) acquisition: the linguistic mediation and the social influence is more crucial for acquiring abstract than concrete words; 3) brain representation: compared to concrete concepts, abstract concepts activate more linguistic brain areas; their different brain representation probably depends on their different acquisition modality; 4) linguistic variability affects more abstract than concrete concepts. I will present the proposal in light of recent behavioral and neural supporting evidence (e.g., Borghi et al., 2011; Gianelli et al., 2013; Sakreida et al., in press; Scorolli et al., 2011; 2012), I will discuss it in the framework of current theories on abstract concepts and words and will outline further research directions necessary to strengthen it.

Oral Presentations

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How the social context enhances the link between linguistic stimuli and motor behaviour

CLAUDIA GIANELLI[1], LUISA LUGLI[2], GIULIA BARONI[2], ROBERTO NICOLETTI[2] & ANNA M. BORGHI[3] [1]*University of Potsdam;* [2]*University of Bologna;* [3]*University of Bologna & National Research Council, Rome*

In the current study we investigated whether and how reading sentences describing a social context can influence our motor behaviour. To this aim we created sentence stimuli in which objects with a positive/negative connotation, both in term of valence (e.g., attractive/smooth) and in term of grasping (e.g., ugly/prickly), could be moved towards the self or towards a generic "another person" target (e.g., "The object is ugly/smooth, bring it to you/give it to another person"). Participants judged whether each sentence was sensible or not by moving the mouse towards or away from their body. Mouse movements were recorded and analysed using behavioural and kinematic parameters, focusing on reaction times (RTs) and amplitude of velocity peaks. Participants could perform the task in one of three conditions: alone (Control condition), sitting in front of an experimenter who acted as a mere observer (Social condition), or interacting with the experimenter who acted as a confederate at the end of task execution (Shared condition). These manipulations aimed at creating a social context at different degrees. Data from both RTs and velocity peaks showed that the presence of a real other person observing or acting as a confederate enhanced the link between the linguistic stimuli and the motor system, thus producing effects similar to a real social interaction, with lower velocity peaks and slower RTs in the Shared as compared to the Social condition, and to the Control condition as well. Similarly, the social context affected the processing of object properties, in particular the those related to grasping, by slowing down RTs and lowering velocity peaks in the Shared condition as compared to the Social one.

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Interference of action verb processing with motor responses is modulated by imageability

ANNE KLEPP[1], VALENTINA NICCOLAI[1], GIOVANNI BUCCINO[2], ALFONS SCHNITZLER[1] & KATJA BIERMANN-RUBEN[1] [1]*Institute for Clinical Neuroscience and Medical Psychology, Heinrich-Heine University, Duesseldorf;* [2]*Department of Medical and Surgical Sciences, University Magna Graecia, Catanzarx*

A semantic decision task on action verbs can lead to slower motor responses if the effector used to give the response coincides with the one involved in the actual execution of the action, i.e. prolonged hand reaction times to hand-verbs in comparison to foot-verbs (Sato et al., 2008). Using magnetoencephalography (MEG) to investigate the neuronal origins of this interference effect, we recorded brain activation of 19 subjects performing Go/NoGo concrete/abstract-judgements on 126 German verbs describing actions performed with hands, feet, or no body part. Button press responses were given with the right hand only if concrete (i.e., hand- or foot-) verbs were shown, creating potential interference of hand-verb language processing with motor planning. All stimuli were matched for word familiarity, hand and foot action verbs additionally for imageability. Including effector and imageability as dichotomous factors in an ANOVA, faster reaction times were found for verbs with high compared to low imageability ($p < 0.001$). More importantly, imageability interacted with effector ($p < 0.032$; Figure 1): for highly imageable hand-verbs, motor responses were slower than for highly imageable foot-verbs. First preliminary MEG data analyses point towards beta-oscillatory modulations during word processing and response planning. How this mediates the observed behavioural effects remains to be investigated. Our behavioural results indicate that the beneficial effect of higher imageability on action verb processing time is perturbed when verb and motor response relate to the same body part. These findings are in line with an embodied view of language processing, with recruitment of sensorimotor brain areas depending on the task and other variables related to the language material, for

instance imageability.

Sato M, Mengarelli M, Riggio L, Gallese V, Buccino G (2008). Task related modulation of the motor system during language processing. Brain Lang;105(2):83-90.

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Context, motor simulation and the construction of meaning VALENTINA CUCCIO *School of Mind and Brain; Humboldt University Berlin*

Meaning is a pragmatic process and needs to be situated in a context to be correctly disambiguated and understood. Thus, context of utterance and communicative intentions of speakers contribute in a fundamental way to the construction of meaning. Only recently, this issue has started to be addressed in the embodied language research (Cuccio, 2012; Papeo, Corradi-Dall'Acqua, Rumiati, 2011; Papeo, Rumiati, Cecchetto & Tomasino, 2012; van Dam, Rueshemeyer, Lindemann and Bekkering, 2010; van Ackerenm Casasanto, Bekkering, Haggort, Rueschmeyer, 2012). Behavioural (van Dam, Rueshemeyer, Lindemann and Bekkering, 2010) and fMRI studies (Papeo, Rumiati, Cecchetto & Tomasino, 2012) found that contextual information prevails over semantics during the processing of action related verbs. However, how precisely context affects motor simulation is still an open question. It is possible to hypothesize that motor simulation, in spite of being automatically triggered by intrinsic semantic features, could be inhibited by the processing of contextual information. Alternatively, context might act before the onset of any motor simulation associated to linguistic processing determining the selection of the contextually salient pattern of motor activation. It is also likely that both these mechanisms take part in the process of contextually determined motor simulation. Indeed, Chersi, Ferrari & Fogassi (2011) proposed a computational model of neural chains for action in the parietal lobe in which both the inhibition and the selection mechanisms are involved. Noticeably, this model predicts that motor simulation during linguistic processing can still be considered automatic. Context is a fundamental part of the construction of meaning and can act by selecting the right neural chain of motor simulation or by inhibiting a wrong one. Thus, in this view, contextual information is an integral part of the process that leads to the construction of meaningful information is an integral part of the process that leads to the construction of meaning.

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Spatial distance effects on real-time interpretation of social relations: evidence from eye tracking ERNESTO GUERRA & PIA KNOEFERLE *Cognitive Interaction Technology Excellence Cluster and Department of Linguistics, Bielefeld University*

According to conceptual metaphor theory, there is a direct relation between abstract ideas (e.g., social relations) and spatial distance. Indeed, a recent study showed that spatial distance can influence participants' evaluation of social bonds (1). Another study found that introducing figures as friends (vs. strangers) modulated the spatial distance between them and a path drawn by participants (2). Could such spatial-distance effects also affect the comprehension of sentences about social events incrementally? In two eye-tracking reading experiment we crossed distance (close vs. far) with social relations (friendly vs. unfriendly). In Experiment 1, participants examined a visual context showing two cards-with-words (far apart vs. close together), followed by a German sentence about a friendly (vs. unfriendly) encounter between two characters (see 1). The words on the cards were the first two sentential nouns. In Experiment 2, the visual context was identical, but we changed the sentence structure (see 2).

1. "Sandra and her $\text{aunt}_{\text{NPs-coord.}}$ met_{VP} $\text{cheerfully/grumpily}_{\text{ADV}}$ in the $\text{elevator}_{\text{PP}}$".

2. "$\text{Sandra}_{\text{NP1}}$ met_{VP} $\text{cheerfully/grumpily}_{\text{ADV}}$ $\text{her aunt}_{\text{NP2}}$ in the $\text{elevator}_{\text{PP}}$".

Reading times revealed rapid and incremental interaction effects between spatial distance and social relations in spill-over (Experiment 1) and first-pass (Experiment 2) measures. In Experiment 1, reading times were shorter when sentences about friendly relations were preceded by cards close together (vs. far apart) and vice versa for sentences that expressed an unfriendly relation. In Experiment 2, however, the opposite pattern was found; reading times were longer for "friendly" sentences when preceded by cards close together (vs. far apart) but shorter for sentences expressing an unfriendly social relation. We discuss the implications of these results for the co-indexing between abstract language and spatial information.

1: Williams & Bargh. (2008). Keeping One's Distance. Psychological Science 19, 302-308.
2: Matthews & Matlock. (2011). Understanding the link between spatial distance and social distance. Social Psychology 42, 185-192.

.. 15 ..

Eye-tracking reveals tense-response compatibility and incompatibility effects: The role of task and working memory RAY B. BECKER[A], BRIDGETTE DECOT[A], ERNESTO GUERRA[A], PIA KNOEFERLE[A] & ROLF ZWAAN[B]
[a]*Cognitive Interaction Technology Excellence Cluster and Department of Linguistics, Bielefeld University;* [b]*Department of Psychology, Erasmus University*

Recent evidence [1] showed that tense-response compatibility effects (faster response times for future-tense sentence when pressing a button with the right-hand (vs. left-hand), and vice versa for past-tense sentence), are observed only when the task relates to the sentence tense. However, response times are a course-grained measure, providing little insight into the time course of sentence comprehension and response preparation. In three eye-tracking experiments, we investigated tense-response compatibility effects and we also assessed participants' working memory (WM). Participants read German sentences such as (1), while planning a left- or right-hand response.

(1)'Yesterday$_{ADV}$ folded$_{VP}$ Jennifer$_{NP1}$ in the living room$_{PP}$ the laundry$_{NP2}$.'

In Experiment 1 we asked participants to judge tense (past or future), but only respond if the sentence made sense. In Experiment 2 we asked participants to decide if the sentence made sense or not. In Experiment 3 we asked participants to judge the subject noun phrase (singular or plural), but only respond if the sentence made sense. Experiment 1 showed compatibility effects in the ADV-region, however, the opposite pattern appeared in the NP1 region. Response times also revealed compatibility effects, but our results suggest that such effect was driven by low-WM readers. In Experiment 2, we found compatibility effects for high-WM readers in the VP-region; no effects were observed in response times. In Experiment 3, we found compatibility effects in the PP-region, but only for singular-noun sentences. For plural-noun sentences, we found an incompatibility pattern. Response times also revealed incompatibility effects for plural-noun sentences. Our results showed interaction effects between tense and response-hand even without a tense-explicit task. Moreover, we showed both compatibility and incompatibility effects depend on participants' WM and task demands. This evidence should help to refine views of embodied cognition.

[1] Ulrich, & Maienborn. (2010). Left-right coding of past and future in language. Cognition 117, 126-138.

.. 16 ..

Can a dynamic emotional face prime the semantic interpretation of an utterance? Comparing older and younger adults KATJA MÜNSTER[1, 2], MARIA NELLA CARMINATI[1, 3] & PIA KNOEFERLE[1, 2, 3] [1]*Department of Linguistics and SFB 673 "Alignment in Communication";* [2]*Cognitive Interaction Technology Excellence Center;* [3]*Department of Linguistics Bielefeld University*

For situated language comprehension, little is known about how a speaker's behavior is integrated with utterance meaning and a referential visual context. Indeed, the speaker is often "disembodied" and participants only hear her voice. In two visual-world eye-tracking studies we examined how the emotional facial expressions of a video-taped speaker affected listeners' comprehension of emotional utterances about event photographs. We tested further whether predictions of socio-emotional selectivity theory (young adults attend more to negative and older adults more to positive stimuli, e.g. Isaacowitz et al., 2006; Mill et al., 2009) extend to spoken sentence comprehension. Participants (young:18-30 years; older:60-80 years; both Ns=16) inspected a dynamic facial expression that was either happy or sad. Next, an either positively or negatively valenced sentence described one of two pictures (positive and negative; presented simultaneously). Participants verified whether the facial expression matched (50 percent of the trials) or mismatched the sentence in valence. Listeners began to gaze more at the event photograph that matched (vs. mismatched) the speaker's emotional expression as soon as reference was disambiguated. Older adults were more strongly influenced by the positive speaker face whereas younger adults were more strongly influenced by the negative speaker face. Thus, a speaker's facial expressions can incrementally influence sentence comprehension; and the negativity and positivity biases in young and older adults respectively extend to face-sentence priming.

Isaacowitz, D. M., Wadlinger, H. A., Goren, D., & Wilson, H. R. (2006). Selective preference in visual fixation away from negative images in old age? An eye-tracking study. Psychology and Aging, 21, 40-48.

Mill, A., Allik, J., Realo, A., Valk, R. (2009). Age-related differences in emotion recognition ability: A cross-sectional study. Emotion, 9(5), 619-630.

.. 17 ..

Using Bayesian models to discriminate theories of magnitude and metaphor ALEXANDRA CARSTENSEN, JOSHUA ABBOTT & RICHARD IVRY *University of California, Berkeley*

People perceive time in the absence of a dedicated perceptual system for timing, but systematically conflate temporal information with other scalar quantities, particularly spatial extent. Two influential accounts of this phenomenon contend that people think about time and space via obligatory mappings between domains, but make contrasting claims about the nature and structure of such mappings. Conceptual Metaphor Theory holds that information in the spatial domain is used asymmetrically to structure the perceptually abstract domain of time (Lakoff & Johnson, 1999). In contrast, A Theory of Magnitude argues that scalar dimensions such as time and space rely on overlapping representations in a shared metrical processing system (Walsh, 2003). Despite clear theoretical differences and substantial empirical support for both theories, neither account makes predictions specific enough to discriminate empirically without additional assumptions. Here we address this problem of underspecification by formalizing each theory in terms of simple Bayesian models. We draw on methods from the memory reconstruction literature to estimate time and space representations on an individual basis, and use these estimates to predict behavior in an established time and space judgment paradigm (Hemmer & Steyvers, 2009; Xu & Griffiths, 2010). We show that this computational formalism can be applied to clearly specify these theories in comparable terms and provide a basis for better informed comparison of their predictions.

Hemmer, P., & Steyvers, M. (2009). A Bayesian account of reconstructive memory. Topics in Cognitive Science, 1, 189-202.

Lakoff, G. & Johnson, M. (1999). Philosophy in the flesh: The embodied mind and its challenge to western thought. New York: Basic Books.

Walsh, V. (2003). A theory of magnitude: common cortical metrics of time, space and quantity. Trends in Cognitive Sciences, 7(11), 483-488.

Xu, J. & Griffiths, T.L. (2010). A rational analysis of the effects of memory biases on serial reproduction. Cognitive Psychology, 60(2), 107-126.

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Grounding words in meaning indirectly - A connectionist model of the propagation of grounding STEVE R. HOWELL[1] & AND, SUZANNA BECKER[2] [1]*Keystone College;* [2]*McMaster University*

Understanding how children learn to map from the orthographic or phonological forms of words to their meanings is a long-standing problem. Connectionist models of this learning process have typically resorted to presenting direct pairings of word forms and meanings. However, in most of the linguistic input a person receives, the meanings of words must be inferred from past experiences and context. We describe a neural network model that begins the learning process through exposure to direct pairings of word forms and their meanings, but subsequently generalizes to more indirect acquisition of word meanings. These word meanings were defined via a set of pre-linguistic conceptual representations that were designed to be as representative as possible of the sensory and motor (sensorimotor) representations of concepts that pre-linguistic children might have, for all of children's earliest words as represented on the MacArthur Communicative Development Inventory (MCDI - Fenson et al, 2000). The network had the dual task of producing the meaning representations for each input word, as well as predicting the next word that would occur. Most words had training targets provided for their meaning representations ('grounded' examples, which map to children's experience of learning a word in the presence of its referent) and the network quickly learned these. However, the network also produced the correct meaning representations for many words which had never had meaning representation targets (ungrounded examples). We argue that this "propagation of grounding" is due to the overlapping task demands that allowed syntactic and semantic word co-occurrence information to influence the word meanings being learned, much as children might learn novel words from context while reading.

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SCHEMA: A framework of embodied conversational robots facilitating small groups YOICHI MATSUYAMA *Department of Computer Science, Waseda University*

We propose the SCHEMA (pronounced as [she:ma]) framework for embodied conversational robots facilitating small groups. SCHEMA was originally designed for a conversational robot that has social capabilities in multiparty situations [1]. We have developed social functions for facilitation tasks, such as a party game task for elderly people [2] and general chatting tasks. We assume four-participant conversation is the minimum unit that needs facilitation skills. In general, three is the minimum number of participants of a multiparty conversation. In such three-participant situations, back-and-forth interactions between two participants out of three primarily occur and another participant tends to be left behind, who cannot properly get floors to speak. Here, they need one more participant who helps the participant left behind to harmonize him/her with the others. Conversational robots have potentials to participate in such conversations as the fourth participant with embodied capabilities. When such an embodied robot steps in the situation to help, there should be proper facilitating procedures to obtain initiatives to control conversational contexts. In this presentation, we show an overview of the SCHEMA framework, including representations of conversational protocols and procedures of obtaining initiatives controlling conversational contexts. These situations and strategies were modeled and optimized as the partially observable Markov decision process. We also show serendipitous question answering capabilities triggering conversations to drive.

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[2] Y. Matsuyama, S. Fujie, H. Taniyama, T. Kobayashi, Psychological evaluation of a group communication activation robot in a party game, in: Eleventh Annual Conference of the International Speech Communication Association, 2010.

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Learning abstract words: The key brick of language CLAUDIA SCOROLLI[1], CARMEN GRANITO[1] & ANNA M. BORGHI[1,2]
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The WordsAsTools proposal (Borghi & Cimatti, 2012) explains the difference between abstract and concrete words by referring to the more relevant role of linguistic information for the former than for the latter. This is due to different acquisition mechanisms: differently from "bread, the meaning of "freedom" has to be explained linguistically. We aimed to verify the hypotheses that word-tool (H1) strengthens the boundaries between categories; (H2) plays a more important role for abstract than for concrete concepts. The referents of concrete concepts were operazionalized as novel Objects (Lego bricks arranged in a similar way); for abstract concepts we selected novel Relations (spatial relations between the Objects; see Borghi et al, 2011). After an experiential training, participants had to group both kinds of exemplars in six different categories. Consistently with literature, with concrete exemplars responses were affected by perceptual features, and were consistent across subjects. Afterwards, half of the participants were provided by a verbal label plus an explanation for each exemplar. When asked to decide whether two elements belonged to the same category - using a keyboard or a microphone - linguistically trained participants performed better than the no-language group (H1). The two groups strongly differed as far as abstract concepts were concerned, particularly for mouth responses (H2). Finally participants had to choose whether a given label matched the previous presented exemplar: data converged in showing a microphone advantage for abstract exemplars. This evidence supports WAT: language is relevant for concrete and abstract words, as it helps better differentiate between categories. Nonetheless, it is more accessible in the representation of abstract word meanings.

Borghi, A.M., Flumini, A., Cimatti, F., Marocco, D., Scorolli, C. (2011) Manipulating objects and telling words. Front. Psychology 2:15.
Borghi, A.M., Cimatti, F. (2012). Words are not just words: the social acquisition of abstract words. RIFL-ISSN: 2036-6728, 5, 22-37

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Being someone's right hand doesn't always feel right: Bodily experiences influence the processing of metaphoric language IRMGARD DE LA VEGA, CAROLIN DUDSCHIG & BARBARA KAUP *University of Tübingen*

In the last years, there has been growing evidence for the assumption that bodily experiences have an impact on language comprehension. However, there is mixed evidence

whether previous experiences influence only the processing of concrete linguistic expressions or whether they affect even the processing of abstract or metaphoric language. If experiences affect the processing of abstract language, then individuals with different bodily experiences should show differences in the processing of abstract information, depending on whether this information is at odds with their previous experience or not. A testbed for this idea are the different experiences of left- and right-handers, which lead left-handers to associate positive entities with their left hand, and right-handers with their right hand (Casasanto, 2009), and linguistic metaphors mapping good to the right and bad to the left (e.g., Paul is Linda's right-hand man vs. Paul has two left feet). If bodily experiences affect the comprehension of abstract language, then left-handers should have more difficulties to process metaphors that map good to the right and bad to the left than right-handers, as the underlying concept of such metaphors is at odds with their experiences. We found evidence for this assumption: In comparison to control conditions, left-handers processed linguistic left-right metaphors significantly slower than right-handers, indicating that bodily experiences affect the processing of abstract language.

Casasanto, D. (2009). Embodiment of abstract concepts: Good and bad in right- and left-handers. Journal of Experimental Psychology: General, 138(3), 351-367.

.. 22 ..

Emotion from action: effect of lateral movements on the affective evaluation of neutral, positive and negative words

AUDREY MILHAU, THIBAUT BROUILLET & DENIS BROUILLET *Epsylon Laboratory, University Montpellier 3*

Idioms in various languages associate good with right and bad with left (e.g. "my right-hand man" or "he has two left feet"). These expressions might reflect right-handers' conception of valence. According to Casasanto's Body-Specificity Hypothesis (2009), the way we interact with our environment determine the way we think about abstract concepts such as valence. Right-handers associate rightward space and positive valence because of their manual dominancy: actions are easier and more efficient on their dominant side than on their non-dominant side. We hypothesize that lateralized actions induces an affective connotation whose valence depends on the side of action. This affective connotation might affect valence judgments, provided that evaluations take place on a response device mapping valence across the horizontal space. Three experiments consisted in lateral movements of response in a visual detection task, followed by a valence judgment task on either neutral, positive or negative words. We also manipulate the orientation of the evaluative scale, with a presentation either matching or mismatching the valence/laterality associations usually encountered in right-handers (respectively right/positive and left/negative versus right/negative and left/positive). We expected rightward movements to cause a more positive evaluation of words, especially when the scale matches classic associations, while leftward movements should cause a more negative evaluation, particularly on a mismatching scale. Results showed that execution of rightward movements and the use of the matching scale led to more positive evaluations of words (especially the neutral ones), while the realization of leftward movements associated to the mismatching scale led to more negative evaluations of both positive and negative words. These results emphasize the emergent nature of the hedonic judgment of words, which appears sensitive to both situational and functional constraints.

Reference Casasanto, D. (2009). Embodiment of Abstract Concepts: Good and Bad in Right- and Left-Handers. Journal of Experimental Psychology: General, 138(3), 351-367

.. 23 ..

An interactive account of visuo-spatial asymmetries: Visuo-motor exploration is situated between biological and cultural determinants

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A growing amount of evidence confirms the influence of the reading and writing habits on visuo-spatial processing, although this phenomenon has been so far testified mainly as a lateralized shift of a single behavioral sign (e.g., line bisection), with a lack of data from pure right-to-left readers (for a review, see

Chokron et al., 2010). The present study contributes to this topic by analyzing multiple attentional and visuo-motor indexes in monolingual Italian (i.e., reading from left-to-right), monolingual and bilingual Israeli (i.e., reading from right-to-left only -Hebrew- or also from left-to-right -English-) participants' performance. Subjects were administered a computerized line bisection task (Experiment 1), a standard star cancellation task (Wilson et al., 1987) and a modified version, in which English letters and words were replaced by Hebrew ones (Experiment 2). Additionally, we designed three versions of the cancellation task (i.e., composed respectively by geometric shapes, English and Hebrew letters), in order to test whether the mere exposure to spatially oriented information might have biased the exploration (Experiment 3). Tasks were presented on a graphics tablet, allowing recording of both chronometric and spatial parameters (i.e., measured in x, y vector coordinates). Taken together, results showed that the on-line visuo-motor performance was modulated by the reading direction (i.e., left-to-right vs. right to left Shifts), from the beginning (i.e., First Mark) to the end of the task (i.e., spatial distribution of Omissions and subjective Epicenter), along with the spatial bias observed in line bisection. Moreover, a clear dissociation emerged in chronometric and spatial parameters, both between reading groups and between different stimuli. This pattern of results favors an Interactive Account, according to which cultural factors, such as the directional scanning associated to language processing, biological factors, such as hemispheric specialization, and situated factors, i.e., determined by contextual requirements, interplay in modulating visuo-spatial processing.

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Tactile subitizing using one hand ZAHIRA Z. COHEN & AVISHAI HENIK *Ben-Gurion University of the Negev, Israel*

Counting small numbers of items-subitizing-is considered to be a pre-attentive, fast and accurate process. Subitizing has been studied mostly with visual presentations and the results are reliable and consistent. In contrast, the study of subitizing in the tactile modality is sparse and the findings are inconclusive. Gallace, Tan and Spence (2008) reported no subitizing pattern in a finger counting experiment. They suggested that this might be related to the duration of stimulus presentations and to the distribution of stimuli across the skin surface. Our study explores various aspects of finger counting and subitizing in the tactile modality. The main manipulation for the number of items was vibro-tactile stimuli on the fingertips of one hand. Stimuli were presented to the dominant or the non-dominant hand and applied in three distribution conditions: neighboring fingers (e.g., thumb-index-middle), distributed fingers (e.g., thumb-middle-pinkie) or mixed (e.g., thumb-index-ring). We conducted two experiments differing in stimuli exposure time (100 ms / 800 ms). The results of the two experiments showed no subitizing pattern regardless of stimuli distribution or exposure time. Stimuli presented to the dominant hand generally yielded faster and more accurate responses only with the 100 ms exposure time. Importantly, unlike Gallace et al.'s suggestion, when the stimuli were presented to non-neighboring fingers, the accuracy rate was lower and the response time was longer than when the stimuli were presented to neighboring fingers. These results are discussed in relation to embodied numerosity; namely, finger counting is based on sequential order of the fingers, therefore stimuli applied to neighboring fingers (vs. non-neighboring fingers) are processed more efficiently.

Gallace, A., Tan, H. Z., & Spence, C. (2008). Can tactile stimuli be subitized? An unresolved controversy within the literature on numerosity judgments. Perception, 37, 782-800.

.. 25 ..

How do people talk and gesture about numbers?: Evidence from TV news casts BODO WINTER[1], MARCUS PERLMAN[1], ALAN MISLOVE[2] & TEENIE MATLOCK[1] *[1]University of California, Merced, Cognitive and Information Sciences; [2]Northeastern University, College of Computer and Information Science*

It has been argued that mathematics is grounded in our sensorimotor experience (Lakoff & Núñez, 2000), and that the very concept of number is rooted in the way we think about physical space (e.g., Dehaene et al., 1993; Lindemann et al., 2007; Shaki & Fischer, 2012). Basic spatial-numerical associations discovered this far include a horizontal mental number line, a vertical mental number line, and size-based associations. Here, we investigate manual spontaneous co-speech gestures in TV newscasts that relate to numerical information. Our data come from the TV News Archive, an online searchable database that includes 426,000 TV news broad-

casts (http://archive.org/details/tv). Analysis focused on statements involving metaphorical phrases such as "large number" and "small number" (reflecting the metaphor MORE IS BIGGER), or "high number" and "low number" (reflecting MORE IS UP). (In neither case is anything literally small, large, low, or high.) So far, we have analyzed 174 gestures that co-occurred with these metaphorical expressions. The results show that in 82% of cases, the movement and form of the gesture were consistent with the metaphorical expression. For instance, one hand moved away from another in "large" number reports, or in an upward direction in "high" number reports. For both size- and verticality-based metaphors, there were significantly more consistent than inconsistent gestures (85%/72% consistent; $p < 0.001, p < 0.05$). Strikingly, purely horizontal gestures were rare (~6% of total) even though research on numbers and space often focuses on the horizontal number line. Our talk will discuss these results along with their theoretical implications, for instance, what they mean for embodied approaches to number cognition. We will also discuss methodological implications for gesture research, focusing on the TV news archive as a novel tool for studying figurative language use.

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Effects of instructional animations with and without gesture observation on grammar acquisition. LYSANNE S. POST, TAMARA VAN GOG, FRED PAAS & AND, ROLF A. ZWAAN
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Animations are widely used as an instructional method. We investigated whether activating the motor system when learning from instructional animations on grammar would foster learning outcomes. Studies in the domain of embodied cognition (e.g., Zwaan et al., 2010) have shown a link between semantics and the motor system. Educational research has shown learning benefits when children were instructed to gesture while explaining math problems (Broaders et al., 2007). In a first study, we found that simultaneously observing and imitating gestures during animation study did not facilitate grammar rule acquisition, and even hindered rule learning for low-ability learners (Post et al., 2013). In the present study it was investigated whether observing gestures in animations would facilitate learning. Moreover, because it is still unclear whether animations of grammar rules have a positive effect on learning, the experiment compared the effects of three instructional conditions for both low and high-ability learners: static pictures, animations without gestures, and animations with gestures (i.e., words being moved by a hand). Results suggest that for children with low language ability, animations with gestures might be better for learning than static pictures. On transfer we did not find these effects. Surprisingly, however, transfer performance for all conditions was better after one week than on the immediate test.

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Post, L.S., Van Gog, T., Paas, F., & Zwaan, R.A. (2013). Effects of simultaneously observing and making gestures while studying grammar animations on cognitive load and learning. Computers in Human Behavior, 29, 1450-1455.

Zwaan, R.A., Taylor, L.J., & de Boer, M. (2010). Motor resonance as a function of narrative time: Further tests of the linguistic focus hypothesis. Brain & Language, 112, 143-149.

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Mental simulation of action sentences in one's native vs. second language KATHLEEN EBERHARD, WON JAE SHIN, SUSAN GUNDERSEN, COLUMBINE CHE & BRANDON BOLDT
University of Notre Dame

Studies have shown that comprehending sentences describing actions involves mentally simulating the actions. One source of evidence comes from comprehenders' response times being affected by whether the action described by a sentence matches an action that is performed or perceived by the comprehender. For example, Kaschak et al. (2005) had listeners judge the sensibility of sentences describing a particular direction of motion (e.g., "You are raising the flag") while they looked at a display showing black and white bars moving in a direction that matched (e.g., upwards) or mismatched (e.g., downwards) the sentence. Response times (RTs) were slower in the match condition than in the mismatch condition, which was attributed to the temporal overlap and low integratability of the motion displays and mental simulation of the sentences. We used Kaschak et al.'s paradigm to examine whether bilinguals, who learned their second language (L2) after their first (L1), would show an attenuated match effect when

comprehending L2 sentences due to L2 words having indirect (via L1 words) or weaker associations with modal conceptual representations. Specifically, 32 Korean-English bilinguals made sensibility judgments to Korean sentences and to English sentences while looking at motion displays that matched or mismatched the direction of motion described by the sentences. Sixteen native English speakers also performed the task and replicated Kaschak et al.'s findings of slower RTs in the match condition. However, the Korean-English bilinguals' showed the opposite effect (i.e., faster RTs in the match condition) for both the Korean and English sentences. We propose that bilinguals' facilitative match effect for the Korean sentences is due to the Subject-Object-Verb order in Korean. The facilitative effect for the English sentences may be due to translating them into Korean and/or the weaker mental simulation of the sentences being aided by a matching perceptual display.

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Corpses in lakes and messy knives: evidence for automatic perceptual simulation during bilingual L2 sentence processing NIKOLA VUKOVIC & JOHN N. WILLIAMS *University of Cambridge*

Evidence from behavioral and neuroimaging studies strongly supports the claim that, when understanding language, people perform mental simulation using those parts of the brain which support sensation, action, and emotion. Several studies within the embodied cognition framework also suggest that comprehending sentences involves building situation models of the sentential content, including detailed visual information. It is debatable, however, to what an extent this is an automatic process. Modifying a classic sentence-picture matching task, the current study presents novel evidence that simulated mental representations are highly automatic indeed, and qualitatively analog to modal states involved in actual vision and perception. We exploit the well-known fact that bilinguals routinely and automatically activate both their languages during comprehension to test whether this automatic process is, in turn, modulated by embodied simulatory processes. Dutch speakers of English heard sentences in their second language which implied specific distance relations, and had to subsequently respond to pictures of objects matching or mismatching this implied distance. Crucially, some of the English sentences contained words which sound similar to unrelated Dutch object words. Participants were significantly slower to reject pictures of these objects when their perceptual features matched the distance relationship implied by the sentence. The same effect was not found for pictures of unrelated control objects. These results suggest that bilinguals not only activate task-irrelevant meanings of interlingual homophones, but also automatically inflect this meaning in a detailed perceptual fashion consistent with implied sentential content. The present study provides novel evidence for embodied semantics and is, to our knowledge, the first to successfully test the nature of non-selective meaning access in bilinguals through methods developed in embodied cognition research.

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An embodied account of the syntactic domain of verbs ALISTAIR KNOTT *Department of Computer Science, University of Otagx*

Verbs have a broader syntactic domain than other word types. They can carry inflections signalling agreement with syntactically remote argument NPs; they can also appear in a variety of syntactic positions themselves (e.g. 'high' in Polynesian and 'low' in English). I argue that an embodied theory of language can provide a natural account of the extended syntactic domain of verbs. Embodied theories of language posit that agents represent the meaning of a concrete sentence by simulating the process of experiencing the episode it describes. I will introduce a particular version of this theory based on a recent model of how simple actions are experienced and represented (Knott, 2012). In this model, experiencing an action involves executing a canonical sequence of attentional and motor operations, in which the agent, patient and action occupy characteristic serial positions. This allows action episodes to be represented in working memory as prepared sequences of sensorimotor operations, and allows 'simulation of episodes' to be subsumed under the more general task of executing a prepared sequence. Prepared attentional/motor sequences are stored as assemblies in prefrontal cortex (Averbeck et al., PNAS 2002). Interestingly, these assemblies contain representations of each operation in the prepared sequence, which are active in parallel throughout its execution. If action verbs denote prepared motor actions, we therefore expect them to be tonically active while experience of an episode is rehearsed. If agreement inflections denote

prepared actions of attention to the agent or patient, we likewise expect these to be tonically active. These assumptions provide a natural explanation for the extended syntactic domain of verbs. If producing a sentence involves rehearsing an experienced episode, the verb and its inflection can be read out at any point, from tonically active planning representations in prefrontal cortex.

A Knott (2012). Sensorimotor Cognition and Natural Language Syntax. MIT Press

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Event duration estimations are modulated by grammatical aspect MONIQUE FLECKEN[1] & JOHANNES GERWIEN[2] [1]*Radboud University, Donders Centre for Cognition, Nijmegen;* [2]*Heidelberg University, Heidelberg*

We investigate the effect of grammatical aspect marking in Dutch sentences, on speakers' perceived duration of highly familiar events and actions. We distinguish two 'layers' of event duration, 'inherent' versus 'finite' duration: In Experiment 1 we established the 'inherent' duration of events. After giving familiarity ratings, participants (N=30) were asked to estimate the inherent duration of a list of different events/actions, described by bare verb phrases ('to boil an egg'), resulting in a selection of highly familiar events, divided in two duration categories, i.e., long and short. These were used for the manipulation of aspect (Experiment 2). Participants (N=30) dragged a slider across the computer screen to estimate the ('finite') duration of randomized progressive and non-progressive event descriptions (N=156). For example: "Paul is een smsje aan het typen" (progressive) vs. "Paul typt een smsje" (non-progressive) - 'Paul is writing vs. writes a text message'. Findings show a complex interaction between aspect marking and inherent event duration: the progressive form extends duration estimations for short events ('to open a bottle'), but shortens the duration of inherently long events ('to repair a bicycle'). We interpret this as evidence for the function of progressive aspect: The zooming in on an intermediate phase and the defocusing of temporal boundaries of an event allows language users to modulate/overwrite duration information of an event, retrieved from world knowledge, to fit communicative needs given by the context. We support the view that grammatical aspect affects situation models (Bergen & Wheeler, 2010), and we find that spatial cognition can be recruited to support thinking about time (Casasanto & Boroditsky, 2008).

Bergen, B. & Wheeler, K. (2010). Grammatical aspect and mental simulation. Brain and Language 112, 150-158.

Casasanto, D. & Boroditsky, L. (2008). Time in the mind: Using space to think about time. Cognition 106, 579 -593.

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Neurobiology of speech act processing NATALIA EGOROVA[A], YURY SHTYROV[B] & FRIEDEMANN PULVERMULLER[C] [a]*University of Cambridge, UK;* [b]*Medical Research Council Cognition and Brain Sciences Unit, Cambridge, UK;* [c]*Brain Language Laboratory, Freie Universitat, Berlin, Germany;*

Although language is a tool for communication, little is known about the brain mechanisms of speech acts, or communicative functions, for which words and sentences are used as tools. In a series of EEG, MEG, and fMRI experiments, in which participants observed communicative interaction, the time course and the brain areas involved in processing the speech acts of Naming and Requesting expressed with single word utterances, were investigated in both, blocked and event-related designs. The results showed that Naming speech acts, placing the emphasis on language-object referential links (Damasio et al., 1996), activated the semantic network, left angular gyrus and bilateral areas in the temporal cortex to a larger extent than Requests. By contrast, there was more activation in the fronto-parietal areas to the Request speech acts, which can be explained by the involvement of the mirror neuron (inferior frontal gyrus, motor cortex, left anterior intraparietal sulcus, right posterior temporal sulcus) and the theory of mind (medial prefrontal cortex, anterior cingulate, bilateral temporo-parietal junction) systems in understanding the action (Pulvermüller and Fadiga, 2010) and social interaction knowledge (Fogassi et al., 2005) along with the associated assumptions of the communication partners (Saxe, 2010, Van Overwalle and Baetens, 2009), relevant for this speech act. Consistent with earlier reports (Weylman et al., 1989, Zaidel et al., 2000), both hemispheres were active in speech act processing. The differences between the pragmatic speech act types were first observed within 200 ms after the word onset, preceding or taking place in parallel with the access to semantic information. These early speech act discrimination is likely to be subserved by the mirror neuron

system, followed by the additional social inferencing between 200 and 300 ms supported by the theory of mind network.

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The motoric basis of 'inner' speech JOHN TAYLOR, ALEX ST. JOHN, DYLAN JONES & BILL MACKEN *School of Psychology, Cardiff University*

The classical cognitivist account of linguistic behavior stipulates abstract, phonological segmental representations as the common underlying basis for the perception and articulation of specific verbal events. Speech theories typically describe a series of stages whereby such abstract segments are assembled into a format for articulatory output, with the fully specified motor representation defined relatively late and some aspects of the output being regarded as merely belonging to the final mechanical implementation in the articulators. We describe experimental evidence showing that late and mechanical aspects of speech are evident even when no actual motor implementation of the speech is required. In a range of settings, we show that the mechanical complexity of articulator movement influences performance even in tasks that only require 'inner' speech. For example, short-term memory for a sequence of syllables is poorer if the co-articulatory transitions between syllables involve movement of the articulators (e.g., from a velar offset to a labial onset) than if no such movement is required (e.g., an alveolar offset to alveolar onset). Such effects occur even when no overt spoken recall or rehearsal is involved. Such effects of articulatory dynamics are also found in silent reading where there is no requirement either for retention of output of verbal material. Even subtle articulatory dynamics, such as the greater fluency achievable when moving from a frontal to a backward closure between syllables (e.g., 'bup' → 'dat') compared to the opposite movement (e.g., 'dat' → 'bup') lead to reliable differences in speech processing even when no spoken output is required, such as in silent reading and short-term memory tasks. Such evidence implicates fully-coded simulated articulatory movement as the underlying mechanism in inner speech.

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Talking about tasting tea twists the tongue: Content-related motor interference in language production KASPER KOK[1] & BENJAMIN BERGEN[2] [1]*Vrije Universiteit, Amsterdam;* [2]*University of California, San Diegx*

Language users engage perceptual and motor processes in content-specific ways during comprehension. But at present there is no evidence whether these non-linguistic processes are also active during language production, and if so at what stage. We addressed this gap using a tongue-twister paradigm (Wilshire, 1999). We manipulated whether the words participants had to produce described mouth actions or not. We predicted that if formulating a message involves activating motor representations of described actions, then participants should have more difficulty articulating words describing mouth actions than non-mouth actions. In two experiments, participants recited tongue twisters comprised of grammatical and meaningful sentences in an ABBA onset pattern, describing mouth or non-mouth actions (e.g. "The sheik sucks/seeks salty shells"). Results in this first experiment showed no significant increase in error rate when the verb described a mouth (e.g. "suck") versus a non-mouth action (e.g. "seek"). In a second experiment, we increased the access the speaker had to the semantic content of the to-be-uttered sentence by presenting a visual context (images of the subject and object of the sentence). In this second experiment, speech error rates were sensitive to content–participants made significantly more errors on the stimuli that described mouth-related actions (381 errors) than on those that were mouth-unrelated (264 errors), $t(59) = 2.51, p = 0.015$.

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Wilshire, C. E. (1999). The "tongue twister" paradigm as a technique for studying phonological encoding. Language and Speech, 42(1), 57-82.

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Sensorimotor semantics in autism: 'disembodiment' and category-specific impairments. RACHEL MOSELEY *MRC Cognition and Brain Sciences Unit*

The involvement of sensorimotor systems for the processing of action-related language has been robustly demonstrated in neuroscience and neuropsychology. More recent research has demonstrated a critical role for motor circuits in the representation of abstract emotion words, too: as the only visible referents of an internal feeling, emotional actions are suggested to bridge the gap between word and meaning for these abstract concepts. What, however, is the precise role of such activation: does it reflect a functionally important

stage in the retrieval of meaning, or an epiphenomenal by-product of activity elsewhere? In order to address this question it is necessary to investigate the effects of motor disease or lesions upon semantic processing, and therefore the representation of action words and abstract emotion words was explored in individuals with autism spectrum conditions (ASC), a population characterised by structural and functional abnormalities of cortical motor systems. Using a range of methodologies including fMRI and EEG/MEG alongside behavioural testing, abnormalities were indeed revealed in this population for the processing of both action- and emotion-related words, both of which are 'disembodied' from cortical motor systems in comparison to typical controls. This inactivity in motor systems during action and emotion word processing appears to correlate with greater number of autistic symptoms; furthermore, motor inactivity during action word processing correlates with a category-specific semantic deficit. The results of these studies and their implications for the role of sensorimotor systems in the representation of these concepts will be discussed.

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Say it like you mean it: Lexical meaning influences prosody MOLLY LEWIS[1] & DUANE G. WATSON[2] [1]*Stanford University;* [2]*University of Illinois at Urbana-Champaign*

Theories of situated cognition predict lexical meaning is grounded in the motor and perceptual systems of the brain [1]. While there is much evidence for this theory in language comprehension, little work has explored this proposal in language production. In previous work, we explored this proposal by investigating whether word meaning can directly affect a word's articulation. We found that participants produced words semantically related to vocalization (e.g.,"yelling") with greater intensity than words semantically unrelated to vocalization (e.g.,"kicking"), and high-effort vocalization words (e.g.,"yelling") with greater intensity than low-effort vocalization words (e.g.,"chatting"). These results suggest that a word's meaning activates related motor representations. One open question from these data is the level of specificity of this activation: If a word's meaning activities motor representations at the level of effectors, all words denoting mouth activities (e.g.,"chewing") might be produced more prominently than words with meanings not involving the mouth (e.g.,"kicking"). However, if more fine-grain lexical semantics activate motor representations, then mouth-related words should be produced less prominently than vocalization words. In the current experiment (N=67), participants read words aloud with meanings denoting high-effort vocalization (e.g.,"yelling"), low effort vocalization (e.g.,"chatting"), non-vocalization mouth activities (e.g.,"chewing"), and foot activities (e.g.,"kicking"). Intensity was analyzed using a mixed effects linear model. Replicating previous results, vocal words (M=57.06 dB) were produced with greater intensity than foot words (M=55.88 dB; t=3.80; β=1.22), and high-effort vocal words (M=57.22 dB) were produced with greater intensity than low-effort vocal words (M=56.99 dB; t=2.12; β=0.20). Critically, mouth words (M=56.36 dB) were not produced with greater intensity than foot words (M=55.88 dB; t=1.25; β=0.24). These results provide evidence that fine-grain semantics are reflected in fine-grain activations of the motor system.

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Attention, language, and manipulation affordances ANDRIY MYACHYKOV, ANGELO CANGELOSI, ROB ELLIS & MARTIN H. FISCHER *University of Glasgow; University of Plymouth; University of Plymouth; University of Potsdam*

Mentally representing manipulable objects involves automatic encoding of their affordances - options for interacting with them (Tucker & Ellis, 1998). Affordance effects emerge both from viewing the object (Tucker & Ellis; 2001) and hearing its name (Tucker & Ellis, 2004). Affordance effects are modulated by attending to the object overtly (Tucker & Ellis, 2004) and covertly (Symes, et al., 2008). However, how the co-presence of linguistic and perceptual cues to the object affects the attribution of affordance effects remains debated. Two experiments investigated (1) how activation of manual affordances is triggered by visual and linguistic cues to manipulable objects and (2) whether graspable object parts play a special role in this process. Participants pressed a key to categorize manipulable target objects co-presented with manipulable distractor objects on a computer screen. Three factors were manipulated in Experiment 1: (1) the target's and

(2) the distractor's handles' orientation congruency with the lateral manual response and (3) the visual focus on one of the objects. In Experiment 2, a linguistic cue factor was added to these three factors - participants heard the name of one of the two objects prior to the target display onset. Analysis of participants' motor and oculomotor behaviour confirmed that perceptual and linguistic cues potentiated activation of grasp affordances. Both target- and distractor-related affordance effects were modulated by the presence of visual and linguistic cues. However, a differential visual-attention mechanism subserved activation of compatibility effects associated with target and distractor objects. We also registered an independent implicit attention attraction effect from objects' handles suggesting that graspable parts automatically attract attention during object viewing. This effect was further amplified by visual but not linguistic cues providing initial evidence for a recent hypothesis about differential roles of visual and linguistic information in potentiating stable and variable affordances (Borghi, 2012).

Poster Session 1

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Fictive motion in action: Gestures and visual representations co-occurring with fictive motion sentences in TV news TILL BERGMANN & TEENIE MATLOCK *Cognitive and Information Sciences, University of California, Merced*

Fictive motion occurs when a static configuration is described in terms of motion, as in The road runs along the river and The mountain rises to 4,000 meters. Motion verbs are used, but nothing actually moves. Research on fictive motion has suggested that sentences like these evoke mentally simulated motion, for instance, "movement" along a path (Matlock 2004; Matlock 2010), as well as modulate brain areas that are involved in motion processing (Saygin et al. 2010). The current work analyzes fictive motion descriptions and accompanying gestures in news reports in the TV News Archive (http://archive.org/details/tv). Our presentation will include analysis of how speakers routinely use fictive motion sentences to describe a wide range of phenomena, including weather patterns, as in Most of the moisture is running parallel along the coast. It will also include novel information about which aspectual forms are chosen (e.g. runs vs. is running) and how people gesture when using fictive motion sentences. In this particular example, the speaker used a sweeping manual gesture to depict moisture parallel to a coastline on a map. The TV News Archive also provides the unique opportunity to look at visual representations of fictive motion, such as a map of the border between Mexico and the US, where the path of the border is slowly traced from east to west. This research not only provides novel insights into how fictive motion sentences and accompanying gestures are generated in various modes of natural discourse, but also allows us to dig deeper into the details of figurative language processing as a whole and thus contributes to the overall enterprise of embodied language research.

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What is beyond a pianist's hand? Syntax in musical motor acts. ROBERTA BIANCO[1, 3], GIACOMO NOVEMBRE[2], PETER KELLER[2, 4], ANGELA FRIEDERICI[1], ARNO VILLRINGER[3] & DANIELA SAMMLER[1] *[1]Max Planck Institute for Human Cognitive and Brain Sciences, Department of Neuropsychology, Leipzig; [2]Max Planck Institute for Human Cognitive and Brain Sciences, Research Group "Music Cognition and Action", Leipzig; [3]Max Planck Institute for Human Cognitive and Brain Sciences, Department of Neurology, Leipzig; [4]MARCS Institute, University of Western Sydney*

It is well established that listening to musical sequences elicits auditory expectations based on syntactic representations [2, 4]. Recent studies examining the execution of musical sequences have extended the notion of syntax to action and embodiment, proposing that musical syntax [1] translates into a 'syntax of action' [3, 5] in expert musicians. To the extent that musical motor acts are governed by syntactic processes, however, these motor representations should predict the goal of an action ('what' will happen next), independently of the manner in which ('how') the action is performed. This is important as to dissociate real syntactic operations from over-learned serial motor patterns. In this study, we asked pianists to imitate sequences of pictures of a hand playing chord progressions. Absence of sound ruled out any auditory-based predictions. The final chord of a sequence could either be irregular in terms of harmonic function (Syntax violation), or the fingering employed for the execution (Manner violation). We compared these two types of violation with a Control condition (regular harmony & fingering) across sequences of variable length (2- or 5-chords), which were expected to lead to different levels of syntactic predictability. As hypothesized, results showed a performance benefit (i.e. faster processing) for chords embedded in syntactically regular sequences, irrespective of their fingering (conventional or unconventional). This indicates that motoric predictions operate based on syntactic representations, and independently from the motor programs required for the execution of the expected chord. Data provide key pieces of ev-

idence for shared syntactic representations in music perception and production.

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Memory for action: Does semantic relation between word and action is a necessary condition to enhance memory performance? VAGNOT CAROLINE[1], ROUSSET STEPHANE[2], BRUNEL LIONEL[1], VERSACE RÉMY[3] & BROUILLET DENIS[1] [1]*Laboratoire EPSYLON, Université Paul Valérie Montpellier 3, Montpellier;* [2]*Laboratoire de Psychologie et NeuroCognition, Université Pierre Mendes France Grenoble 2;* [3]*Laboratoire d'Etudes des Mécanismes Cognitifs, Université Lumière Lyon 2.*

It was generally observed that memory performance after motor encoding is superior to that after verbal encoding (Cohen, 1989; Zimmer et al., 2001). However we could note that in most studies the action to perform is always related to the word to be remembered. We created an innovative paradigm in which participants had to perform an action for each word without semantic link between them. In a learning phase, participants had to memorize a list of words while performing an action for each word (turn a door-knob to the right; turn a door knob to the left). In accordance with an isolation paradigm, one action was performed more frequently (i.e., non-isolated) than the other (i.e., isolated). Then, in a recognition phase, participants had to judge whether the word was presented or not during the learning phase. In Experiment 1, to respond "old", half of the participants performed the same action that they performed most frequently during the encoding (i.e., associated to non-isolated items) whereas the other half performed the less frequent action (i.e., associated to isolated items). In Experiment 2, participants responded by pressing a key on the keyboard. The main result of these experiments highlights that encoding action without semantic link influences memory judgment in a recognition task. Our data are consistent with a perspective of memory where enacted actions engage the motor system (Engelkamp & Zimmer, 1985).

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The mutual roles of action representations and spatial deictics in French language YANN COELLO[1] & BONNOTTE ISABELLE[2] *Research Unit on Cognitive and Affective Sciences, University of Lille.*

Many aspects of language associated with an object's noun inform about the location of the object in relation to the action system. In the present study, we tested whether the determiners la (the) and cette (that) in French language carry embodied spatial information. In Experiment 1, participants performed a reachability judgment task after having evaluated the correct spelling of a determiner (la or cette) and an object-noun (balle-ball, tasse-cup, or pomme-apple). Response time for judging reachability was shorter when the determiner la rather than cette was previously presented. The opposite result was obtained with unreachable objects. In Experiment 2, we tested whether watching a reachable or unreachable object influenced the subsequent spelling judgment task of a determiner (la or cette) and a noun (balle, tasse or pomme). Result showed that spelling judgments were faster when the stimulus was the determiner la rather than cette, whatever the reachability of the object presented before. Considered together, these data stress the close connection between the spatial content of determiners and the representation of action possibilities, giving some evidence for embodied language processing. By contrast, presenting an object at a reachable or an unreachable location seems not sufficient to activate the related linguistic descriptors.

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Investigating situated language in real-life discourse using electrocorticography JOHANNA DERIX[1,2,3], OLGA ILJINA[1,4,5], JOHANNA WEISKE[1,2,3], ANDREAS SCHULZE-BONHAGE[1,3], AD AERTSEN[2,3] & TONIO BALL 1, 3 [1]*Epilepsy Center, University Medical Center Freiburg;* [2]*Institute for Biology I, University of Freiburg;* [3]*Bernstein Center Freiburg, University of Freiburg;* [4]*GRK 1624, University of Freiburg;* [5]*Faculty of Philology, University of Freiburg*

Traditional experimental research has revealed a wealth of insights into the neural basis of speech and language. Experimental paradigms and settings, however, often lack resemblance to real life, and naturalistic, dynamic communication is "the dark matter" of cognitive neuroscience[1]. Here, our aim was to address the neural correlates of real-world social behavior. To this aim, we combined analysis of simultaneously recorded electrocorticographic (ECoG) recordings and monitoring video obtained extraoperatively 24/7 over several weeks during pre-neurosurgical diagnostics of epilepsy. ECoG offers a high spatiotemporal resolution and resilience against artifacts, and it may be a suitable method to study dynamic, real-world behavior. We compared conversations of epilepsy patients with two different dialogue partners, and found that brain recordings from the anterior temporal lobe can be used to decode, with high accuracy, whether a patient was talking to their treating physician or to their life partner[2]. In a subsequent study, we were interested whether neural activity during natural behaviour is modulated by the speech content. We identified basic elements of speech ("idea units") in the discourse periods and classified them according to the presence and type of memory content based on the taxonomy developed by Dritschel[3]. While the neural signals across the different classes revealed similar responses in speech-related areas, pronounced class-specific differences could be observed in the prefrontal cortex. Overall, our findings demonstrate that investigation of social interaction and situated speech by means of ECoG is a promising approach to explore higher-order human cognition.

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Mental simulation of action and weight in language understanding and memory LÉO DUTRIAUX & VALÉRIE GYSELINCK *Laboratoire Mémoire et Cognition, Institut de Psychologie, Université Paris Descartes*

Numerous studies have shown that motor simulation is involved in the understanding of action-related sentences or words. This is taken as evidence that meaning is embodied. For example, in Glenberg and Kaschak (2002) study, participants had to judge the sensibility of action sentences by making a response that required moving toward or away from their bodies. The results showed that when the action described by the sentence was congruent with the movement required for the answer, response time were shorter. The aim of the present study is to replicate these results with the consideration of an additional factor that might modulate the effects obtained: the weight of the object transferred in the action sentence (light or heavy). More importantly, it aims at studying the effect of the motor simulation on long term memory. For this purpose, 36 young adults had to make a sensibility judgment task on action sentences, within a congruent or incongruent context of response. They then had to make a cued recall task to assess for their memory of the 32 light and 32 heavy objects presented. Like in Glenberg and Kaschak's study, results showed a time benefit of the sensibility judgment task when the movement of the response was congruent with the action sentence presented. Response times were also shorter for the heavy objects than for the light ones. Crucially, this effect was found to be independent of the congruency. Concerning the memory task, unlike the sensibility judgment task, no main effect of congruency or weight was found, but there was an interaction between those factors. We discuss these results in light of embodiment and episodic memory theories.

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Eye movements are influenced by the extraction of meaning from parafoveal words in reading SVEN HOHENSTEIN & REINHOLD KLIEGL *University of Potsdam*

Eye movements in reading are influenced by word features in foveal and parafoveal vi-

sion. There is a large corpus of evidence indicating readers can extract orthographic information from parafoveal words. But there has been an on-going debate on the question whether parafoveal preprocesing is based on semantic codes. We employed three experiments with a gaze-contingent display-change technique. Subjects read German sentences containing a critical target noun for which a parafoveal preview was presented. The target replaced the preview word during the saccade to the parafoveal preview that was either semantically related or unrelated to the target. Fixation durations on the target word were shorter when a semantically related parafoveal word was presented. In the second experiment, spelling was manipulated: Sentence presentation either followed the German rules (i.e., nouns were printed with an initial capital letter) or consisted of lower-case letters only. Semantic preview benefit was obtained under both conditions. In the third experiment, we employed two further preview conditions, identical and pronounceable nonword, and manipulated text contrast. Whereas contrast had negligible effects, target fixation durations were reliably different for all four types of preview.

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Small elephants and big needles: Can perceptual information affect memory and judgments about the meaning of words? NATALIE A. KACINIK[1,2], RITA W. EL-HADDAD[1,2], KENDALL J. ESKINE[3], LOLLY STARR-GLASS[1] & SAMUEL SALAMON[1] *[1]Brooklyn College; [2]Graduate Center, City University of New York; [3]Loyola University New Orleans*

There is now considerable evidence that representations of word meaning are "embodied" and grounded in our perceptual and motor experiences (Barsalou, 2008; Glenberg, 2010; Hauk et al., 2004; Zwaan et al., 2002). However, the majority of this research has relied on priming and interference procedures, or on measuring or manipulating brain activity. A better test of embodiment theories would be to examine the extent to which perceptual information may be incorporated into existing representations to potentially alter their processing, and whether those effects persist over time. The present study therefore involved manipulating the perceptual appearance of words, specifically font size, to be congruent or incongruent with an object's actual size (e.g., elephant presented in a large or small font, respectively). Participants were presented with the words in either an explicit or more implicit memory paradigm prior to engaging in a recognition memory test and property judgment task, in the same session and after a 2-week delay. We hypothesized that words presented in a font-size that was either congruent or incongruent with the item's actual size would result in correspondingly better or worse memory and property judgment performance compared to the middle "neutral" font. However, the results showed that the font size manipulation generally did not have significant effects on how participants represented and processed the words. These findings thus appear to present a challenge for embodied accounts of word meaning, but some potential explanations and issues will be discussed with respect to the type of perceptual manipulation and stimulus items employed in this study.

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Embodiment in numerosity and language and their interaction with space: Is there a common embodied representation of space? MARTIN LACHMAIR, HANS-CHRISTOPH NUERK & BARBARA KAUP *Universität Tübingen*

The concept of embodiment has been shown to both language and number processing. For both domains, (embodied) interactions with space have been repeatedly shown. However, so far, these have been largely parallel strings of research, which have not been brought together: We do not know whether (embodied) spatial coding for these different domains is at a common stage or whether we are looking at different representations? To examine this questions, we manipulated four different numerical and linguistic components and vertical space in one single experiment to investigate common stages of processing by examining resulting interaction. We manipulated number magnitude (small-large) and vertical word association with plural nouns (top: words like "roof", bottom: words like "worm", neutral: words like "desk") in a Go-Nogo Lexical Decision Task. We observed specific interactions between numerical, linguistic and spatial variables, which suggest - at least partially - a common embodied representation of space which may be applied for language and number. The implications of these results for a unified view on embodied cognition across domains are discussed.

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A task comparison of motor activation in online sentence comprehension KEVIN J. Y. LAM[1], MARCEL C. M. BASTIAANSEN[3], TON DIJKSTRA[1] & SHIRLEY-ANN RUESCHEMEYER[2]
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Although motor activation has been observed during comprehension, establishing the functional role of such activation remains unclear. The current EEG study evaluates the functional issue in terms of task demands. Specifically, a semantic evaluation task and a letter-matching task were each expected to differentially engage the comprehension processes which, critically, may or may not reveal corresponding motor activation. Mu desynchronization (8 - 12 Hz) from the motor cortex was measured on critical verbs embedded in visually presented Dutch sentences (e.g., De winkelkarretjes die zij wegduwt zijn kapot./The trolleys that she pushes away are broken.). Manipulation of the verbs' action specificity was intended to elicit differences in mu desynchronization (e.g., more action specificity for pushing trolleys than delivering trolleys). Half of the stimuli were constructed as semantically congruent sentences, the other half as semantically incongruent sentences to elicit an N400 effect, a measure of semantic comprehension, which was indeed observed in both tasks (e.g., The trolleys that she pushes away/sews are broken.). The preliminary results indicate that the motor system is activated in both tasks yet differently so in interesting ways. Whereas the semantic evaluation task shows the predicted main effect of action specificity, the letter-matching task shows an interaction of congruency and action specificity, with greater motor activation for action non-specific verbs than action specific ones in semantically incongruent sentences. Notably, the latter result was previously observed in a passive reading task using similar stimuli (Lam, Bastiaansen, Dijkstra, & Rueschemeyer, in preparation). This study underscores the claims of theories of embodied language by showing that (1) motor activation occurs even in a task that does not necessitate explicit retrieval of meaning, and that (2) the task-dependent patterns of motor activation reveal the different functional interactions between the motor system and comprehension processes.

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Spatial interference in mental arithmetic OLIVER LINDEMANN[1] & MICHAEL WIEMERS[2]
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The presented study investigates the effects of spatial information on mental arithmetic. In Experiment 1, participants solved addition and subtraction problems and indicated the result verbally while moving the arm continuously either leftwards, rightwards, upwards or downwards. The analysis of the problem solving performance revealed a mapping between arithmetic operations and spatial movements along both the horizontal and vertical axes. Specifically, performance in mental addition was better while making upwards compared to downwards movements as well as when moving right compared to left, while the inverse pattern was observed in subtraction. In Experiment 2, spatial information was irrelevant for the task and instead of instructing to perform active body movements, participants calculated while the problems moved in one of the four cardinal directions on the screen. Interestingly, for visual motions, the spatial effects on arithmetic performances were restricted to the vertical dimension. Taken together, our findings provide evidence for an impact of spatial processing on mental arithmetic. This linkage is stronger and more automatized for the vertical dimension, supporting the notion that sensory motor experiences in the vertical dimension provide a grounding for arithmetic operations.

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Do speed verbs affect low-level speed discrimination processes? LAURA J. SPEED, AURELIO BRUNX & GABRIELLA VIGLIOCCX *Cognitive, Perceptual & Brain Sciences Research Department, University College London*

The embodied approach predicts that processing perceptual information of a word's referent at the same time as processing the word will affect the way that the word is understood (e.g. Meteyard, Bahrami & Vigliocco, 2007). A similar effect should also be seen in the opposite direction: processing words should affect performance on corresponding perceptual tasks (e.g. Meteyard, Zokaei, Bahrami & Vigliocco, 2008). This experiment investigates whether words that refer to speed affect performance on a speed discrimination task. In each run, participants were presented with a

'standard' grating moving at a fixed speed (3, 5 or 8Hz). On each trial, participants had to decide whether subsequent gratings were moving faster or slower than the standard. During the task, participants listened to spoken verbs of fast motion, slow motion, or no motion. This psychophysical method allows one to measure the low-level perception of visual speed using the speed discrimination threshold: how reliably one can distinguish between different speeds, and the point of subjective equality: the perceived speed of the standard. Listening to words of different speeds did not affect any of the psychophysical measures of speed discrimination. Looking at RTs, participants were faster to decide that a grating was "slower" than the standard when they had been passively listening to "slow" verbs compared to other verb types. No comparable effects were found for "faster" decisions. Results suggest a match effect between the speed of the comparison grating and the speed of word, for "slow" only. This study raises the question of what level semantics affects visual processes.

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Do our eyes look along the mental time line?

KURT STOCKER[1], MATTHIAS HARTMANN[2] & CORINNA MARTARELLI[2] [1]*Psychological Institute, University of Zurich, Zurich;* [2]*Department of Psychology, University of Bern*

Language suggests at least two possibilities how we might embody progression through time: whole-body motion (e.g., I am leaving the past behind, and I am moving on to a better future) or gaze direction (e.g., I am looking back through the tough past, and I'm looking ahead to a better future). The first possibility (conceptualization of whole body motion through time) has been investigated in recent embodiment experiments and it has for example been found that forward whole-body motion is associated with future cognition. However, when it comes to the second possibility, we are not aware of any study that has directly addressed gaze direction through time in embodiment experiments; thus the current investigation sets out to explore the relation between eye movements and the representation of time. Research has identified two body-related mental time lines in Western cultures: a sagittal (behind the body = past; in front of the body = future) and a transversal (left of the body = past/anteriority; right of the body = future/posteriority) time line. We investigate if eyes project time onto the left-right transversal axis and additionally explore if eyes project time onto the up-down vertical axis. Participants listen to 32 German sentences while being remotely eye tracked (and while for instance looking at an empty screen). Eye movements are recorded using the iView X RED tracking system (SensoMotoric Instruments, Teltow, Germany). Preliminary data (n=7) of this ongoing study suggest a promising first trend. We find more rightward saccades when sentences include an after-that phrase when compared to a before-that phrase (e.g., Now I'm cooking. After that I will water the plants vs. Now I'm shopping. Before that I was at the hairdresser's). These preliminary results suggest that spontaneous eye movements are a potential indicator of the embodiment of time.

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Visuospatial memory's sensitivity to language and image orientation

DAVID W. VINSON, DREW H. ABNEY, RICK DALE & TEENIE MATLOCK *Cognitive & Information Sciences, University of California, Merced*

Cognitive linguistics research has provided useful insights into how linguistic form can influence our perceptions and conceptions of a wide range of phenomena, including politics, physical space, and time (e.g., Fausey & Matlock, 2011; Matlock, 2004; Matlock, Ramscar, & Boroditsky, 2005; Nunez & Sweetser, 2005). Still, there is much to learn about the connection between language and visual memory. To investigate this relationship, we turn to classic research on visual memory and representational momentum. In Freyd's (1983) seminal work on representational momentum, people were given a visual memory task. They viewed images of a man either falling off a ledge or standing on a ledge, and later had to indicate the location of the man from memory. The man was placed farther along the trajectory on average when he appeared to be falling. The current work expands Freyd's research by exploring the connection between language and visual memory, specifically, how linguistic input will influence representational momentum judgments. Participants in our study first

viewed a static image of a man that appeared to have fallen off or to have jumped from a cliff (face up or face down in mid air), and read one of these linguistic primes: THE MAN FELL OFF THE CLIFF, THE MAN JUMPED OFF THE CLIFF, or nothing. In brief, visual memory was influenced by motion verbs (intentional, not intentional) and image orientation (face up or face down). These results support the idea that lower-level processes such as visual memory can be influenced by higher-level information such as motion verbs and observed body orientation.

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Reasoning about similarity and proximity BODO WINTER & TEENIE MATLOCK *University of California, Merced, Cognitive and Information Sciences*

In both natural and human-made environments, similarity and proximity are highly correlated. Across the board, similar objects or people tend to be located closer to each other than dissimilar objects and people. In Conceptual Metaphor Theory (Lakoff & Johnson, 1980; Lakoff, 1987), this environmental correlation is thought to be internalized. The resulting metaphor similarity is proximity provides mental structure for reasoning and motivation for such linguistic expressions as "These colors are close" or "Their political views are far apart". Our experiments address the conceptual nature of this metaphor. In Experiment 1 (N = 82), we displayed two characters either close to each other or far away from each other. In the close condition, participants judged the characters to be more similar than in the far condition. In Experiment 2 (401 participants), we tested the reverse mapping. Participants either read a text that emphasized the similarities of two people, or a text that emphasized the differences. Subsequently, participants were asked to indicate the characters' imagined positions on a sheet of paper. Placement distances were closer in the similar condition. Experiments 3 (N = 368) and 4 (N = 80) replicated these findings with a different set of stimuli. In sum, two experiments revealed that people judge entities to be more similar to each other when they are placed closely in space, while two other experiments showed that entities are judged to be closer to each other when they are thought to be more similar. This research extends previous investigations of similarity is proximity (Casasanto, 2008; Pecher & Boot, 2010) by employing a between-subjects design, by using richer linguistic stimuli and by highlighting the significance of this metaphor for everyday reasoning. Furthermore, it poses challenges to the notion of the unidirectionality of metaphorical mappings.

Poster Session 2

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The context-driven meaning construction effects on language induced motor activity: Grip-force study of linguistic focus and lexical anticipation PIA ARAVENA[1], MARIE-ELODIE COURSON[1], VICTOR FRAK[2], ANNE CHEYLUS[1], YVES PAULIGNAN[1], VIVIANE DEPREZ[1] & TATJANA NAZIR[1] *[1]L2C2-Institut des Sciences Cognitives, CNRS/UCBL, Université Claude Bernard Lyon; [2]Institut de Réadaptation Gingras-Lindsay de Montréal, Centre de de Recherche Interdisciplinaire en Réadaptation du Montréal Métropolitain, Université de Montréal*

The cognitive study of linguistic meaning typically has adopted the notion of "meaning" as an entity that is "contained" in word. This reductionist view has motivated traditional discussions about whether language induced motor activation should be considered as part of lexical access or as result of the ensuing meaning integration. Growing psycholinguistic evidence for the interdependency of lexical access and context dependent meaning construction must be integrated in motor language debate. In the present study we aimed to shed light on the role of context on the recruitment of sensorimotor structures during language processing. In 2 experiments we analyzed on-line

modulations of grip-force while participants are listening to specific target words within different sentential contexts. We found that context anticipates motor semantic features of lexical items (experiment 2) and can switch them off if they are not relevant (experiment 1). Present results show that the recruitment of motor structures during language processing does not depend only on the action word as such, but also on event information surrounding the word. Findings like these put into question the notion that word meaning is stored in a mental lexicon requesting new frameworks that associate psycholinguistic models to neurobiological data of meaning representation.

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Powerful and positive words are up only when metaphor is primed FRANCESCA M. M. CITRON[1], MICHAEL KUCHARSKI[1] & ADELE E. GOLDBERG; [1]*Cluster of Excellence "Languages of Emotion", Freie Universität Berlin;* [2]*Linguistics Program, Princeton University*

Research on embodied metaphors has shown that priming one domain can automatically activate an associated domain, e.g., reading power-related words elicits faster subsequent responses to cues presented higher on a computer screen (Zanolie et al., 2012) and valence decisions are faster for positive words higher on the screen (Meier & Robinson, 2004). We aimed to further investigate these metaphorical associations: 1) Can they be activated by contingently presenting both domains simultaneously, instead of priming one? 2) Are the associations elicited if the task is other than the explicit, power vs. valence decision task (DT) used in previous work? We selected high and low-power words (teacher, pupil) matched for valence, arousal and several psycholinguistic variables, as well as positive and negative words (smile, frown), also carefully matched. Words were presented either high or low on a computer screen. In experiment 1, words were intermixed with non-words and participants performed a lexical DT. In experiment 2, a power vs. valence DT was used for the two word sets. Results revealed no metaphorical associations: high-power and positive words presented higher on the screen were not responded to faster than if presented low on the screen. Further analyses revealed no main effect of spatial position overall. Interestingly, high-power words elicited significantly faster reaction times than low-power words, in both lexical and power DTs. Similarly, positive words elicited faster reaction times than negative words, although only when presented lower on the screen. Contingent presentation of the two domains does not elicit activation of the metaphorical mappings. Rather, the semantics of powerfulness or valence of words influences performance. Further, the type of task (implicit vs. explicit processing of powerfulness/valence) seems not to modulate the effects. The present work thus investigates when metaphorical associations are activated (as suggested by, e.g., Willems & Francken, 2012).

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Perspective-taking strategies for grounding spatial reference in a situated directive task KATHLEEN EBERHARD[1] & MATTHIAS SCHEUTZ[2] [1]*University of Notre Dame;* [2]*Tufts University*

We investigated the use of two perspective-taking strategies for grounding spatial reference in a corpus of spoken dialogue from a situated directive task. The corpus consists of interactions between 16 dyads who communicated remotely via phone. One person (searcher) was embedded in a real-world search environment consisting of six connected rooms and a surrounding hallway. The environment had 25 boxes scattered throughout it that required various tasks to be performed by the searcher. The other person (director) helped the searcher find the boxes via a 2D floor map that showed the locations of most of the boxes relative to landmark objects such as chairs, desks, filing cabinets, etc. The director also had to mark the locations of the boxes not shown on the map based on the searcher's descriptions. Thus the dialogue reflects the director and searcher's collaborative efforts to ground spatial references concerning the boxes' locations and the searcher's dynamic position. Both the searchers and directors adopted a route-perspective in which object locations were described from the searchers' changing viewpoint (i.e., their left, right, front, behind or a relative frame of reference). This strategy required common ground to have a sufficiently accurate representation of the searcher's position and orientation. For some dyads, the director's map facilitated the initial establishment of this representation by labeling the searcher's starting point. When the searcher's starting point was not shown, the dialogue demonstrated (sometimes lengthy) collaborative effort to ground this information. Both searchers and directors also adopted a

gaze perspective in which objects are located relative to other objects (e.g., box is on the chair, or intrinsic frame of reference). This strategy was used when grounding was unsuccessful with a route perspective and when conveying the precise location of an object was important.

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Identification depends on individual characteristics - A new perspective on perspective in simulated actions ANNE KARINA FELDMETH, DANIEL MÜLLER-FELDMETH, SASCHA WOLFER & LARS KONIECZNY *Center for Cognitive Science, University of Freiburg*

Theories of embodied language processing argue that understanding language is accomplished by representing the information given in a multimodal situation model. A decisive factor in constructing this mental representation is the perspective a comprehender adopts within this model. It is claimed that pronouns are one linguistic form that plays a powerful role in determining the perspectives characterizing simulations. Brunyé et al. (2009) found that the use of personal pronouns in 1st or 2nd foster identification with the agent and embodying its perspective. It is yet an open question, whether or not perspective taking is influenced by the match between individual properties of the comprehender and possible referents of a sentence, for example gender or age: match or mismatch might facilitate, impede or even prohibit identification with a particular referent in the discourse representation. The experiment addresses the factor gender. Participants read sentences describing a directed action between two referents represented by 3rd person pronouns with different gender (he/she): "Er/Sie wird ihr/ihm das Buch geben." (He/She will give her/him the book.). Adopting the Action-Sentence-Compatibility-paradigm, participants have to judge the meaningfulness of each sentence by pushing a button that requires a movement either towards or away from them. Verbs are rated beforehand according to their implicit direction. According to our hypothesis, the arrangement of pronouns in combination with the gender of the participant will influence identification with one or the other referent and thus the direction of the simulated action. Data is currently being collected. We argue that positive results would signify that situation models incorporate richly structured simulations shaped by interactions of external input and the individual body.

Brunyé, T. T., Ditman, T., Mahoney, C. R., Augustyn, J. S. & Taylor, H. A. (2009). When You and I Share Perspectives. Psychological Science, 20 (27).

.. 75 ..

Using Xbox Kinect to explore spatial-numerical association of arm movements in parity judgments YARIV FESTMAN, OLIVER LINDEMANN & MARTIN. H. FISCHER *University of Potsdam*

Spatial-numerical associations were initially studied using chronometric methods to reveal the orientation of the mental number line (SNARC effect; Dehaene, Bossini, and Giraux, 1993). Recent evidence has shown that unconstrained spatial movements can be valuable in the study of embodied number representations (Fischer and Campens, 2009). We used the Xbox Kinect to record arm movements in a parity judgment task. We replicated SNARC in the horizontal dimension and found a similar trend in the vertical dimension. Movement amplitudes were also affected by number magnitude. Together, these results generalize evidence for the mental number line to everyday behaviors and suggest that natural user interfaces (NUI) can be used to study embodied cognition.

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Is conjunction meaning grounded in spatial representations? ERNESTO GUERRA & PIA KNOEFERLE *Cognitive Interaction Technology Excellence Cluster and Department of Linguistics, Bielefeld University*

Cognitive linguistic theory proposes that grammar is inseparable from meaning. But, what is the meaning of function words such as and and or? According to Langacker (2008), grammatical categories have a schematic meaning, providing structure for mental representations. In two experiments, we examined this hypothesis by assessing the relation between four conjunctions (and, or, but, either...or) and three spatial dimensions (distance, size and containment). In Experiment 1, participants (N=108) made drawings for each conjunction using a set of geometric figures. We evaluated the drawings on the spatial dimensions of interest. In Experiment 2, we prepared eight visual spatial schemas (differing in distance, containment, and size) and asked participants (N=24) to rate them as a function of how well they represented a given conjunction. Each schema was com-

bined with all four conjunctions. In Experiment 1, participants drew objects further apart for "or" and "either...or", and closer together for "and"; distance between objects for "but" was equal to the overall mean. Furthermore, "and" was more often illustrated by drawing objects contained within the same frame rather than in separate frames. By contrast, the opposite pattern was observed for "either...or". Drawings for "but" used objects of different size. In Experiment 2, participants' ratings showed that distance was relevant for "and" (higher ratings for objects close together), "or", and "either...or" (higher ratings for objects far apart). Similarly, object containment was relevant for "or", "either...or" (highest ratings for objects separated by frames), and "and" (lowest ratings for objects separated by a frame). No differences for "but" were found regarding distance or containment schemas. Instead, schemas presenting objects of different size received the highest ratings for "but". These results provide good evidence for the existence of links between conjunctions and spatial representations.

Langacker, R. (2008). Cognitive Grammar: A Basic Introduction. New York: Oxford University Press.

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Gesture tracking on tablet devices as an experimental platform HUNTER HATFIELD & TONIC ARTOS *University of Otagx*

Innovations in methodology can be as important to scientific progress as innovations in theory. Despite the fact that touch-gesture interfaces with software have become ubiquitous with the growth of smart phones and tablet devices, most computer-based experimentation in psycholinguistics continues to be based on the keyboard and the mouse. This is likely due, not to the lack of potential of touch gestures to investigate language processing, but to the unavailability of an experimental platform to conduct such experiments. The Otago PsyAn Lab experimental platform (OPAL) is an open source set of tools that allows a researcher to design and conduct experiments in a native AndroidTM environment on many common devices. Using a prototype of OPAL, syntactically ambiguous sentences were investigated. Well-studied syntactic phenomena (relative clause attachment, adverb ambiguity and sentence/noun coordination) were studied in order to compare the results to well-established methods such as self-paced reading and eye-tracking. Participants were asked to underline masked text, similar to a self-paced reading experiment, in order to read a set of sentences. The location of the finger was continuously tracked to examine time spent at a character-by-character level. Growth curve analysis indicated all three types of sentences varied by condition. Critically, the continuous tracking of finger movements also was able to establish the locus of linguistic processing difficulty more consistently than other methodologies (Witzel, Witzel & Forster, 2012). Gesture tracking allows a great number of motor movements to be tracked, and the potential of this capability for research on embodied language processing will be explored.

Witzel, N., Witzel J., & Forster, K.I. (2012). Comparisons of online reading paradigms: Eye tracking, moving-window, and maze. Journal of Psycholinguistic Research, 41, 105-128.

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Up/North is not always good: Metaphorical associations between cardinal direction and valence are different in Hong Kong and in the United States YANLI HUANG[1], CHI-SHING TSE[2] & KIT W. CHO[3] [1]*Department of Educational Psychology, Faculty of Education, the Chinese University of Hong Kong;* [2]*Department of Educational Psychology, Faculty of Education, the Chinese University of Hong Kong;* [3]*Department of Psychology, University at Albany, State University of New York*

The Conceptual Metaphor Theory (e.g., Lakoff & Johnson, 1980) suggests that people represent abstract concepts in terms of concrete concepts via metaphorical association, e.g., valence such as positive is associated with direction such as up. By considering the "up-north" and "down-south" associations, previous studies (e.g., Meier, Moller, Chen, & Riemer-Peltz, 2011) reported that cardinal directions (north and south) could be metaphorically associated with valence (good and bad), as reflected by participants' estimates for where a rich/poor person would live and their own living preference, in the United States (U.S.). In four studies, we used Meier et al.'s paradigms to test if this metaphoric association between south/north and good/bad could also be found in Hong Kong (H.K.). In the first two studies, participants in Albany, New York (Study 1), and H.K. (Study 2) indicated where a person with high or low socioeconomic status (SES) lives in a fictional city. The U.S. samples considered that the people with high SES would live in further north ar-

eas, whereas those with low SES would live in further south areas, replicating Meier et al.'s findings. However, H.K. samples showed an opposite pattern (i.e., people with high and low SES would live in further south and north areas, respectively), consistent with the fact that more rich people are living in the southern part of H.K.. Similar to Meier et al., H.K. participants' "south-rich" and "north-poor" pattern became nonsignificant in Study 3 when the cardinal direction was told to be reversed- "north" is down and "south" is up-in the fictional city. Furthermore, H.K. participants preferred to live further south areas (Study 4), again opposite to what Meier et al. found in the U.S. Overall, the findings of these four experiments suggest that the metaphorical association between cardinal direction and valence could be modulated by culture.

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An investigation into real-world speech production and perception by means of ECoG OLGA ILJINA[1,2], JOHANNA DERIX[1,3], JOHANNA RUESCHER[1,3], AD AERTSEN[3,4], ANDREAS SCHULZE-BONHAGE[1,4] & TONIO BALL[1,4] [1]*Epilepsy Center, University Medical Center, Albert-Ludwigs-University;* [2]*GRK 1624, Albert-Ludwigs-University;* [3]*Neurobiology and Biophysics, Faculty of Biology, Albert-Ludwigs-University;* [4]*Bernstein Center Freiburg*

One influential account of how we understand spoken language is the motor theory of speech perception (MTSP). It postulates that both speech production and perception are inherently motoric processes which crucially rely on a common articulatory module (Liberman and Mattingly, 1985). This predicts the existence of an area in the articulatory motor cortex in which these two phenomena must overlap. It is currently unclear whether the articulatory motor cortex is typically involved whenever we listen to somebody speak in our daily life (Wilson, 2009), or if such activation is a rather exotic phenomenon (Hickok, 2009). We addressed this issue by examining brain activity "outside of the lab". To test whether or not the (anatomically- and functionally-defined) articulatory motor cortex is activated during real-world speech perception, we employed extra-operative electrocorticographic (ECoG) recordings obtained in four epilepsy patients during their real-life conversations with visitors and medical staff, and we used functional information obtained by electrocortical stimulation. In all subjects, high-gamma (70-100 Hz) responses in the articulatory motor cortex indeed overlapped between receptive and expressive speech. The anatomical location of this overlap area (superior ventral premotor cortex (svPMC) bordering on the primary motor cortex) agrees well with the earlier experimental fMRI study by Wilson et al. (2004). Thus, activation of the cortical motor system appears to be a robust, reproducible feature of real-world speech perception. This finding is consistent with the MTSP, yet it does not exclude other functional interpretations.

Hickok, G., Holt, L.L., Lotto, A.J., 2009. Trends Cogn. Sc.i 13:330-331.
Liberman, A.M., Mattingly, I.G., 1985. Cognition 21, 1-36.
Wilson, S.M., 2009. Trends Cogn. Sci. 13, 329-330; author reply 330-331.
Wilson, S.M., et al., 2004. Nat. Neurosci. 7, 701-702.

.. 80 ..

The influence of number magnitude on words with implicit location information MARTIN LACHMAIR, CAROLIN DUDSCHIG & BARBARA KAUP *Universität Tübingen*

Numerical processing and language processing have both been suggested to be grounded in spatial relations. Theoretical background of this study is on one hand a vertical oriented SNARC effect (e.g., Schwarz & Keus, 2004), assuming low numbers with an implicit down directional cue and high numbers with an implicit up directional cue. On the other hand while word processing there are strong compatibility effects between words with an implicit up or down directional cue (e.g., sky, ground) and subsequent responses up or down (Lachmair, Dudschig, De Filippis, de la Vega, & Kaup, 2011). Thus, in the present study we were concerned with whether these effects are fully independent grounding phenomena, or whether they share a common basis. We expected, if number processing activates spatial dimensions that are also relevant for understanding a word's meaning, processing numbers should influence subsequent lexical access to words. Thus, in two experiments, words with an implicit up or down directional cue were primed with low (1, 2) and high (8, 9) numbers. Subjects had to perform a lexical decision task on the words, first with a bimanual response and second with go-no-go responses. Interestingly, in both experiments we found a significant interaction between implicit directional cue of words and that of num-

bers. Low numbers facilitate processing of low-words (e.g., ground) and hinder processing of up-words (e.g., sky). The reversed pattern holds for high numbers. In a further experiment we implemented a paradigm allowing simultaneous presentation of words and numbers. Again, we presented words with implicit directional cue (e.g., sky, ground); this time embedded in the number flankers 1, 5 and 9. Again, we expected an interaction. And this is exactly what we found: words and number flankers interact significantly. Moreover, the neutral flanker lies numerically between the mean RT for 1- and 9-flankers, which fits nicely to our assumption of spatial relatedness. These results provide strong evidence that number meaning and word meaning indeed are grounded in spatial relations, sharing a common representational platform.

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The early ups and downs of morality: Evidence for embodied moral evaluation in 24-month olds C. MINAEW, I. HENRICHS & B. ELSNER *Department of Psychology, University of Potsdam*

Expressions like "She's an upstanding person" are part of everyday communication. Lakoff and Johnson (1980) already postulated that such linguistic conceptual metaphors like "good is up" or "bad is down" might represent a deeper principle of cognition, modulated by bodily experience. Recent research indicates a relation between evaluative judgments and verticality in adults (Crawford et al., 2006; Meier & Robinson, 2004). Within their second year of life, children develop a fundamental understanding of prosocial and moral evaluation. However, it is still unclear, whether their evaluative judgements are also grounded in embodied cognition. The present study investigated whether young children's moral evaluation is associated with the vertical dimension of space. 24-month-old children (N = 48) first watched a puppet theater in which a protagonist tried to cross a river. In two following scenarios, either a helper emerged, who took the protagonist to the other riverside in his boat, or a hinderer appeared, who pushed the protagonist off his boat and crossed the river on his own. In a subsequent choice phase, the children were shown a house with two vertically arranged windows, and were asked to indicate behind which window they expected to find the helper or the hinderer. Based on the "good is up/bad is down"-metaphor, we hypothesized that the toddlers would designate the upper window for the helper and the lower window for the hinderer. Indeed, children's choices differed according to the agent's valence ($\chi^2 = 4.30; p = .039$) and followed the expected pattern. These findings indicate that moral evaluation seems to be embodied in cognitive structure already at an early age. To our knowledge, this is the first evidence that discloses a relation between moral evaluation and vertical dimension in children.

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Modality compatibility in a semantic categorization task ANDREA M. PHILIPP, SIMONE SCHÄFFNER, DENISE N. STEPHAN & IRING KOCH *RWTH Aachen University*

Language can be perceived with different sensory modalities (auditory for spoken language vs. visual for written language) and it can be produced with different response modalities (vocal for spoken language vs. manual for written language). In the present study, we examined the influence of sensory and response modalities in a semantic categorization task. More specifically, we compared different modality combinations and the effect of switching between these combinations. Participants had to perform a semantic categorization task (i.e. forest vs. farm animal) in each trial. The language input was given either auditory (spoken animal names) or visual (written animal names), the right/left decision had to be given either vocal (by saying right or left) or manual (by pressing a right/left response key). The modality combinations were blocked so that participants either switched between compatible combinations (auditory-vocal and visual-manual) or between incompatible combinations (auditory-manual and visual-vocal). Note that modality compatibility was defined by an overlap between the sensory modality and the sensory consequence of the response modality (cf. Stephan and Koch, 2010). The results of the present study demonstrate higher response times and error rates when two different modality combinations had to be used in successive trials (e.g., auditory-vocal followed by visual-manual) as compared to using the same modality combination twice (i.e., "switch costs"). Additionally, these switch costs were larger for incompatible combinations than for compatible combinations. The result indicates that performance in the semantic categorization task is influenced by the combination of sensory modality and response modality and that the corresponding task-set is modality specific.

Stephan, D. N., & Koch, I. (2010). Central crosstalk in task switching: Evidence from manipulating input-output modality compatibility. Journal of Experimental Psychology: Learning, Memory & Cognition, 36, 1075-1081.

.. 83 ..

The role of reading direction in mental model construction during auditory language comprehension ANTONIO ROMAN[1], ANDREA FLUMINI[2], MARYSOL ESCOBAR[3] & JULIO SANTIAGOA[1] [1]*Dept. of Experimental Psychology, University of Granada;* [2]*Dept of Psychology, University of Bologna, Bologna;* [3]*Faculty of Administrative and Social Sciences, Autonomous University of Baja California*

In a recent study, Roman, El Fathi and Santiago ("Spatial biases in understanding descriptions of static scenes: The role of reading and writing direction", Memory & Cognition, in press) showed that when people listen to scene descriptions like "the table is between the lamp and the TV", they tend to deploy the described objects using the same directionality as the script in which the input language is written. If the language was Spanish, participants preferred to draw the lamp on the left and the TV on the right, whereas if the language was Arabic, the lamp tended to be drawn on the right and the TV on the left. In the present study we manipulated experimentally the directionality of prior reading experience. Spanish participants read either a normal (left-to-right) four pages text or its horizontally mirror reversed version (right-to-left), and then carried out the same scene description drawing task. Mirror reading induced a nine-fold increase in the preference for a right- to-left ordering of objects (from 6% to 53.5%). Thus, a small amount of practice reading in the opposite direction to the habitual one is enough to drastically change the spatial preferences for mental model construction during auditory language comprehension.

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Suppressing sound symbolism: The role of embodiment in the Bouba/Kiki effect DAVID M. SIDHU & PENNY M. PEXMAN *University of Calgary*

The Bouba/Kiki Effect (Köhler, 1947; Ramachandran & Hubbard, 2001) is the tendency to pair nonwords containing rounded vowels and/or continuant consonants (e.g., bouba) with rounded shapes, and nonwords containing unrounded vowels and/or stop consonants (e.g., kiki) with jagged shapes. Although it has been demonstrated across a number of tasks (for example Parise & Spence, 2012), an explanation of the underlying mechanism for this sound symbolism effect has been elusive. One suggestion put forth by Ramachandran and Hubbard (2001) is that the kinesthetic experience of pronouncing nonwords may play a role. Thus the embodied experience of 'round' or 'sharp' movements while pronouncing nonwords like bouba or kiki, may become associated with 'round' or 'sharp' visual stimuli respectively. In cases where nonwords are read silently, this articulatory experience may be derived through simulation. The role of articulation in sound symbolism has, however, never been tested. To this end, we conducted a study in which we interfered with participants' articulatory simulation while they performed a Bouba/Kiki task. Nonwords included 'round', 'sharp' and neutral items. Compared to participants who read nonwords silently, participants whose articulation was disrupted showed a significantly reduced Bouba/Kiki Effect. Notably, our manipulation especially inhibited the articulation of 'sharp' phonemes, and we observed the strongest reduction in the effect for 'sharp' nonwords. Further, under the manipulation participants judged more of the neutral nonwords as matching the rounded shapes. Together these findings suggest that embodied articulatory experience is a key component of the Bouba/Kiki Effect.

Köhler, W. (1947). Gestalt psychology. New York, NY: Liveright.

Parise, C. V., & Spence, C. (2012). Audiovisual crossmodal correspondences and sound symbolism: a study using the implicit association test. Experimental Brain Research, 220, 319-333.

Ramachandran, V. S., & Hubbard, E. M. (2001). Synaesthesia: A window into perception, thought and language. Journal of Consciousness Studies, 8, 3-34.

.. 85 ..

The effect of body posture and empathy on the recognition of facial expressions of emotions and deception detection MIRCEA ZLOTEANU & DANIEL C. RICHARDSON *University College London*

Previous research has indicated that adopting certain body postures can have significant effects on the way individuals process social information, but little is known of the effect pos-

tures may have on social acuity, the ability to perceive the psychological state of others and correctly interpret their behavioural cues. The current study investigated the effect of open and closed body postures on the recognition of facial expressions of emotion and deception detection. It was hypothesised that adopting an Open posture would result in improved recognition of all seven universal expressions, compared to a Closed posture. Secondly, the Open posture would improve accuracy of deception detection, due to the improvement in recognition of cues of deception. Differences in empathy were also considered, as empathy is an important individual difference relating to the accurate recognition of emotional states in other, predicting that individuals with higher self-reported empathy would outperform individuals with lower empathy scores on both facial expression recognition and deception detection. We found partial support for our experimental hypotheses. The Open posture improved accuracy of truth detection, but not of lie detection. No effect of posture was found for the recognition of facial expression of emotion. The predicted advantage of higher trait empathy was found for truth detection, but no effect for either the lie detection or for facial expression recognition. We frame our results in terms of theories of social acuity and information processing, and highlight their implications in the field of deception detection.

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When left is not right: Handedness effects on learning object-manipulation words using pictures with left or light-handed first-person perspectives JACQUELINE A. DE NOOIJER, TAMARA VAN GOG, FRED PAAS & ROLF A. ZWAAN *Erasmus University Rotterdam*

According to the Body Specificity Hypothesis, reading or hearing an action word leads to creating body specific mental simulations of the denoted action. Left and right-handers should, therefore, make different mental simulations. We investigated whether seeing a picture with a left-handed, right-handed or bimanual perspective, which either matches or mismatches the participants' mental simulation, would differentially influence left and right-handers in the number of object-manipulation words they learned from an artificial language. We found a significant interaction between the picture that was shown (left, right, bimanual) and handedness. Right-handers recalled more definitions of the words that were learned with a picture of a right-handed perspective, compared to a left-handed perspective. For left-handers there was no difference in the number of words learned under the different conditions. In a replication study we found the same results. These findings suggest that seeing a picture of an action can improve recall for right-handers when the perspective shown matches the learners own body. Left-handers, who come into contact with the right-handed perspective frequently, can presumably overcome the lack of motor experience with visual experience and were therefore not influenced by the perspective they were shown during word learning.

Information

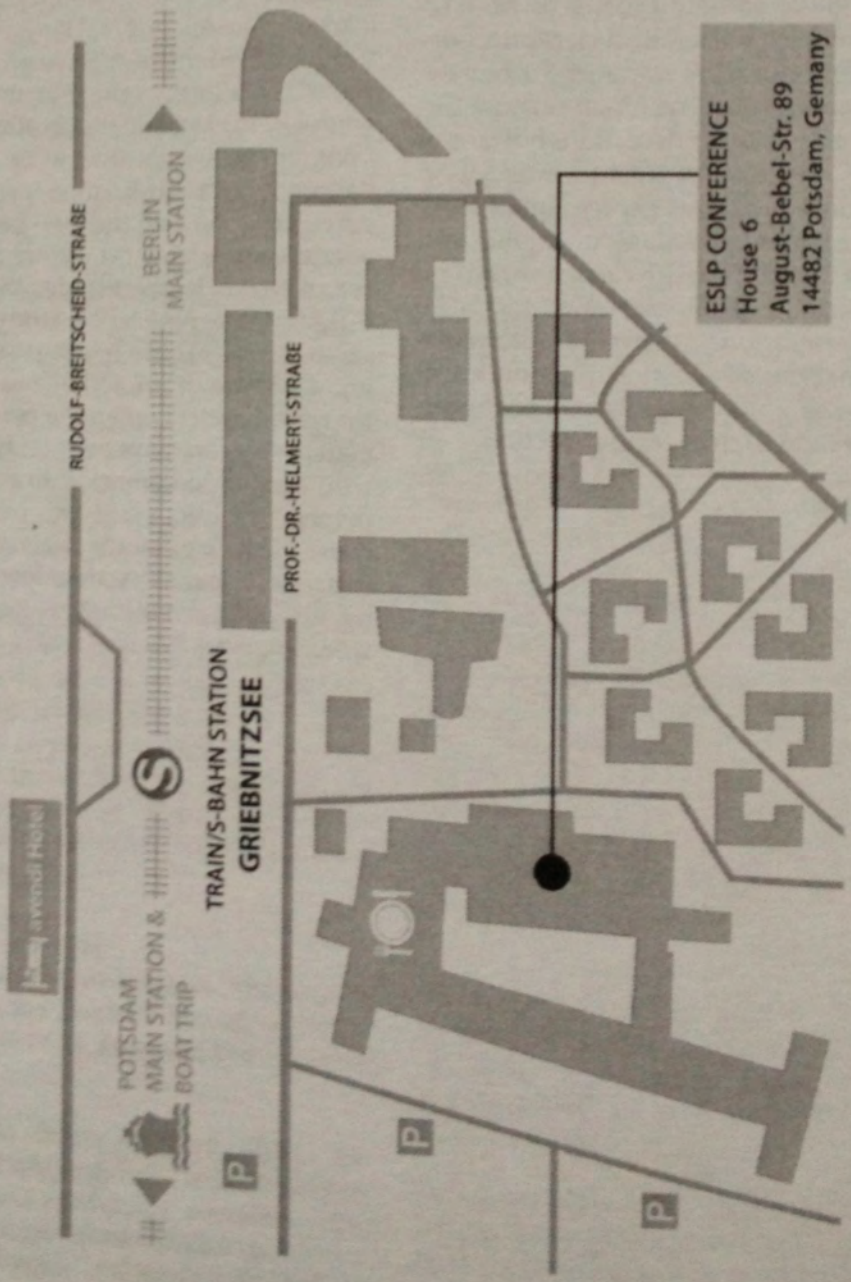
Conference Venue

The plenary lectures, talks and poster sessions as well as coffee breaks will take place at Campus Griebnitzsee of the Potsdam University in House 6, August-Bebel-Str. 89, 14482 Potsdam (see map below).

The campus is 2 minutes walk away from the the station Griebnitszee, which assures connections to both Potsdam and Berlin (S-bahn line 1 and 7, Regional Trains RB 21 and 22).

Lunches

Lunches are included in the conference fee and will be provided by the University canteen located in House 1.

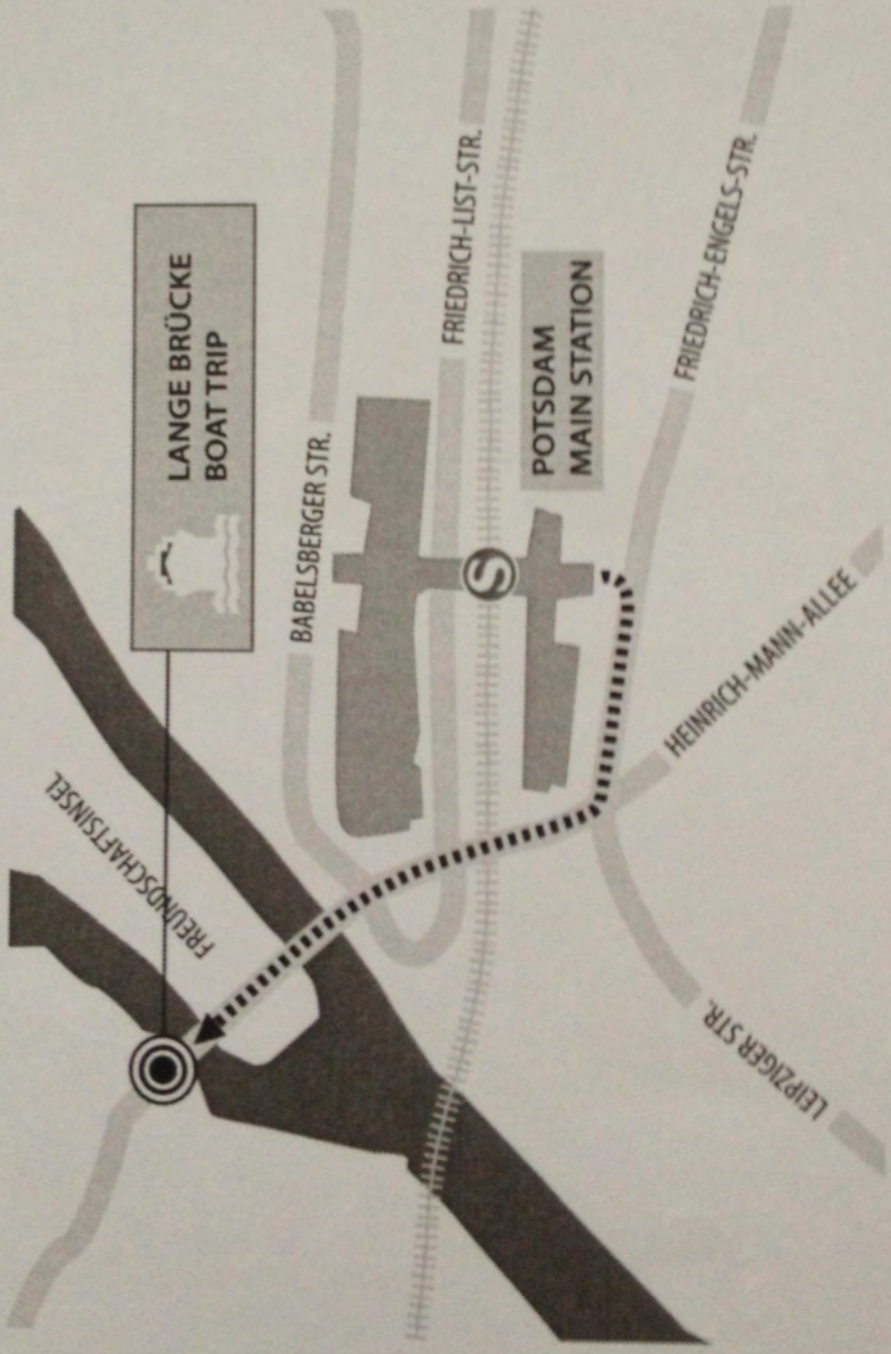


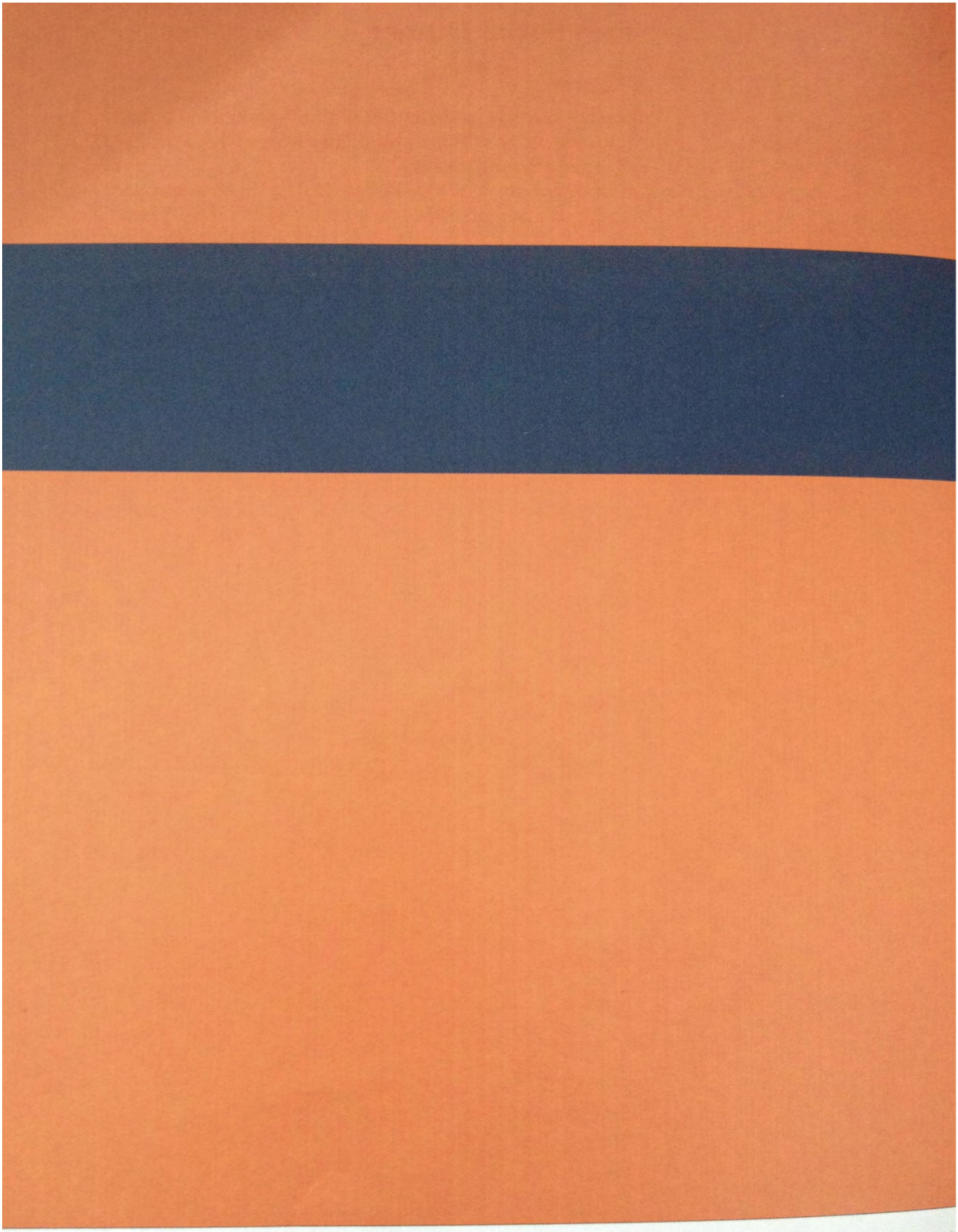
Free Social Dinner

A special event will take place on **Tuesday evening** for all ESLP participants. You are all invited to join us on board of the MS "Königswald" to discover the beautiful surroundings of Potsdam and enjoy a typical dinner.

The boat cruise will start at **18:00** (boarding at the "Lange Brücke" in Potsdam, see map below) and will last 3 hours. We will provide you with a free ticket for public transport to the departure point of the boat upon request. No fees will be charged for admission to this event. You only have to pay for your drinks.

Please be at the boat on time and bring the voucher for the dinner, which you received with your conference materials.





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