

# X. Dubrovnik Conference on Cognitive Science

24 May – 27 May 2018, Dubrovnik, Croatia

## Communication, Pragmatics, and Theory of Mind



### **Invited Speakers:**

Nausicaa Pouscoulous (UCL, UK)  
Paula Rubio-Fernández (MIT, USA)  
Arthur M. Jacobs (FU Berlin, Germany)  
Ira Noveck (CNRS Lyon, France)  
Deirdre Wilson (UCL, UK)  
Noah Goodman (Stanford University, USA)  
Judith Holler (MPI for Psycholinguistics, Nijmegen, NL)

### **Chairs:**

Bálint Forgács, Lilla Magyari

### **Organizers:**

Francesca Bonalumi, Paula Fischer, Birgit Knudsen, Barbu Revencu, Laura Schlingloff,  
Georgina Török

Centre for Advanced Academic Studies (CAAS) Dubrovnik  
University of Zagreb

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CENTRAL EUROPEAN COGNITIVE SCIENCE ASSOCIATION

# Program

## Thursday, May 24

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16.00 – 18.00 Registration

18.00 – 19.00 Welcome Reception

## Friday, May 25

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08.00 – 09.00 Registration

09.00 – 10.00 Nausicaa Pouscoulous: “Pathways to pragmatics: what children can teach us”

10.00 – 11.30 Poster Session 1 and Coffee break

11.30 – 12.30 Paula Rubio-Fernández: “How children and adults use referential contrast for efficient communication”

12.30 – 14.30 Lunch

14.30 – 15.30 Arthur M. Jacobs: “Neurocognitive poetics or How the brain works in literature”

15.30 – 17.00 Poster Session 2 and Coffee break

17.00 – 18.00 Ira Noveck: “When what is said comes close to what is meant”

## Saturday, May 26

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- 09.00 – 10.00 Deirdre Wilson: “Metonymy and mindreading”
- 10.00 – 11.30 Poster Session 3 and Coffee break
- 11.30 – 12.30 Young Researchers’ Session  
Jana Bašňáková: “I see your point: The neural correlates of indirect communicative pointing gestures”  
Charlotte Grosse Wiesmann: “Longitudinal evidence for 4-year-olds’ but not 2- and 3-year-olds’ false-belief-related action anticipation – independently of pragmatic factors”  
Lucas Raynal: “Developmental trajectory of verbal approximations’ comprehension, an event-related potential (ERP) study”
- 12.30 – 14.30 Lunch
- 14.30 – 15.30 Noah Goodman: “Using and learning language”
- 15.30 – 16.00 Coffee break
- 16.00 – 17.00 Judith Holler: “Multimodal pragmatics: Language and the body in interaction”
- 17.00 Social Program

## Sunday, May 27

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Departure

# Abstracts – Invited speakers

## Pathways to pragmatics: what children can teach us

Nausicaa Pouscoulous  
University College London, UK

Human communication – pragmatic theories tell us – requires impressive inferential abilities and mind-reading skills (such as recognising communicative intentions and taking into account common ground). To learn how to speak and become competent communicators children need both. Yet, theories are divided concerning the breadth of mindreading skills in young communicators. Research is also divided on how good young children's pragmatic abilities are. On the one hand, much evidence suggests pragmatics play a grounding role in the development of communication and language acquisition. On the other hand, linguistic pragmatic inferences such as metaphors and implicatures seem to develop later than other linguistic abilities. Indeed, some maintain that there are two separate systems for belief reasoning: a simpler one and a more sophisticated one that develops later (Apperly & Butterfill, 2009); along this line of reasoning we should also expect there to be two separate kinds of pragmatic abilities: an early set using (amongst other things) the simpler theory of mind system and a second set of pragmatic skills appearing later in childhood and using full-blown theory of mind abilities. I will argue that there is no need to divide pragmatic abilities in such a way to bridge the gap between pragmatic inferential skills found in toddlers and the difficulties with pragmatic phenomena observed in preschoolers. I will discuss evidence showing that phenomena such as metaphor and implicatures can be understood by much younger children than previously established and suggest that several factors – independently of children's pragmatic abilities *per se* – may explain children's apparent struggle with pragmatic inferences. There is an exception, nonetheless: irony. Irony comprehension is consistently found only after school age. I will finish by presenting an account explaining this discrepancy.

## How children and adults use referential contrast for efficient communication

Paula Rubio-Fernández

Massachusetts Institute of Technology, USA

The general assumption in Gricean pragmatics is that minimal referential expressions that determine unique reference are optimal. This assumption, however, fails to take into account perceptual factors. For example, if the star is the only blue sticker in a display, then referring to it as 'the blue star' may be optimal – or at least not as redundant as if all the stickers were blue.

In this talk, I will present a series of cross-linguistic studies with adults (including language production and eye-tracking language comprehension) supporting the hypothesis that redundant referential expressions may be efficient. Overall, the results of these studies suggest that adult referential communication runs efficiently, even when we use redundant referential expressions.

I will also present a series of developmental studies with Norwegian and Spanish preschoolers investigating the development of referential contrast in child language.

## Neurocognitive poetics or How the brain works in literature

Arthur M. Jacobs

Freie Universität Berlin, Germany

Reading is not only (cold) information processing, but involves affective and aesthetic processes that go far beyond what current models of word recognition, reading, or text comprehension can describe. The Neurocognitive Poetics perspective (Jacobs, 2015a,b; Willems & Jacobs, 2016) emphasizes such affective-aesthetic processes during the reading of verbal materials in more natural and ecologically valid tasks and contexts going from ‘micropoems’ in the form of single words (Jacobs, 2017) or metaphors (Jacobs & Kinder, 2018) to entire poem corpora (Jacobs et al., 2017, Jacobs, 2018). It also provides methods, e.g. Quantitative Narrative Analysis/QNA tools like the Berlin Affective Wordlist/BAWL (Jacobs et al., 2015), as well as models (e.g., the Neurocognitive Poetics Model/NCPM; Jacobs, 2015a; Jacobs & Willems, 2017) for quantifying the wealth of distinctive features of all kinds of verbal materials used in such tasks and predicting their effects on reader responses, e.g. for use as parametric regressors in fMRI studies on literature reception. In this paper I address the issue of how the brain works in literature within the framework of the NCPM. Its predictions are discussed in the light of empirical results from studies on word recognition, metaphor comprehension or poetry reception.

## When what is said comes close to what is meant

Ira Noveck

Centre National de la Recherche Scientifique, Lyon, France

For the last twenty years or so, much experimental work has been devoted to pragmatic inference, i.e. cases where what a speaker means goes beyond what she merely said. For many researchers, the pragmatic effects linked to something said (whether it be an enrichment or what is attributed to a specific speaker) is viewed as practically automatic (or even grammatical). For example, in the case of scalar implicature (in which *Some participants are children* can be understood as *Some but not all participants are children*) authors often assume that the enrichment "typically" or "usually" arises as soon as the underinformative term -- *some* in the above example -- is uttered. In the first part of this talk, I take a step back to re-evaluate such claims. I then turn to cases in which the pragmatic import of terms is indeed conventionalized. This harkens back to Grice's conception of conventional implicature, which he contrasted with conversational implicature. Conventional implicatures refer to a class of words that include pragmatic meaning but without altering an utterance's truth-conditional content (e.g., *but* provides contrast while being truth-functionally equivalent to *and*). This leads me to report on some of my recent attempts with colleagues to experimentally isolate participants' behaviors with respect to the pragmatic import of conventionalized meanings found specifically in French.

## Metonymy and mindreading

Deirdre Wilson

UCL Linguistics, UK; IFIKK, University of Oslo, Norway

The last twenty or thirty years have seen a move away from code-based theories of communication to inferential theories on which the speaker's aim is not to *encode* her message in an utterance but to provide *clues* to her intended meaning. Figurative utterances (e.g. metaphor, irony, metonymy) present a challenge to inferential accounts of communication. Throughout their history, figurative utterances have been standardly analysed using code-like 'transfer of meaning' rules (e.g. 'In irony, the literal meaning is replaced by its opposite', 'In metaphor, the literal meaning is replaced by a related simile or comparison', 'In metonymy, the literal meaning is replaced by the name of an associated attribute or adjunct'). While there are now several plausible inferential accounts of metaphor and irony, metonymy – illustrated in (1)-(3) – continues to present a serious challenge.

- (1) The *appendicitis* in bed 3 is threatening to write to the newspapers
- (2) Can you take the *pepperoni pizza* his glass of wine?
- (3) *Buckingham Palace* is refusing to comment.

How can the speaker of (1)-(3) be seen as providing *evidence* of her intention to refer to a patient, a customer and a group of people rather than a disease, a dish or a building, respectively? In this paper, I will outline a new approach to metonymy (developed jointly with Ingrid Lossius Falkum) which may help to meet this challenge. On this approach, metonymy is a type of neologism, or word coinage, and is understood in exactly the same way as other types of word coinage, needing no special interpretive rules or mechanisms.



## Using and learning language

Noah Goodman

Stanford University, USA

Probabilistic models of human cognition have been successful at capturing the ways that people represent and reason with uncertain knowledge. The Rational Speech Act framework uses probabilistic modeling tools to formalize natural language understanding as social reasoning: literal sentence meaning arises through probabilistic conditioning, cooperative speakers choose utterances to convey relevant information to listeners, and context-specific interpretation is the result of listeners reasoning about cooperative speakers. I will describe how this framework can explain some of the remarkable efficiency and flexibility in human language use, including resolving the puzzle of over-informative reference, explaining hyperbolic uses of numerical expressions (“I waited a million years”), and providing a simple semantic theory of generic sentences (“professors like to talk”). I will then explore how this approach may help us build systems that learn to use grounded language, by combining RSA pragmatics with deep neural net models for semantics.

## Multimodal pragmatics: Language and the body in interaction

Judith Holler

Max Planck Institute for Psycholinguistics, Nijmegen, Netherlands

The natural home of language use is in face-to-face interaction. In this kind of environment, language is multimodal, consisting not only of speech but also of many layers of visual signals. I will first present research corroborating the notion that the information carried by speech and the body forms an integrated semantic system. I will then illustrate various ways in which visual bodily signals are involved in the social act of communicating. To this end, I will talk about the link between visual bodily signals and communicative intentions and their role in pragmatic processes core to dialogue. In particular, I will present experimental studies investigating the connection between gesture and recipient design, and the role of the body in achieving mutual understanding. These studies show that gestures are instrumental in the process of grounding and for signaling information status, as well as in adapting one's utterances to the knowledge state of an addressee. I will then report findings from corpus studies that focus on a typical environment in which we use multimodal language and aim to achieve mutual understanding, namely casual face-to-face conversation. Conversational turn-taking requires extremely fast semantic and pragmatic processing to allow us to make our contributions in a time-sensitive fashion and I will present findings that suggest an important role of the body in this domain. Together, the different studies demonstrate, firstly, that the body is an integral part of the human language system. Secondly, they show that speech and visual bodily signals do not just 'double up' to increase redundancy in the system, but that the two modalities interact in an intricate manner to master the challenge of human communication.

# Abstracts – Young researchers' talks

I see your point:

The neural correlates of indirect communicative pointing gestures

Jana Bašnáková, Max Planck Institute for Psycholinguistics, Nijmegen, Netherlands &  
Institute of Experimental Psychology, CSPS SAS, Slovakia

Jos van Berkum, UiL-OTS, Department of Languages, Literature and Communication,  
Utrecht University, Netherlands

Emanuela Campisi, Department of Humanities, University of Catania, Italy

Peter Hagoort, Max Planck Institute for Psycholinguistics, Nijmegen, Netherlands

Communication is not limited to the linguistic code: conversations often rely on signals that are both non-conventional and non-verbal, such as pointing gestures. In an fMRI study, we compared the neural correlates of communicative meaning comprehension in cartoon stimuli for verbal utterances and matched pointing/showing gestures, which were either direct or indirect. The choice of indirect speech and pointing gestures was motivated by the fact that they amplify two features present in everyday communication: first, complete reliance on context for figuring out the speaker's informative intentions (pointing gestures without coded meaning); second, the necessity to bridge the gap between explicitly stated and implicitly communicated message (indirect speech). Our hypothesis was that indirectness should engage the same mentalizing regions regardless of modality, since it expresses identical social intentions. We found that the difference between verbal and gestural indirectness was indeed not in regions associated with social cognition (medial prefrontal cortex, bilateral TPJ, precuneus), but rather with resolving semantic ambiguity (right BA45). We conclude that while the intentional-inferential infrastructure for interpersonal communication is the same regardless of the communicative signal's modality, the ambiguity inherent in indirect pointing gestures makes it more difficult to establish their referential/literal meaning, relative to verbal indirectness.

*Keywords: pointing gestures, indirect speech, communicative intentions*

E-mail: [jana.basnakova@savba.sk](mailto:jana.basnakova@savba.sk)

## Longitudinal evidence for 4-year-olds' but not 2- and 3-year-olds' false-belief-related action anticipation – independently of pragmatic factors

Charlotte Grosse Wiesmann, Max Planck Institute for Cognitive and Brain Sciences,  
Leipzig, Germany

Angela D. Friederici, Max Planck Institute for Cognitive and Brain Sciences,  
Leipzig, Germany

Nikolaus Steinbeis, University College London, UK

Denisse Disla, Freie Universität Berlin, Germany

Tania Singer, Max Planck Institute for Cognitive and Brain Sciences, Leipzig, Germany

Understanding other individuals' false beliefs is considered a milestone of Theory of Mind, which has long been assumed to be achieved around the age of 4 years. In the past decade, however, infants younger than 2 years of age have been shown to display correct expectations of the actions of an agent with a false belief. The developmental trajectory of these early abilities from infancy to preschool-age and their limitations remain a matter of debate. We tested children longitudinally from 2 to 4 years of age with an established anticipatory looking false belief task, and found correct anticipation only by the age of 4 but not at the ages of 2 and 3 years. There was a significant developmental change between 3 and 4 years of age around the same age when children start passing traditional false belief tasks. We then manipulated a pragmatic factor of the task to test its impact on early false belief performance. This showed that the presence of a sound while the agent was looking away and acquiring a false belief did not improve infants' action anticipation. Taken together, these findings point towards the fragility of early belief-related action anticipation before the age of 4 years.

*Keywords: Theory of Mind, false belief, anticipatory looking, longitudinal development*

E-mail: [wiesmann@cbs.mpg.de](mailto:wiesmann@cbs.mpg.de)

## Developmental trajectory of verbal approximations' comprehension, an event-related potential (ERP) study

Lucas Raynal, University Cergy Pointoise  
Évelyne Clément, University Cergy Pointoise  
Emmanuel Sander, University of Geneva  
Louise Goyet, University Paris 8  
Mariane Habib, University Paris 8  
Yannis Idir, University Paris 8  
Pia Rämä, University Paris 5

Recent studies suggest that unrefined concepts sometimes lead young children to accept their unconventional applications to a situation (semantic approximations). This study aims at assessing whether young children are less prompted than adults to detect semantic approximations' incongruity. The N400 component, reflecting incongruity detection, is compared in French 3.6-4.2 years' old children and adults presented with 160 images (e.g. someone peeling an orange) associated with a sentence ("she is X an orange") containing either a congruent ("peeling"), an approximative ("undressing ") or an incongruent verb (e.g. "pressing"). Incongruent verbs should elicit more negative N400 than congruent verbs for both children and adults. Critically, we expect approximative verbs to elicit N400 similar to the ones elicited by incongruent verbs for adults, but similar to the ones elicited by congruent verbs for children. Data from adults have already been collected while those from children are still being collected and will be presented at the conference. Results from adults demonstrate that N400 are more negative for incongruent and approximative verbs than for congruent verbs, suggesting the detection of semantic approximations' incongruity. The implications of the comparison between children and adults' ERP responses to semantic approximations will be discussed regarding theories of conceptual development.

*Keywords: semantic approximation, N400, conceptual development, analogy, metaphor*

E-mail: [lucasraynal@gmail.com](mailto:lucasraynal@gmail.com)

# Poster sessions

## Poster Session 1: Friday, May 25, 10.00-11.30

**Some books are made of chocolate. Context sensitivity in truth judgments of seemingly absurd sentences**

*Adina Camelia Bleotu*

**Use of first-person singular and plural forms in politicians' speech**

*Lilla Magyari, Bálint Forgács, Nora Lien Nguyen Dang, Csaba Pléh*

**Linguistic vs. social embodiment: Is there a meaningful difference?**

*Tomaž Babič, Anja Levačič, Aleš Oblak*

**Does social distance modulate adults' egocentric biases when reasoning about false beliefs?**

*Benjamin Farrar, Ljerka Ostojić*

**Ascribing false beliefs is not sufficient for ascribing intentions based on beliefs**

*Britta Schünemann, Marina Proft, Hannes Rakoczy*

**Psychology and pragmatics: a two time birth**

*Csaba Pléh*

**Non-native speakers' perceptions of foreigner talk use in native/non-native speaker communication in the U.S.**

*Danielle Labotka, Susan A. Gelman*

**Saying, presupposing and implicating: How pragmatics modulates commitment**

*Diana Mazzarella, Robert Reinecke, Ira Noveck, Hugo Mercier*

**Factors in ambiguity resolution of quantifiers**

*Tal Tehan, Yechezkel Shabanov, Zafrit Levin, Rama Novogrodsky, Einat Shetreet*

**Children's long-term learning from linguistic in-group and out-group members**

*Eszter Endrődi, Katalin Oláh, Ildikó Király*

**A new approach to assist children with autism develop visual perspective taking skills using a humanoid robot - Methodology development**

*Gabriella Lakatos, Luke Wood, Ben Robins, Dag Sverre Syrdal, Abolfazl Zarak, Kerstin Dautenhahn*

**Children's understanding of the ironical tone of voice: Evidence from eye-tracking and picture selection**

*Ingrid L. Falkum, Franziska Köder*

**The language of friendship: Exploring the contributions of pragmatics & structural language skills to play behaviours in children**

*Jenny Gibson, Elian Fink*

**A psycholinguistic-developmental analysis of character representation in picture-based narratives**

*Judy Kupersmitt*

**Error monitoring in explicit probabilistic sequence learning**

*Kata Horváth, Zsófia Kardos, Ádám Takács, Karolína Janacsek, Dezső Németh, Andrea Kobor*

**Investigation of explicit and implicit categorization strategies**

*Krisztián Borbély, Anett Ragó, Máté Varga*

**Children's understanding of aspectuality in an action-based false belief task**

*Lisa Wenzel, Sebastian Dörrenberg, Marina Proft, Ulf Liszkowski, Hannes Rakoczy*

**Age-related differences in multimodal recipient design: Younger, but not older adults, adapt speech and gestures to their addressee's knowledge state**

*Louise Schubotz, Asli Özyürek, Judith Holler*

**How much bullshit can you handle? The role of form and content in the creation of bullshit**

*Marek Jurkovič, Vladimíra Čavojová, Ivan Brezina*

**To be perceptive or not to be perceptive, that is the question. A comparative study of interspecific communicative interactions with pigs and dogs**

*Melinda Lovas, Linda Gerencsér, Paula Pérez Fraga, Dóra Ujváry, Attila Andics*

**Who seeks for human assistance when facing an unsolvable problem? A comparative study of pigs' and dogs' looking behavior**

*Paula Pérez Fraga, Linda Gerencsér, Melinda Lovas, Dóra Ujváry, Attila Andics*

**Children's acquisition of regular metonymy: Exploring the producer-product relation**

*Rebecca Zhu, Mahesh Srinivasan*

**Aging, short- and long-term memory in a traditional Dania tribe of Papua**

*Agnieszka Sorokowska, Piotr Sorokowski, Agnieszka Sabiniewicz, Anna Oleszkiewicz, Corinna E. Loeckenhoff*

**Understanding Moore-paradoxical sentences and logical inconsistency in children**

*Szabolcs Kiss, Brigitta Szenetes-Hajler*

**The effects of transcranial direct current stimulation over the medial-frontal cortex on cognitive control**

*Teodóra Vékony, Adrienn Holczer, László Vécsei, Anita Must*

**A more pragmatic Sefo-task**

*Sebastian Dörrenberg, Marc Heuser, Hannes Rakoczy, Ulf Liszkowski*

**When implicit mentalising turns into explicit: Effects on behavioural responses**

*Zsófia Esperger, Luca Kozma, Ferenc Kocsor*



## Poster Session 2: Friday, May 25, 15.30-17.00

### **Commitment and implicit communication**

*Francesca Bonalumi, Julius Tacha, Thom Scott-Phillips, Christophe Heintz*

### **Creating shared conceptual representations**

*Sara Bögels, Branka Milivojevic, Naomi de Haas, Christian Döllner, Marlou Rasenberg, Asli Ozyurek, Mark Dingemans, Lotte Eijk, Mirjam Ernestus, Herbert Schriefers, Mark Blokpoel, Iris van Rooij, Stephen C. Levinson, Ivan Toni*

### **Uncovering complex individual dynamical representations using reaction times in a probabilistic learning task**

*Balázs Török, David G. Nagy, Karolina Janacsek, Dezső Németh, Gergő Orbán*

### **Native word stress representation is associated with working memory capacity**

*Borbála German, Andrea Kóbor, Valéria Csépe, Ferenc Honbolygó*

### **Lossy compression in human memory**

*David G. Nagy*

### **14-month-old human infants spontaneously represent others' false beliefs involving numerical identity mistakes**

*Dora Kampis, Ildikó Király, Josep Call, György Gergely*

### **Grounding relevance theory in oscillatory dynamics**

*Elliot Murphy*

### **Unlike little kids: Adults' selective trust decisions under limited cognitive resources**

*Franziska Brugger, Jonas Hermes, Tanya Behne, Hannes Rakoczy*

### **The role of pragmatics vs. novelty in a label assignment task**

*Hanna Marno, Dan Sperber*

### **When do we read minds? Methodological and developmental variation in pragmatic inference**

*Isabelle Lorge, Napoleon Katsos*

### **The effect of disagreement on children's source memory performance**

*Johannes Mahr, Iulia Savoş, Olivier Mascaro, Hugo Mercier, Gergely Csibra*

**The role of semantic categories in infants' false-belief understanding**

*Júlia Baross, Bálint Forgács, Judit Gervain, Eugenio Parise, Gergely Csibra, György Gergely, Ildikó Király*

**Expectations of shared cultural knowledge hinder children's false belief attribution**

*Katalin Oláh, Zsófia Válint, Ildikó Király*

**The meaning of some**

*Katalin É. Kiss, Ágnes Langó-Tóth, Lilla Pintér*

**Context sensitivity of level-2 perspective taking**

*Lívía Priyanka Elek, Renáta Szücs, Katalin Oláh, Fruzsina Elekes, Máté Varga, Clara Ajisuksmo, Ildikó Király*

**Cognitive underpinnings of irony understanding in children**

*Maria Zajackowska, Kirsten Abbot-Smith, David Williams*

**How linguistic common ground management affects online language comprehension**

*Marlou Rasenberg, Geertje van Bergen, Joost Rommers*

**An event-related potential (ERP) study of cognitive control in young adulthood**

*Martina Knežević*

**Functions of ostensive communicative stimuli of storytelling for children**

*Melinda Papp, Lívía Ivaskó*

**The effect of an audience on dogs' performance**

*Orsolya Kiss, József Topál*

**Can Eurasian jays (*Garrulus glandarius*) integrate others' desires and perspectives to protect their caches?**

*Piero Amodio, Ljerka Ostojić, Christopher Krupenye, Nicola Clayton*

**She knows/ She thinks/ She doesn't know that X: Presuppositional effects trigger context sensitivity of language-induced motor activity: A grip-force study**

*Robert Reinecke, Tatjana Nazir, Jacques Jayez*

**Nonverbal communication: People lower their voice frequencies when giving expert advice**

*Piotr Sorokowski, Agnieszka Sorokowska, Davit Puts, Janie Johnson, Katarzyna Pisanski*

**Putting complement clauses and false belief into context**

*Silke Brandt, Stephanie Hargreaves, Anna Theakston*

**Infants' interpretation of direct approaches of human and non-human agents**

*Szilvia Biro*

**Being bilingual does not enhance the ability of preschool children to produce alternative names**

*Theodora Karadaki, Martin J. Doherty*

**Lexicalization of orthographic representations: A pilot study**

*Vera Varga, Valéria Csépe*

**The role of Theory of Mind functions in language comprehension in adults**

*Zsuzsanna Üllei, Bálint Forgács, Judit Gervain, Eugenio Parise, Gergely Csibra, György Gergely, Lívía Elek, Ildikó Király*

### Poster Session 3: Saturday, May 26, 10.00-11.30

**Even 3-4 years-olds understand implicatures if the cognitive load of the task is reduced**

*Andrea Balázs, Anna Babarczy*

**Children's assessment of a speaker's attitude influences their understanding of the speaker's beliefs**

*Anna Babarczy, Marta Szucs, Andrea Balázs*

**Are all labels widely shared? Children's understanding of the boundaries of conventions**

*Begum Ozdemir, Patricia Ganea*

**The impact of movement-based classroom music education on cognitive development in first-grade children**

*Borbála Lukács, Emese Maróti, Kata Asztalos, Ferenc Honbolygó*

**Theory of Mind, working memory and math performance: A longitudinal study**

*Daniela Kloo, Beate Sodian, Susanne Kristen, Christopher Osterhaus*

**The role of shared space in the choice of spatial demonstratives**

*David Peeters*

**The director's task and camera controls: A second look**

*Edward W. Legg, Robert W. Lurz, Nicola S. Clayton*

**How does Theory of Mind understanding support children's peer interactions in a social pretend play context**

*Elian Fink, Jenny Gibson*

**Referential entropy influences the production of overspecifications**

*Elli N. Tourtouri, Les Sikos, Matthew W. Crocker*

**Belief updating processes in human adults**

*Ildikó Király, Barbara Pomiechowska, Gergely Csibra, Ernő Téglás, Ágnes Kovács*

**What counts as a fork anyway? A pragmatic account of classic counting error**

*Ivan Kroupin, Susan Carey*

**Climax, intention and goal spotting in sequences of others' actions**

*Josita Maouene, Mounir Maouene*

**The interpretative wiggle-room: The role of evidence in epistemic vigilance and plausible deniability**

*Julius Tacha, Francesca Bonalumi, Thom Scott-Phillips, Christophe Heintz*

**Is language required to represent others' mental states? Evidence from beliefs and other representations**

*Krešimir Đurđević, Steven Samuel, Edward W. Legg, Robert Lurz, Nicola S. Clayton*

**Differential responses of socialized minipigs to their caregivers; attachment bond or social preference?**

*Linda Gerencsér, Melinda Lovas, Paula Pérez Fraga, Anna Gábor, Dóra Ujváry, Márta Gácsi, Attila Andics*

**Lessons from Comparative Cognition: What can non-human studies tell us about human Theory of Mind?**

*Ljerka Ostojić, Edward W. Legg, Claire Hughes, Nicola S. Clayton*

**The development of nonverbal deception in 3-year-olds**

*Mareike Heinrich, Sebastian Dörrenberg, Ulf Liszkowski*

**Developmental relations between early social-cognitive abilities**

*Marianna Jartó, Johanna Rüter, Ulf Liszkowski*

**Default mode network of human brain supports theory of mind**

*Marta Marciniak*

**Constructivist Theory of Mind and deception in early school age**

*Melania Moldovan, Narcisa Prodan, Laura Visu-Petra*

**Relationship between framing-effect susceptibility and sensitivity to perceived risk in doctors**

*Nataliya Bogacheva, Elizaveta Pavlova*

**Interpreting physical and mental metaphors: Is Theory of Mind associated with pragmatics in middle childhood?**

*Paola Del Sette, Serena Lecce, Luca Ronchi, Luca Bischetti, Valentina Bambini*

**A blind spot for desires: signature limits in the implicit system**

*Rachel Crosby, Ljerka Ostojić, Edward Legg, Nicola S. Clayton*

**Evaluating cognition through linguistic features**

*Sofia de la Fuente, Ricardo Olmos, Saturnino Luz*

**Visual perspective-taking: How stepping into another's shoes can make you forget where you left your own**

*Steven Samuel, Edward Legg, Robert Lurz, Nicola S. Clayton*

**Domestic dogs may not be able to project their own visual experiences onto others**

*Ljerka Ostojić, Yvette Kalaba, Krešimir Đurđević, Tea Jermaniš, Edward W. Legg*

**The relationship between mindreading and nonverbal humor comprehension in deaf children**

*Timea Budai, Zsuzsanna Schnell, Kata Lénárd, Szabolcs Kiss*

**Personal attitudes towards ambiguity and risk in relation to the framing effect in Russian and Azerbaijani doctors**

*Yulia Krasavtseva, Tatiana Kornilova, Selena Kerimova*

# Abstracts – Posters

*Poster session 1*

*Friday, May 25, 10.00-11.30*

Some books are made of chocolate. Context sensitivity in truth judgments of seemingly absurd sentences

Adina Camelia Bleotu, University of Bucharest, Romania

By means of a TVJT, 30 Romanian-speaking 9 year olds and 30 adults were tested for contextual sensitivity in truth judgments of absurd sentences. Inspired by Noveck (2011)'s use of absurd statements alongside factual ones, the subjects in the current study were asked whether they agree with three absurd statements "Some books are made of chocolate", "Some fish are made of leaves" and "Some houses are made of bubbles". All subjects answered negatively. Afterwards, in the same testing session, the subjects were shown pictures of book-shaped chocolate pieces, leaves stuck on a paper, which had the shape of a fish (children are taught to use leaves as fish in art classes) and a photoshopped house made of a bubble, and they were asked to reassess the truth value of the already evaluated statements. All participants in the experiment then agreed that the statements were true, thus showing sensitivity to contextual cues. Interestingly, subjects accommodated under the extension of concepts such as "book", "fish", "house" book-like, fish-like and house-like entities, i.e. second-order representations of the referents at stake. This shows context plays an important part in assessing the truth of a statement, as speakers can creatively modify the intension of concepts to pick out more referents than expected.

Keywords: *context sensitivity, absurd sentences, concepts*

E-mail: [cameliableotu@gmail.com](mailto:cameliableotu@gmail.com)

## Use of first-person singular and plural forms in politicians' speech

Lilla Magyari, Péter Pázmány Catholic University, Hungary

Bálint Forgács, Eötvös Loránd University (ELTE), Hungary

Nora Lien Nguyen Dang, Péter Pázmány Catholic University, Hungary

Csaba Pléh, Central European University, Hungary

Several studies have found characteristic patterns of language use by those who are more likely to exhibit signals of power. For example, politicians who show a behavioural pattern of exuberant self-confidence recklessness, and contempt for others – described by some as the 'Hubris Syndrome' – use the pronoun 'we' instead of 'I' more often than more modest politicians. In our study, we have analyzed the ratio of the first-person singular ('I') and plural ('we') pronouns and verbal inflections in the semi-spontaneous speech of four Hungarian Prime Ministers since 1998. Two of them (Viktor Orbán and Ferenc Gyurcsány) had the opportunity to be PM in more than one electoral cycle. We have found no difference in the ratio of 'I' and 'we' in the speech of these two politicians, while the singular first-person pronoun was used more often by the others. Both Orbán and Gyurcsány used more often first-person singular verbal inflections during their first time being PM, while the difference between the amount of the singular and plural first-person verb inflections decreased during the course of their later prime-ministerships. These results support the hypothesis that extended period of powerful positions increase the exhibition of power in verbal behavior.

Keywords: *language use, corpus analysis, Hubris syndrome, power*

E-mail: [lillamagyari.ppke@gmail.com](mailto:lillamagyari.ppke@gmail.com)



## Linguistic vs. social embodiment: Is there a meaningful difference?

Tomaž Babič, University of Ljubljana, Slovenia

Anja Levačič, University of Ljubljana, Slovenia

Aleš Oblak, University of Ljubljana, Slovenia (*presenting author*)

Enactivist models of language posit that communicating agents constitute a continuous languaging-mediated interaction between a linguistic body and its lifeworld. Languaging is understood as an agent's linguistic engagement in sense-making, which, in turn, is inherent to any cognizing entity. When employed in congress with other agents, it leads to emergence of new, social meanings. Linguistic body is an abstract self that co-evolves with one's organismic self, composed entirely of linguistic sensitivities. Given that enactivist conception of language focuses on the interactive, we have to contend with related concepts: social embodiment and embeddedness. The former refers to all non-linguistic elements of an interaction, such as posture, whereas the latter deals with agent-social environment couplings. Due to the need for refined enactivist theories of language, we believe it necessary to conduct a conceptual analysis of this terminology. We present an overview of these embodiment types and put into question distinctions between them, hypothesizing that they denote the same concept. Considering, for instance, that language evolved from gestural protolanguage and that Vygotskian psychology asserts that even private speech has its genesis in social interactions, it follows that linguistic bodies are subsumed by social embodiment, rather than a distinct form of embodiment.

*Keywords: enactivism, social, linguistic, embodiment, sense-making*

E-mail: [oblak.ales.93@gmail.com](mailto:oblak.ales.93@gmail.com)

## Does social distance modulate adults' egocentric biases when reasoning about false beliefs?

Benjamin Farrar, University of Cambridge, UK

Ljerka Ostojić, University of Cambridge, UK

When given privileged information of an object's true location, adults often overestimate the likelihood that a protagonist holding a false belief will search in the correct location for that object. This type of egocentric bias is often labelled the 'curse of knowledge'. Interestingly, the magnitude of this bias may be modulated by the social distance between the perspective taker and target. However, this social distance effect has yet to be fully demonstrated when adults reason about false beliefs. Using a continuous change-of-location false belief task, we investigated, i) whether adults were biased by their own knowledge when reasoning about another's false belief and, ii) whether the magnitude of this egocentric bias was modulated by social distance. Adults' egocentric biases were smaller when reasoning about an out-group protagonist's false belief. No evidence for an egocentric bias was found when participants reasoned about a dog's false belief. These results are consistent with the hypothesis that social distance modulates egocentric biases when adults reason about false beliefs. Although the social distance effect size was small, it could partially explain why a recent large-scale replication attempt reported a much smaller curse of knowledge effect than previous studies.

Keywords: *Theory of Mind, egocentric bias, social distance*

E-mail: [bgf22@cam.ac.uk](mailto:bgf22@cam.ac.uk)

## Ascribing false beliefs is not sufficient for ascribing intentions based on beliefs

Britta Schünemann, University of Göttingen, Germany

Marina Proft, University of Göttingen, Germany

Hannes Rakoczy, University of Göttingen, Germany

Intentions are the subjective reasons for acting. For an action to be intended, agents have to hold not only an attitude towards the outcome of the action but also the belief that the planned action will lead to the desired outcome. In contrast to attitudes, little is known about the belief-component. The ability to ascribe beliefs certainly is necessary for ascribing intentions which are based on beliefs. However, it may not be sufficient: Other competencies may be required, e.g. for further processing the ascribed beliefs. This study investigates, whether this constellation of appreciating beliefs being necessary but not sufficient for ascribing intentions is mirrored in ontogeny. To this aim, children's performance on structurally similar belief and intention test questions regarding analogous scenarios of an agent acting on false beliefs is compared.

Overall, children performed better on belief than on intention test questions. Solely for children who already showed a complete appreciation of beliefs, the ability to correctly incorporate an agent's beliefs when ascribing intentions based on beliefs increased with age. This pattern indicates that a fully developed understanding of beliefs is necessary, but not sufficient for the appreciation of intentions based on beliefs.

Keywords: *Theory of Mind, intentionality, aspectuality*

E-mail: [britta.schuenemann@uni-goettingen.de](mailto:britta.schuenemann@uni-goettingen.de)

## Psychology and pragmatics: a two time birth

Csaba Pléh, Central European University, Budapest, Hungary

The psycholinguistic treatment of the pragmatic aspects of language has come to life two times. The first one started in the 1970s, as an attempt to find an external setting to a grammar based vision of language (grammar based psychopragmatics). The second wave started in the 2000s by the program of Noveck and Sperber as a gricean philosophy based experimental pragmatics. Some features of them shall be contrasted.

Grammar based psychopragmatics has lived in two domains. In the experimental domain it was mainly concerned with embedding language processing into the physical environment and into the mental representation of the physical world. Its typical issues were sentence-picture verification tasks (Clark and Chase) like The star is not over the cross \*

+

Another central issue of theirs was the differentiation between lexical and encyclopedic knowledge in treating inferences in sentences sequences like The girl took out the basket from the trunk. The beer was warm (Kintsch).

At the same time this attitude was rather analytic in its attitude to language regarding its social uses. It assumed and analyzed following a Searle style speech act analysis a large set of rules in interpreting indirect uses of language like Would you mind closing the door? In its most ambitious forms it tried to relate the rule based attitude to language of an ethnomethodologist flavor with the dream of creating basic rules of language and social life (Labov and Fanshel).

Gricean philosophy based experimental pragmatics is part of the social move in cognitive science. Regarding the structure of language it is more holistic, assuming a basic system of relevance rather than myriads of particular social rules (Sperber). It concentrates on the representation of other minds and their knowledge and intentions rather than representation of the physical world, it is based on a ToM centered view of language (Noveck). It is treating relations between language and the physical world also in frames of a social model of referential acts instead of a stative “correspondence” issue. At the same time, its main inspirations in creating experiments is mainly coming from philosophical considerations, and less from sociolinguistic case studies of discourse.

Keywords: *experimental pragmatics, sentence verification, ethnomethodology, Theory of Mind*

E-mail: vispleh@ceu.edu

## Non-native speakers' perceptions of foreigner talk use in native/non-native speaker communication in the U.S.

Danielle Labotka, University of Michigan, United States

Susan A. Gelman, University of Michigan, United States

Registers – context-dependent styles of speech – mirror and reinscribe the social world through communication. Sometimes, though, the social reality a register reflects can be ambiguous, as with Foreigner Talk (FT). FT is the register native speakers may use when talking to non-native speakers (NNS), marked by slow, loud, over-enunciated, and simplified speech. Some researchers claim FT is a form of accommodation that seeks to improve communication, but others suggest FT is a way native speakers reinscribe social distance from NNS. To understand the social impact of FT, we must understand how NNS interpret it. In this study, 125 non-native English-speaking adults in the U.S. answered a questionnaire about FT. We predicted NNS would think FT is used for both reasons listed above and that FT would impact their sense of belongingness in the U.S. When asked why people use FT, 34% of participants mentioned their language ability, 20% thought native speakers were trying to be helpful, and 40% thought it reflected beliefs about their group status or ability. Additionally, participants rated their belongingness in the U.S. as lower when receiving FT than in general ( $p < .01$ ). These findings provide insight into how social information is gleaned from native/non-native speaker communication.

*Keywords: non-native speakers, communication, foreigner talk*

E-mail: [dlabotka@umich.edu](mailto:dlabotka@umich.edu)

## Saying, presupposing and implicating: How pragmatics modulates commitment

Diana Mazzarella, Leibniz-ZAS, Germany

Robert Reinecke, ISC Marc Jeannerod, France

Ira Noveck, ISC Marc Jeannerod, France

Hugo Mercier, IJN, France

Commitment plays a crucial role in the stabilization of communication. While commitment increases the acceptance of the message communicated, it comes with a price: the greater the commitment, the greater the cost (direct or reputational) the speakers incur if the message is found unreliable (Vullioud, Clément, Scott-Phillips & Mercier, 2017).

This opens up the question of which linguistic cues hearers deploy in order to infer speaker commitment in communication. We present a series of web-based studies to test the hypothesis that distinct meaning-relations – saying, presupposing and implicating – act as pragmatic cues of speaker commitment. Our results demonstrate that, after a message *p* is found to be false, speakers incur different reputational costs as a function of whether *p* had been explicitly stated, presupposed or implicated. All else being equal, participants are significantly more likely to selectively trust the speaker who implicated *p* than the speaker who asserted or presupposed *p*.

These results provide the first empirical evidence that commitment is modulated across meaning-relations, and shed a new light on the strategic advantages of implicit communication. Speakers can safeguard (at least partially) the trust hearers grant them by communicating unreliable messages by means of implicatures.

*Keywords: commitment, implicature, presupposition, experimental pragmatics*

E-mail: mazzarella@leibniz-zas.de

## Factors in ambiguity resolution of quantifiers

Tal Tehan, Tel Aviv University, Israel

Yechezkel Shabanov, Tel Aviv University, Israel

Zafrit Levin, Tel Aviv University, Israel

Rama Novogrodsky, Haifa University, Israel

Einat Shetreet, Tel Aviv University, Israel (*presenting author*)

To describe a collective event of John taking one picture of five elephants, we would use the quantifier “*all*”. To describe a distributive event of John taking five separate pictures, we could use either “*all*” or “*each*”. Namely, “*each*” is obligatorily distributive, whereas “*all*” is ambiguous between collective and distributive readings. In a series of experiments, we examined which factors influence such ambiguity (in Hebrew where the distinction is marked morpho-syntactically). We asked participants to choose between an ambiguous and a distributive statement (“*Mom covered all children/each child*”) to describe a picture (Experiment 1) or a story (Experiment 2&3) concerning distributive or collective events. For collective events, ambiguous statements were chosen regardless of the presentation form, as only they allow collectivity. For distributive events, distributive statements were chosen in the picture task, but participants alternated between distributive and ambiguous statements in the story task. When manipulating the statements to include an adjunct which restricts the semantic form (“*Mom covered all children/each child with a blanket*”; Experiment 4), ambiguous statements were chosen following collective stories and distributive statements were chosen after distributive ones. This suggests that both the context (as manifested in the task mode) and semantic form affected ambiguity resolution.

## Children's long-term learning from linguistic in-group and out-group members

Eszter Endrődi, Eötvös Loránd University, Budapest, Hungary

Katalin Oláh, Eötvös Loránd University, Budapest, Hungary

Ildikó Király, Eötvös Loránd University, Budapest, Hungary; Central European University, Budapest, Hungary

Numerous studies have shown that even few-month-old infants can differentiate between certain social groups, and that children prefer to accept information from people belonging to their linguistic group from early on. The aim of our study was to test whether children prefer to store information in long-term memory coming from a linguistic in-group member over someone speaking in a foreign language. To investigate this question, we designed a paradigm where a model speaking either in their native or a foreign language presented 4-, and 5.5-year-old children an action (how to retrieve a toy from an opaque box) and children had the opportunity to manipulate the box themselves immediately after the demonstration and a week later. Preliminary results show no difference between the two groups in the direct imitation task, however, we found that the native group performed better than the foreign group in delayed imitation. The results we have gained so far imply that children's long-term retention of information is affected by the group membership of the source, independently of their immediate performance on the task.

Keywords: *social cognition, naïve sociology, memory*

E-mail: endrodie@gmail.com



## A new approach to assist children with autism develop visual perspective taking skills using a humanoid robot - Methodology development

Gabriella Lakatos, University of Hertfordshire, United Kingdom

Luke Woord, University of Hertfordshire, United Kingdom

Ben Robins, University of Hertfordshire, United Kingdom

Dag Sverre Syrdal, University of Hertfordshire, United Kingdom

Abolfazl Zarak, University of Hertfordshire, United Kingdom

Kerstin Dautenhahn, University of Hertfordshire, United Kingdom

In the present research we aimed to develop a methodology to assist children with autism improve their Visual Perspective Taking (VPT) and Theory of Mind (ToM) skills using a humanoid robot. Visual Perspective Taking is the ability to see the world from another person's perspective, drawing upon both social and spatial information. Children with autism often find it difficult to understand that others might have perspectives, viewpoints and beliefs that are different from their own, which is a fundamental aspect of both VPT and ToM. The games we designed were implemented with the Kaspar robot and to our knowledge this is the first attempt to improve these skills of children with autism through interacting with a humanoid robot. The games involved a number of different actions with the common goal of helping the children to see the world from the robot's perspective. In order to measure the potential impact of the games on the children, three tests (Smarties test, Sally-Anne test and Charlie test) were conducted with the children before and after of their interaction sessions with the robot. Our findings suggest that some children may benefit from this approach of robot-assisted therapy.

*Keywords: visual perspective taking, Theory of Mind, assistive robotics, autism, human-robot interaction*

E-mail: [g.lakatos@herts.ac.uk](mailto:g.lakatos@herts.ac.uk)

## Children's understanding of the ironical tone of voice: Evidence from eye-tracking and picture selection

Ingrid L. Falkum, University of Oslo, Norway

Franziska Köder, University of Oslo, Norway

Few developmental studies of irony have specifically tested claims made by theories of adults' understanding of verbal irony (e.g., 'What lovely weather!' uttered in a downpour). A key debate in the pragmatic literature concerns the main mechanism underlying irony: Does irony consist in echoing and dismissing an attributed thought, or in pretending to perform a speech act that one simultaneously dismisses? This study investigates the different predictions about the ironical tone of voice made by echo and pretence accounts. Using a story comprehension task combining eye-tracking and picture selection with children aged 3-9 years and a control group of adults (N = 173), we hypothesised that, given children's early familiarity with pretence, a parodic, exaggerated tone of voice (pretence) would make an ironical utterance easier to understand than a deadpan tone of voice (echo). Both the online and offline results showed an improvement in irony understanding with age, and that the performance of 4-5-year-olds improves when the ironical utterance is uttered with a parodic tone of voice. We take our results to suggest that the two tones of voice might be linked to different mechanisms, with 'regular' irony involving echoing alone and 'parodic' irony involving both echoing and pretence.

*Keywords: irony, pragmatic development, pretence, echo, eye-tracking*

E-mail: [i.l.falkum@ifikk.uio.no](mailto:i.l.falkum@ifikk.uio.no)

## The language of friendship: Exploring the contributions of pragmatics & structural language skills to play behaviours in children

Jenny Gibson, University of Cambridge, UK

Elian Fink, University of Cambridge, UK

It has been suggested that pragmatic competence may contribute to the established link between structural language ability and later social competence in children. We explore this hypothesis via a longitudinal, observational study of how structural language abilities and pragmatic skills relate to observed peer behaviours during social play.

We will present data from 234 children (mean age 5.10 years,  $SD=0.4$ ) who were assessed on measures of structural language ability, parental report of pragmatics, and social competence. Children were also filmed during 10 minutes of pretend play with a classmate and videos subsequently coded for behaviours relating to pretence (e.g. negotiation 'I'll be the dragon, you be the princess' or enactment: pretending to be a dragon) and amity behaviours (e.g. sharing, showing) towards peers (inter-rater Kappas  $> .72$ ). All measures were repeated approximately 12 months later.

Concurrent associations between structural language, parent-rated pragmatics and pretence play behaviours will be presented, as will the individual contributions of these predictors to social competence at time 1 and time 2. Preliminary analysis at T1 shows that pragmatic language relates positively to the frequency of role enactment but not amity during pretend play. The importance and role of linguistic social behaviour for friendships is discussed.

*Keywords: pragmatics, friendship, play, language, children*

E-mail: [jlj53@cam.ac.uk](mailto:jlj53@cam.ac.uk)

## A psycholinguistic-developmental analysis of character representation in picture-based narratives

Judy Kupersmitt, Department of Communication Disorders, Hadasah Academic College, Jerusalem, Israel

The representation of characters in narratives has been studied from socio-cognitive perspectives but less so from the lenses of psycholinguistics. The present aims to identify the linguistic structures used to express three levels of character representation – actors, agents, and persons – focusing on the expression of mental states and false belief.

80 participants divided into four age groups – ages 5, 8, 11 and adults – were asked to tell a story based on a wordless picture book. The analysis considered linguistic strategies at the lexical (e.g., mental verbs), syntactic (e.g., coordination or subordination), and semantic levels (e.g., causal relations).

Results show that the level of actors predominates at age 5 and it is syntactically represented by isolated clauses with no clear semantic relations and emerging temporal relations. Lexical choice is less specific at this age, too. At age 8, characters are mostly represented as agents, and linguistic expression becomes more varied, with clauses linked by coordination and some subordination. At age 11, more complex syntactic constructions and semantically specific verbs emerge, to express actions co-occurring with various mental states.

The discussion focuses on the interrelations between the linguistic configurations, the semantic relations they express (e.g. causality, simultaneity) and the discourse motivated representation of characters.

*Keywords: narrative, character representation, language forms, syntax*

E-mail: [judyku@hadassah.ac.il](mailto:judyku@hadassah.ac.il)

## Error monitoring in explicit probabilistic sequence learning

Kata Horváth, Eötvös Loránd University, Hungarian Academy of Sciences

Zsófia Kardos, Hungarian Academy of Sciences

Ádám Takács, Eötvös Loránd University

Karolina Janacsek, Eötvös Loránd University, Hungarian Academy of Sciences

Dezso Nemeth, Eötvös Loránd University, Hungarian Academy of Sciences

Andrea Kobor, Brain Imaging Centre, Research Centre for Natural Sciences, Hungarian Academy of Sciences, Budapest, Hungary

The acquisition of sequential regularities in the noisy environment is a fundamental process, which is strongly affected by negative outcomes, such as errors. The aim of the present study was to investigate whether the process of error monitoring differs between predictable repeating and unpredictable random events. 24 healthy young adults performed an explicit probabilistic sequence learning task while event-related brain potentials were recorded synchronized to the erroneous responses. Error-related negativity (ERN) was measured for the repeating and the random events, respectively. To track the effect of learning on error monitoring, the learning session was divided into three equal time periods. We found that the mean amplitude of the ERN gradually decreased as the task progressed. Moreover, this decrease took place earlier for the predictable stimuli than for the random ones. The motivational significance theory of ERN can explain our results: The higher the engagement in the task, the higher the amplitude of the ERN. Accordingly, we assume that the relevance of errors decreased as learning developed, yielding a decrease in the ERN amplitude. Furthermore, our results also suggest that the predictable repeating events lead to faster adaption to the probabilistic regularities of the actual environment.

*Keywords: ERN, error monitoring, sequence learning*

E-mail: [kata.horvath1009@gmail.com](mailto:kata.horvath1009@gmail.com)

## Investigation of explicit and implicit categorization strategies

Krisztián Borbély, Eötvös Loránd University, Hungary

Anett Ragó, Eötvös Loránd University, Hungary

Máté Varga, Eötvös Loránd University, Hungary

During explicit category learning the acquired categorization rule helps us deciding the category membership of every element. However, during implicit categorization we lack that verbalizable rule, thus making the nature of categorization completely different. We used a supervised category-learning task on naturalistic, but arbitrarily created complex visual stimuli. In the learning phase we presented a simple explicit rule next to a hidden information-integration task. In the test phase we measured the acquisition of the implicit rule registering hit rates and reaction times for the new category members lacking the explicit information. At this point we have already collected and analysed 457 adult and 152 eleven year-old children participants' data. Results revealed that, while acquiring the explicit rule easily and quickly, participants can also categorize quite effectively if they have to rely only on their implicit knowledge. Reaction times and under certain conditions hit rates as well are following the family resemblance structure. Increase of reaction times in the test phase reflects the cost of switching to implicit strategy.

Keywords: *categorization, category learning, implicit learning*

E-mail: [borbely.krisztian@gmail.com](mailto:borbely.krisztian@gmail.com)

## Children's understanding of aspectuality in an action-based false belief task

Lisa Wenzel, University of Göttingen, Germany

Sebastian Dörrenberg, University of Hamburg, Germany

Marina Proft, University of Göttingen, Germany

Ulf Liskowski, University of Hamburg, Germany

Hannes Rakoczy, University of Göttingen, Germany

Recent studies on Theory of Mind (ToM) competences in standard change of location tasks have shown that narrative and action-based versions facilitate belief ascription, so that also children younger than 4 years are able to pass. But does this facilitating effect apply only to change of location tasks or is it a generalizable phenomenon that can also be found in tasks tapping other features of ToM, e.g. understanding aspectuality? To answer this question we tested 72 3-year-old children with two action-based tasks based on Rubio-Fernandez and Geurts (2013): a change of location task and an analogue aspectuality task. In addition, we tested half of the children with an explicit change of location task. While children performed in both action-based tasks above chance in the true belief condition, they performed at chance level in the false belief condition. Nevertheless, children's performance in the false belief condition correlated within the two action-based tasks, indicating that both tasks address the same competence and a unified understanding of aspectuality and beliefs. Comparisons between action-based and explicit false belief tasks also revealed a significant correlation, suggesting that the performances measured in all three tasks seem to tap the same underlying ToM capacity.

Keywords: *Theory of Mind, false belief, aspectuality*

E-mail: [lisa.wenzel@uni-goettingen.de](mailto:lisa.wenzel@uni-goettingen.de)

Age-related differences in multimodal recipient design: Younger, but not older adults, adapt speech and gestures to their addressee's knowledge state

Louise Schubotz, Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands

Asli Özyürek, Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands;  
Centre for Language Studies, Radboud University Nijmegen, The Netherlands; Donders  
Institute for Brain, Cognition, and Behaviour, Radboud University Nijmegen, The  
Netherlands

Judith Holler, Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands;  
Donders Institute for Brain, Cognition, and Behaviour, Radboud University Nijmegen,  
The Netherlands

Speakers can adapt their multimodal utterances for addressees via a process called recipient design. Here, we investigate whether this ability is modulated by the speaker's age and cognitive abilities. Younger and older adults participated in a narration task in which one participant (the speaker) narrated six short comic stories to another participant (the addressee). One half of each story was known to both participants, the other half only to the speaker. Younger, but not older adults, accommodated to their addressee's knowledge state by using fewer words, mentioning fewer events, and producing fewer gestures in relation to speech when narrating mutually known as opposed to novel story content. The effects on speech were most pronounced in younger individuals with higher verbal working memory. We argue that the age-related behavioural differences may be due to cognitive ageing, as well as age-related changes in social and pragmatic goals.

*Keywords: co-speech gesture, cognitive ageing, recipient design, common ground*

E-mail: [louise.schubotz@mpi.nl](mailto:louise.schubotz@mpi.nl)



## How much bullshit can you handle? The role of form and content in the creation of bullshit

Marek Jurkovič, Slovak Academy of Sciences, Slovakia  
Vladimíra Čavojová, Slovak Academy of Sciences, Slovakia  
Ivan Brezina, Slovak Academy of Sciences, Slovakia

Creators of bullshit are said to be unconcerned with the truth value of their statements, their main goal is to impress and they do it by obscuring the lack of meaning. To examine whether the most defining feature of bullshit is its obscured form or content unconcerned with the truth value, we collected 24 dictionary definitions and then modified them to create 3 new versions of each: (F) the form was changed, using oversophisticated synonyms (in order to impress); (C) the content was changed (to make them untrue); (FC) both form and content were altered. We asked 234 participants to evaluate all forms of statements for their truthfulness, understandability and likability. Our hypothesis linked obscureness with increased likability, but the results showed that people generally judged too obscure statements as more unlikable and untrue than simpler untruthful statements. Compared to dictionary definitions, likability seemed to be more closely related to perceived truthfulness than to understandability. From C and FC statements, we selected 13 items that were deemed most likable and truthful to participants, providing us with basis for a new tool designed to measure bullshit receptivity.

Keywords: *bullshit, bullshit receptivity, obscurantism, impressiveness*

E-mail: [jurkovicmarek@gmail.com](mailto:jurkovicmarek@gmail.com)

To be perceptive or not to be perceptive, that is the question. A comparative study of interspecific communicative interactions with pigs and dogs

Melinda Lovas, Department of Ethology, Eötvös Loránd University, Budapest, Hungary  
Linda Gerencsér, Department of Ethology, Eötvös Loránd University, Budapest, Hungary;  
MTA-ELTE 'Lendület' Neuroethology of Communication Research Group, Hungarian  
Academy of Sciences - Eötvös Loránd University, Budapest, Hungary

Paula Pérez Fraga, Department of Ethology, Eötvös Loránd University, Budapest,  
Hungary

Dóra Ujváry, Department of Ethology, Eötvös Loránd University, Budapest, Hungary  
Attila Andics, Department of Ethology, Eötvös Loránd University, Budapest, Hungary;  
MTA-ELTE 'Lendület' Neuroethology of Communication Research Group, Hungarian  
Academy of Sciences - Eötvös Loránd University, Budapest, Hungary

Comprehending how domestic and non-domestic animals are sensitive to human-given cues and attention has received considerable interest over the last decade. Former investigations had the conclusion that juvenile farm pigs are able to use human referential cues in an object choice task – when exposed to former training. Our aim is to further investigate highly socialized young pigs' interspecific (human-oriented) communicative social skills in a comparative framework, in relation with the extensively studied family dog.

In two groups of young pigs and dogs living in human families we assess i) the appearance of voluntary and reinforced gazing at the human partner's eye/face in a 'food-requesting' context, and ii) the animals' sensitivity to human referential pointing gestures in a two-way object choice paradigm (without applying former training). Our preliminary results are partly in line with our hypotheses: similarly to dogs, pigs exhibit behaviors – voluntarily as well as when being reinforced – indicative of interspecific communicative intentions towards humans (i.e. face/eye-oriented gazing). However, opposed to dogs, human pointing gestures do not seem to affect pigs' response in an object choice task. Using highly socialized pigs in comparative, interspecific studies may help distinguish the effects of domestication and individual experience in processing human social-communicative signals.

Keywords: *interspecific, communication, comparative, pig, dog*

E-mail: [mimi.lovas@gmail.com](mailto:mimi.lovas@gmail.com)

Who seeks for human assistance when facing an unsolvable problem?  
A comparative study of pigs' and dogs' looking behavior

Paula Pérez Fraga, Eötvös Loránd University, Hungary

Linda Gerencsér, Neuroethology of Communication Research Group, Academy Science  
Eötvös Loránd University, Hungary

Melinda Lóvas, Eötvös Loránd University, Hungary

Dóra Ujváry, Eötvös Loránd University, Hungary

Attila Andics, Neuroethology of Communication Research Group, Academy Science  
Eötvös Loránd University, Hungary

One key element in human communicative interactions is the looking behaviour, which has been explored also in animals. Dogs were found to look back at humans when faced with an unsolvable task, which behaviour is interpreted and defined as a communicative act aimed at seeking human assistance.

The aim of our study is to explore human-oriented communicative behaviour in the highly social domestic pig (*Sus scrofa domesticus*) by assessing the presence of looking at humans, and to compare that with dogs' similar behaviour. We hypothesized that pigs would seek for human assistance (look at humans) when facing an unsolvable problem.

In controlled laboratory settings, we tested dogs and minipigs, both living in human families. We used an already validated test, the solvable/unsolvable task paradigm, in which the animal is exposed to a solvable problem that after several trials becomes unsolvable.

Preliminary results show that pigs establish communicative interaction and do look at humans when facing an unsolvable task, however, they perform it to a lesser extent than dogs and are more persistent in trying to solve the task on their own. These differences between dogs' and pigs' performance could be partly based on their different domestication history.

Keywords: *communication, looking behavior, pigs, problem solving*

E-mail: pauliperezfraga@gmail.com

## Children's acquisition of regular metonymy: Exploring the producer-product relation

Rebecca Zhu, University of California, Berkeley

Mahesh Srinivasan, University of California, Berkeley

Many words in natural languages carry multiple distinct but related meanings. Interestingly, there are also constraints on the possible meanings a word can have: for example, proper names for producers (i.e. Picasso) can be metonymically extended to label products (i.e. paintings) but rarely refer to other associated items (i.e. paintbrushes). We explored how constraints on metonymic language develop, contrasting the hypothesis that constraints are learned from linguistic experience with the hypothesis that constraints reflect privileged conceptual relations independent of linguistic experience.

In this study, 4- and 5-year-olds, 8- and 9-year-olds, and adults were introduced to artists with either novel names (i.e. Dax) or conventional names (i.e. Picasso), and then heard the names used metonymically in contexts that could refer to either the artists' products or tools. Both 8- and 9- year-olds and adults were above chance at choosing products over tools for conventional and novel metonyms. 4- and 5-year-olds were at chance for novel metonyms but chose products above chance for conventional metonyms. Surprisingly, children of both age groups reported that the conventional names were unfamiliar, suggesting that their metonymic interpretations were independent of prior linguistic experience. Ongoing studies address why 4- and 5-year-olds may succeed or fail across conditions.

Keywords: *metonymy, language, concepts, development*

E-mail: [rebeccazhu@berkeley.edu](mailto:rebeccazhu@berkeley.edu)

## Aging, short- and long-term memory in a traditional Dania tribe of Papua

Agnieszka Sorokowska, Department of Psychosomatic Medicine, TU Dresden, Germany;  
Institute of Psychology, University of Wrocław, Poland

Piotr Sorokowski, Institute of Psychology, University of Wrocław, Poland

Agnieszka Sabiniewicz, Institute of Psychology, University of Wrocław, Poland

Anna Oleszkiewicz, Institute of Psychology, University of Wrocław, Poland

Corinna E. Loeckenhoff, Department of Human Development, Cornell University

Living in different environmental conditions might challenge memory in different ways. Moreover, training can be a source of improvement of both Short- and Long-Term Memory. The aim of our study was to investigate the existence of environment-dependent changes in aspects of Short- and Long-Term Memory in a traditional (Dani of Papua, n = 62) and modern (Poland, n = 134) population.

Polish participants performed better in both memory tasks but especially with regard to Short-Term Memory. What is more, also age-related changes appeared to differ in the examined populations. However the country was not a significant moderator of the memory level changes in both populations, in Poles Long-Term Memory level correlated negatively with age, while in Dani no significant correlation between these variables was noticed.

Obtained differences between Short- and Long-Term Memory levels in the two populations can be explained by more significant role of Short-Term Memory in modern societies, since it is related to technical development, electronic revolution and reading ability. In turn, dissimilarities in age-related Long-Term Memory changes in both populations seem to provide an interesting issue to be examined by future studies.

*Keywords: memory, short-term memory, long-term memory, Dani of Papua, aging*

E-mail: sorokowska@gmail.com

## Understanding Moore-paradoxical sentences and logical inconsistency in children

Szabolcs Kiss, University of Pécs, Hungary

Brigitta Szenetes-Hajler, University of Pécs, Hungary

The present poster reports an experiment on recognition of Moore-paradoxical sentences and logical inconsistency in preschool and school-aged children. What is Moore's paradox? It is paradoxical to assert that It is raining, but I do not believe that it is raining. Our research questions are: When and how do children recognise the paradoxical nature of Moorean sentences? What is the relationship between the developing theories of mind and this recognition? Is understanding of pure logical inconsistency a prerequisite for comprehending the paradox? During the experiment, children (N=83, from 5- to 8-year-olds) had to choose between two speakers the one who said something silly. So, one of the speakers always expressed a paradoxical statement while the other one said a syntactically matched control sentence. In the second part of the experiment children had to recognise logically inconsistent stories. According to our experimental findings, 5-and 6-year-old children performed poorly at both tasks while the overwhelming majority of seven-and eight-year-olds could select the Moore-paradoxical sentences and were able to recognise logical inconsistency. In sum, understanding of Moore-paradoxical sentences develops in parallel with recognising pure logical inconsistency in children. So, there are interesting developments in theory of mind reasoning in the elementary school period.

Keywords: *Moore-paradox, logical inconsistency, Theory of Mind, cognitive development*

E-mail: [kiss.szabolcs@t-online.hu](mailto:kiss.szabolcs@t-online.hu)

## The effects of transcranial direct current stimulation over the medial-frontal cortex on cognitive control

Teodóra Vékony, Department of Neurology, University of Szeged, Hungary

Adrienn Holczer, Department of Neurology, University of Szeged, Hungary

László Vécsei, Department of Neurology, MTA-SZTE Neuroscience Research Group,  
University of Szeged, Hungary

Anita Must, Department of Neurology, MTA-SZTE Neuroscience Research Group,  
University of Szeged, Hungary

In most studies investigating the effects of transcranial direct current stimulation (tDCS) on cognitive control, the dorsolateral prefrontal cortex serves as the target area. Although an extensive network - including the medial-frontal cortex - takes part in the implementation of effective cognitive control, to date, only a few studies aimed to stimulate this area. In the current study, we applied active or sham tDCS for 20 minutes over medial-frontal areas during the administration of a flanker task (n=20). Subsequently, event-related potentials (ERP) have been recorded. We hypothesized tDCS to improve cognitive control as reflected by changes in behavioural flanker effect and in conflict-related ERP components. However, we did not find stimulation-related differences in the behavioural flanker effect, neither during, nor after the stimulation. Nevertheless, frontal N200, but not P300, revealed differences between the groups: we found increased amplitudes in the active stimulation group, resulting from an increase for incongruent stimuli. We conclude that a single session of tDCS over the medial-frontal cortex is not represented on the behavioural level, however, changes in ERPs suggest that medial-frontal stimulation might still modulate cognitive control.

Supported by the UNKP-17-3 New National Excellence Program of the Ministry of Human Capacities.

*Keywords: transcranial direct current stimulation, medial-frontal cortex, cognitive control*

E-mail: vekteo@gmail.com

## A more pragmatic Sefo-task

Sebastian Dörrenberg, University of Hamburg; University of Göttingen, Germany

Marc Heuser, University of Hamburg, Germany

Hannes Rakoczy, University of Göttingen, Germany

Ulf Liskowski, University of Hamburg, Germany (*presenting author*)

A recent replication of the Sefo-task, an interactive paradigm where an experimenter (E) requests infants to retrieve one of two objects he falsely believes to be in one of two boxes, was unsuccessful in finding FB representation, i.e. infants were not able to choose against the referred-box. Surprisingly, the Sefo-task suffers from weak pragmatic soundness. It is unclear why E leaves the room or does not retrieve the toy himself. Further, infants often offered both objects, which indicates that they did not understand the referential specificity. We designed a new Sefo-task where E introduces a substrate which can be used for a fun game. E leaves the room to get the substrate, and it occupies his hands at the return. In familiarization trials, the substrate obviously corresponds to a specific object (e.g., marble and marble run). In the test trials, it is not clear which object is the match (note, both potentially work with the substrate). We tested 36 24-month-olds between-subject in a TB condition or in two FB conditions (with feedback, without feedback) with repeated trials. Results show that even with more pragmatics, infants do not show FB understanding. Only in the feedback FB condition performance was slightly better.

*Keywords: Theory of Mind, pragmatics, interaction, false belief*

E-mail: [sebastian.doerrenberg@uni-hamburg.de](mailto:sebastian.doerrenberg@uni-hamburg.de)



## When implicit mentalising turns into explicit: Effects on behavioural responses

Zsófia Esperger, University of Pécs, Hungary

Luca Kozma, University of Pécs, Hungary

Ferenc Kocsor, University of Pécs, Hungary

Strong evidence of implicit (in this study spontaneous and unconscious) mentalising derive from behavioural measurements. We were curious about how the shift from implicit to explicit (elicited and conscious) mentalising may alter our behavioural responses. Adult participants completed a ball detection task twice, consecutively, first with a non-mentalising instruction (implicit manipulation) and a second time either with non-mentalising or mentalising instructions (explicit manipulation). Mentalising instructions either facilitated participants to, or inhibited them from, reasoning about another agent's mental state. Regarding the tasks linked to implicit manipulation, we have replicated that another agent's false belief alters participants' behavior just as their own true belief does. We expected that a facilitating instruction amplified while an inhibiting instruction weakened the effect of the agent's false belief on participants' behaviour. Contrary to this, though, facilitation ceased this effect, while inhibition reduced it. Consequently, after explicit manipulation the agent's false beliefs altered participants' behavior in a different way to their own belief did. We concluded that implicit mentalising may support self-other integration, while explicit mentalising supports self-other distinction through behavioural responses. Further research should rule out alternative explanations.

Ferenc Kocsor was supported by the ÚNKP-17-4 -I.-PTE-298 New National Excellence Program of the Ministry of Human Capacities during the implementation of this study.

*Keywords: mentalising, implicit/explicit dimension, self/other dimension, behavioural measures*

E-mail: [esperger.zsofia@pte.hu](mailto:esperger.zsofia@pte.hu)

Commitment and implicit communication

Francesca Bonalumi, Central European University, Budapest, Hungary

Julius Tacha, University of Vienna, Austria

Thom Scott-Phillips, Central European University, Budapest, Hungary

Christophe Heintz, Central European University, Budapest, Hungary

While communicating something, we are typically held to be committed to the message conveyed, and therefore we risk to incur direct or reputational costs if our message is false. Some authors claim that implicating is less committing than explicitly stating (Morency et al. 2008), and that people use implicit communication because of strategic considerations and in order to bypass epistemic vigilance (Pinker 2010; Reboul 2017).

We claim, to the contrary, that a speaker is taken to be committed to the message conveyed even when it is implied rather than explicitly stated. The implicit-explicit distinction is orthogonal to epistemic vigilance and commitment: a speaker is committed to a content X to the extent that there is mutual manifestness of the hearer relying on X being satisfied.

We tested this hypothesis in different studies by presenting participants with vignettes and videoclips illustrating everyday situations in which a promise was violated by an agent A. We asked them to judge whether a promise was broken, and whether A is a desirable partner in future interactions and accountable for the broken promise. We manipulated the hearer's reliance on the promise and whether its content is implicit or explicit. The results support our claim that, with regards to commitment, there is no principled or qualitative distinction between explicit and implicit communication.

Keywords: *commitment, epistemic vigilance, implicit communication*

E-mail: bonalumi\_francesca@phd.ceu.edu

## Creating shared conceptual representations

Sara Bögels, Donders Institute for Brain, Cognition, and Behaviour, Nijmegen,  
The Netherlands

Branka Milivojevic, Donders Institute for Brain, Cognition, and Behaviour, Nijmegen,  
The Netherlands

Naomi de Haas, Donders Institute for Brain, Cognition, and Behaviour, Nijmegen,  
The Netherlands

Christian Döllner, St Olavs University Hospital, Trondheim, Norway

Marlou Rasenberg, Radboud University Nijmegen, The Netherlands

Asli Özyürek, Radboud University Nijmegen, The Netherlands

Mark Dingemans, Max Planck Institute for Psycholinguistics, Nijmegen,  
The Netherlands

Lotte Eijk, Radboud University Nijmegen, The Netherlands

Mirjam Ernestus, Radboud University Nijmegen, The Netherlands

Herbert Schriefers, Donders Institute for Brain, Cognition, and Behaviour, Nijmegen,  
The Netherlands

Mark Blokpoel, Donders Institute for Brain, Cognition, and Behaviour, Nijmegen,  
The Netherlands

Iris van Rooij, Donders Institute for Brain, Cognition, and Behaviour, Nijmegen,  
The Netherlands

Stephen C. Levinson, Max Planck Institute for Psycholinguistics, Nijmegen,  
The Netherlands

Ivan Toni, Donders Institute for Brain, Cognition, and Behaviour, Nijmegen,  
The Netherlands

Language is predominantly used in a communicative and interactive way. To communicate effectively, interlocutors have to create shared conceptual representations, ensuring that they refer to similar concepts. How do interlocutors arrive at such shared representations? We address this question by quantifying conceptual alignment between interlocutors during naturalistic interaction and relating this to multimodal processes (e.g., grounding, gesture, phonological, and lexical alignment). Two participants interact in a 'director-matcher' paradigm, describing and finding novel objects in several rounds, leading to pair-specific conventionalized descriptions. Afterwards, they create joint stories about a subset of these objects. Before and after the interaction, each participant individually names the objects. The results show that participants who interacted with each other provide more similar names to objects they communicated about, but only after the interaction. This points to conceptual alignment,

but the amount of alignment varied across pairs. We present these and other results on conceptual alignment and discuss how they can be related to multimodal characteristics of the interaction. The next step in this project will be to measure participants' brain activity in response to the novel objects with fMRI before and after the interaction, to investigate how conceptual representations change as a function of communicative interactions.

Keywords: *conversation, alignment, language, multimodality, semantics*

E-mail: [s.bogels@donders.ru.nl](mailto:s.bogels@donders.ru.nl)

## Uncovering complex individual dynamical representations using reaction times in a probabilistic learning task

Balázs Török, MTA Wigner RCP Computational Systems Neuroscience Lab, Hungary  
David G. Nagy, MTA Wigner RCP Computational Systems Neuroscience Lab, Hungary  
Karolina Janacsek, Eötvös Loránd University, Hungary  
Dezső Németh, Eötvös Loránd University, Hungary  
Gergő Orbán, MTA Wigner RCP Computational Systems Neuroscience Lab, Hungary

Humans learn and employ complex, task-independent representations of their environment such as intuitive physics and intuitive psychology. Uncovering these subject-specific representations is a major challenge and has recently been addressed by the cognitive tomography framework, which enables inference of stationary mental representations from discrete choices. We extended cognitive tomography such that it can handle richer human behavioral data and more complex models by inferring dynamical mental models in individuals from reaction times in probabilistic sequential learning experiments. We validate our approach by inferring individual participants' representations in early parts of the tasks and subsequently predicting trial by trial response times later in the experiments. Variants of our probabilistic learning task were completed by 307 healthy adults in total. Our formulation allows us to predict individual learning trajectories, specifically, how individual biases affect their learned internal models. Furthermore, we infer parameters characterising an individual's high-level prior expectations such as expected randomness of latent dynamics as well as randomness of observations given latent state of a process. These higher level subject-specific parameters will allow us to formulate trial by trial predictions across fundamentally different tasks.

*Keywords: internal representation, reaction times, probabilistic learning, Bayesian nonparametrics, Bayesian inference*

E-mail: [torok.balazs@wigner.mta.hu](mailto:torok.balazs@wigner.mta.hu)

## Native word stress representation is associated with working memory capacity

Borbála German, Brain Imaging Centre, Research Centre for Natural Sciences, Hungarian Academy of Sciences, Budapest, Hungary; Department of Cognitive Science, Budapest University of Technology and Economics, Budapest, Hungary

Andrea Kóbor, Brain Imaging Centre, Research Centre for Natural Sciences, Hungarian Academy of Sciences, Budapest, Hungary

Valéria Csépe, Brain Imaging Centre, Research Centre for Natural Sciences, Hungarian Academy of Sciences, Budapest, Hungary

Ferenc Honbolygó, Brain Imaging Centre, Research Centre for Natural Sciences, Hungarian Academy of Sciences, Budapest, Hungary; Institute of Psychology, Eötvös Loránd University, Budapest, Hungary

Previous studies have shown associations between aspects of language processing and executive functions at the behavioural and neural level. During speech processing, perception of word stress is suggested to be based on long-term representation in the Hungarian language. In the present study, the possible associations between the ability to apply this representation and the subcomponents (inhibition, switching, working memory) of executive functions were examined. To investigate this relationship, we recorded event-related brain potentials (ERPs) of Hungarian speakers in a passive oddball paradigm with two syllable long pseudowords varying in their stress pattern. We also measured the subcomponents of executive functions by neuropsychological tests (Counting span, Verbal fluency, Go/No Go task). Results showed a significantly positive relationship between the Mismatch Negativity ERP component elicited by the legally (stress on the first syllable) stressed pseudoword and the working memory capacity. This association may imply that the magnitude of working memory capacity has an influence on how effectively the speech processing system could maintain the long-term word stress representation to compare it with the actual perceptual input. Our result sheds light on the level at which cognitive factors measured by behavioural tasks and neural processes measured by ERP components interact with each other.

*Keywords: word stress template, MMN, executive functions*

E-mail: [german.borbala@ttk.mta.hu](mailto:german.borbala@ttk.mta.hu)

## Lossy compression in human memory

David G. Nagy

Episodic memory stores detailed representations of past experiences. However, given the constraints on memory resources, verbatim storage of all sensory experience seems unfeasible. Conversion of experiences into compressed memory traces entails a commitment to a particular distortion function which specifies the parts of experiences to retain or discard. We propose that memory should retain the information represented in the latent variables of a probabilistic model of the environment, which yields a distortion function which prioritises predictive power regarding future experiences and regarding task related variables. We argue that semantic memory provides the required latent variable model and consequently we term this form of compression semantic compression. We relate semantic compression to the normative framework of lossy compression, rate distortion theory, and contrast the resulting deviations in compressed episodes with memory errors and biases observed in the experimental literature on human memory. Specifically, we show how semantic compression leads to observed category effects in delayed reproduction of sketch drawings.

*Keywords: episodic memory, semantic memory, compression, memory distortions*

E-mail: davidnagy@elte.hu

## 14-month-old human infants spontaneously represent others' false beliefs involving numerical identity mistakes

Dora Kampis, Department of Psychology, University of Copenhagen, Denmark  
Ildikó Király, Central European University, Budapest, Hungary; ELTE, Budapest, Hungary  
Josep Call, University of St Andrews, UK  
György Gergely, Central European University, Budapest, Hungary

In the current study we presented 14-month-old infants with numerical identity mistakes: infants received information indicating that there are two objects in a scene, while another person falsely believed there is one object only.

First, an experimenter (E1) showed the infants and another experimenter (E2) the content of a kinder-egg, which was then closed and put in a box. Subsequently they both saw that the (closed) egg was taken out. Then while E2 was present (True Belief trial - TB) or absent (False Belief trial - FB), but always visibly to the infant, the egg's content was revealed. Crucially, the egg's content was different than previously, suggesting that there were in fact two eggs. As a result, infants (and E1 in TB) had reasons to believe an egg remained in the box, whereas E2 in False Belief mistakenly thought the box was empty. We measured duration of infants' search in TB and FB trials. If infants represent E2's belief in the two scenarios, and as previously found the other's belief modulates infants' own search duration, then infants should search less in FB trials. Preliminary data is in line with these predictions, data collection is expected to finish April 2018.

E-mail: [dk@psy.ku.dk](mailto:dk@psy.ku.dk)



## Grounding relevance theory in oscillatory dynamics

Elliot Murphy, University College London, London; University of Westminster, London

A growing body of work over the last decade has investigated the potential functional role of neural oscillations in language comprehension. It will be argued that a number of recent developments in the field, and related domains of systems neuroscience, can generate much-needed linking hypotheses between the language sciences and neuroscience. To this end, I will focus on an area of linguistics whose existence has barely been acknowledged by the oscillation literature – pragmatics – and argue that elementary principles of discourse interpretation like relevance-seeking (though not more complex, peripheral aspects of pragmatic knowledge) can be implemented via generic, domain-general mechanisms elsewhere argued to be responsible for particular aspects of visual attention. It will be suggested that these two systems share a number of striking computational properties, and hence may share homologous oscillatory substrates.

Keywords: *relevance, visual attention, oscillations, alpha, gamma*

E-mail: [elliott.murphy.13@ucl.ac.uk](mailto:elliott.murphy.13@ucl.ac.uk)

## Unlike little kids: Adults' selective trust decisions under limited cognitive resources

Franziska Brugger, University of Göttingen, Germany

Jonas Hermes, University of Göttingen, Germany

Tanya Behne, University of Göttingen, Germany

Hannes Rakoczy, University of Göttingen, Germany

Preschoolers engage in different cognitive strategies in their selective trust decisions as a function of context and task demands: sometimes they employ rational, trait-based strategies, preferring models in line with their individual competences. At other times, they employ global strategies, preferring models also for unrelated tasks. But why? We tested the predictions of a dual process account on selective trust in adults, comparing the results to those obtained with children.

Adults (N=120) were familiarized with pairs of models that either differed in their degree of competence within one domain or were both highly competent, but in different domains. In test trials, adults chose between the models for tasks related and unrelated to the models' competences. Cognitive load was varied in three conditions: i) a secondary task, ii) time pressure, or iii) no restrictions.

We predicted (1) when global strategies yield unique yet erroneous solutions, (a) adults will be more proficient than children and (b) even adults will fall back on global strategies under cognitive load. (2) When global strategies provide no unique solution, more rational decisions are expected. Results show that adults use rational strategies in all conditions. Moreover, a secondary task enhanced adults' ability to choose the relevant experts.

*Keywords: selective trust, dual process account, cognitive development*

E-mail: [franziska.brugger@psych.uni-goettingen.de](mailto:franziska.brugger@psych.uni-goettingen.de)

## The role of pragmatics vs. novelty in a label assignment task

Hanna Marno, Central European University, Cognitive Science Department, Budapest, Hungary

Dan Sperber, Central European University, Cognitive Science Department, Budapest, Hungary; Institut Jean Nicod, Paris, France

Children typically apply a novel label to a novel object, rather than to a familiar object; a phenomenon called Mutual Exclusivity (Markman et al., 2003). A recent explanation is that children tend to associate novel stimuli together (Horst et al., 2011). We show that pragmatic factors may override novelty. In our study two-year-old children first played with a novel object together with E1. Then E1 left the room and E2 brought another three novel objects for the child to manipulate on his/her own. Finally, E1 came back and requested the child to give her the 'Bitye'. Most children chose the first object, with which they had a common history with E1, even though it was the least novel. Furthermore, the results of a control study, where instead of requesting for the 'Bitye', E1 requested the child to choose 'one toy', excluded the possibility that children would have chosen the 'common play object' in the first experiment due to their personal preference towards the object. This suggests that children understand a novel word by considering to which object the speaker is most likely to have intended to refer.

*Keywords: word acquisition, mutual exclusivity, pragmatics, novelty*

E-mail: hanna.marno@gmail.com

## When do we read minds? Methodological and developmental variation in pragmatic inference

Isabelle Lorge, University of Cambridge  
Napoleon Katsos, University of Cambridge

We piloted a version of Frank and Goodman (2014)'s word learning task (exp 2) adding a familiar object in training for reasons of symmetry: one character (singled out with red circle and sentence 'Oh, that's a kitten with a fep!') had thus two novel objects A and B, whereas the second one had object B and a familiar object (e.g., an apple). This should not have made a difference at testing time on inferring that the speaker is referring to object A, yet participants ( $n=22$ ) were at chance ( $m=0.48$ ,  $sd=0.50$ ,  $t = -0.42441$ ,  $df = 87$ ,  $p= ns$ ), whereas results were quantitatively equivalent to Frank and Goodman's in a version without familiar object ( $n=28$ ,  $m=0.64$ ,  $sd=0.48$ ,  $t = 3.1411$ ,  $df = 111$ ,  $p<0.01$ ). However, contrary to Frank and Goodman's, children ( $n=112$ , mean age = 5;1) were actually significantly more likely to choose object B ( $m=0.65$ ,  $sd=0.48$ ,  $t = -6.2962$ ,  $df = 416$ ,  $p<0.00001$ ) in the version without familiar object. It does not seem that RSA can currently account for these findings. We discuss the results in terms of working memory and salience effects between training and testing and the parameters influencing the activation of theory of mind processes.

*Keywords: Theory of Mind, pragmatics, word learning, methodology*

E-mail: [ipcl2@cam.ac.uk](mailto:ipcl2@cam.ac.uk)

## The effect of disagreement on children's source memory performance

Johannes Mahr, Department of Cognitive Science, Central European University,  
Budapest

Iulia Savoş, Department of Cognitive Science, Central European University, Budapest

Olivier Mascaro, Institut des Sciences Cognitives Marc Jeannerod, Lyon

Hugo Mercier, Institut des Sciences Cognitives Marc Jeannerod, Lyon

Gergely Csibra, Department of Cognitive Science, Central European University,  
Budapest

Research on children's source memory abilities has found that children under the age of five perform poorly. One reason for this might be that source memory tests for children have commonly targeted purely epistemic uses of source information. Here, we investigated to what extent young children are sensitive to the communicative functions of source information. One context in which source information is particularly useful in virtue of its communicative functions is disagreement. When faced with disagreement, the source of one's belief can serve as an effective way to prove its reliability. Thus, we asked whether children's source memory performance would improve in the face of disagreement. Four-year-old children learned about the contents of a container either through a first-hand (seeing) or second-hand (being told) source before being faced with a puppet who either agreed or disagreed with them about those contents. We found that children performed better in reporting the source of their belief about the contents of the container to the puppet after having faced disagreement rather than agreement. Further, children were better at reporting source after having had second-hand compared to first-hand access to the container. These results suggest that conversational context can facilitate source report in four-year-olds.

Keywords: *source memory, communicative competence, disagreement*

E-mail: mahr\_johannes@phd.ceu.edu

## The role of semantic categories in infants' false-belief understanding

Júlia Baross, Eötvös Loránd University, Hungary

Bálint Forgács, Eötvös Loránd University, Hungary

Judit Gervain, Université Paris Descartes, France

Eugenio Parise, Lancaster University, UK; Central European University, Hungary

Gergely Csibra, Central European University, Hungary, Birkbeck College,  
University of London, UK

György Gergely, Central European University, Hungary

Ildikó Király, Eötvös Loránd University, Hungary

The aim of the present study was to investigate how 14-month-old infants process a linguistic label in an object naming paradigm, in the presence of an adult observer, who has a false belief about the identity of the object. Event-related potentials were recorded in a puppet-theatre setting in order to explore whether infants interpret labels generically, when they refer to different exemplars from the same category (e.g. a toy car from the perspective of the infant, but another one from the perspective of the observer), or if they process the exact, item specific content of the observer's false belief about the object's identity. In half of the trials the objects' identity and their labels were congruent to both the observer and the infant. In the other half of the trials, unknown to the observer but visible to the infant, the first object presented was switched to another, perceptually distinguishable exemplar from the same category. Intriguingly, according to our preliminary analysis, we found no significant difference between the two conditions in any time windows. Infants seem to process object labels as referring to types and not tokens, even in a false belief situation. Further studies are necessary to clarify the findings.

*Keywords: semantic categories, false belief, ERP*

E-mail: barossjulia@naver.com

## Expectations of shared cultural knowledge hinder children's false belief attribution

Katalin Oláh, Eötvös Loránd University, Hungary

Zsófia Válint, Eötvös Loránd University, Hungary

Ildikó Király, Eötvös Loránd University; Central European University, Hungary

In this research project, we investigate the hypothesis that making sense of behavior depends on the interaction of two processes: a dynamic mentalizing process and a more rigid one that helps us make inferences about the background knowledge of others. To investigate the question, we applied the classic Smarties task. We tested 4-year-old children in two conditions. The Ostensive condition followed the classic procedure of the task where an experimenter presents children with a Smarties box and shows them that it contains pencils instead of chocolate. Then, children are asked what another person would think is inside the box. In the Non-ostensive condition, instead of showing children the contents of the box, the experimenter accidentally knocks it over, revealing the pencils inside. Our preliminary results suggest that children in the Non-ostensive condition were more likely to correctly attribute the belief to another person that the box contains chocolate (12 out of 21) than children in the Ostensive condition (8 out of 21). We suggest that this pattern of results can be explained by children's bias to interpret the information received in an ostensive context as part of shared cultural knowledge and this leads to an overgeneralization error.

Keywords: *mentalizing, shared knowledge, culture, ostension*

E-mail: olah.katalin@ppk.elte.hu

## The meaning of some

Katalin É. Kiss, Research Institute for Linguistics of the Hungarian Academy of Sciences,  
Hungary; Pázmány Péter Catholic University, Hungary

Langó-Tóth Ágnes, Research Institute for Linguistics of the Hungarian Academy of  
Sciences, Hungary

Lilla Pintér, Pázmány Péter Catholic University, Hungary (*presenting author*)

Whereas adults interpret e.g. some in Some horses jumped over the fence as ‘some but not all’, children understand it as ‘some and possibly all’ (see Noveck 2001). It is assumed that the basic meaning of some is ‘some and possibly all’; the ‘some but not all’ reading is a pragmatic inference, which children cannot access because of their immature pragmatic abilities. We argue that some and its Hungarian equivalent néhány are not pragmatically but semantically ambiguous; they have a non-specific counting meaning, ‘a few’, and a specific proportional meaning, ‘a proper subset of’. The two variants have different distributions, the former occurring with verbs taking nonspecific complements and the latter occurring with verbs taking specific complements. We tested the hypothesis that young children are insensitive to the counting-proportional distinction, and overgeneralize the counting reading. In a picture-selection task, preschoolers (mean age: 5;2, N = 13) opted for cards depicting a non-proportional setting (‘all of a few’) in 74% of the trials, and this ratio decreased to 58% in the group of six-year-olds (mean age: 6;4, N = 14) and to 42% in the group of eight-year-olds (mean age: 8;1, N = 18).

Keywords: *pragmatic implicature, semantic ambiguity, non-specific counting reading, specific proportional meaning, language acquisition*

E-mail: pinterlilla87@gmail.com



## Context sensitivity of level-2 perspective taking

Lívia Priyanka Elek, Eötvös Loránd University, Hungary

Renáta Szücs, Eötvös Loránd University, Hungary

Katalin Oláh, Eötvös Loránd University, Hungary

Fruzsina Elekes, Hungarian Academy of Sciences, Hungary, Eötvös Loránd University,  
Hungary, Central European University, Hungary

Máté Varga, Budapest University of Technology and Economics, Hungary

Clara Ajisukmo, Atma Jaya Catholic University of Indonesia, Indonesia

Ildikó Király, Hungarian Academy of Sciences, Hungary, Eötvös Loránd University,  
Hungary

Recent results suggest that perspective taking is a flexible and context-sensitive mechanism. Given that perspective taking is strongly linked to social factors, involving these when identifying the relevant contextual elements in the process would allow a better understanding of the afore mentioned sensitivity. The present work focuses on the effects of cultural context (individualistic vs. collectivistic) and the group membership (minimal group vs. linguistic groups) of the social partner on performance in a level-2 perspective taking task. 8-9-year-old participants had to perform a number verification task in pairs and we measured the occurrence of altercentric intrusion. We replicated previous findings in the individualistic culture showing spontaneous level-2 perspective taking; however, results suggest that this may not be similarly pronounced in a collectivist culture. In addition, preliminary data suggest potential differences depending on the linguistic group membership of the partner.

*Keywords: perspective taking, minimal group membership, linguistic group membership, cultural context*

E-mail: [elek.livia.priyanka@gmail.com](mailto:elek.livia.priyanka@gmail.com)

## Cognitive underpinnings of irony understanding in children

Maria Zajackowska, University of Kent

Kirsten Abbot-Smith, University of Kent

David Williams, University of Kent

We examined the relationship between irony interpretation and Theory of Mind measures (Strange Stories, Happé, 1994) and the Theory of Mind Inventory (ToMI, Hutchins et al., 2012), as well as working memory, set shifting and inhibitory control, whilst controlling for non-verbal IQ.

We also examined different types of irony interpretation. All previous studies have used 'simple' forms of irony, where the hearer can see from the real world context that the literal meaning cannot be true (e.g., saying 'It's a perfect day for a picnic' when it's raining). We included a 'complex' irony condition, where the non-literal interpretation cannot be inferred from the visual context.

We presented children (N=51; aged 6;01 - 9;01) with 10 videos, in both simple and complex irony conditions. After each short dialogue, participants answered an open-ended question, then a forced-choice (out of three) question about the speaker's meaning.

Children selected above chance for simple irony (M = 76% correct) but significantly below chance for complex (M = 25% correct) irony. Regression analyses showed that when controlling for age, nonverbal IQ and formal language, ToM measures related to simple irony interpretation. There was no relationship found between the EF and ToM measures and complex irony interpretation.

*Keywords: irony, Theory of Mind, executive functioning, pragmatics*

E-mail: mkz2@kent.ac.uk

## How linguistic common ground management affects online language comprehension

Marlou Rasenberg, Radboud University Nijmegen, The Netherlands

Geertje van Bergen, Max Planck Institute for Psycholinguistics, The Netherlands

Joost Rommers, Donders Institute for Brain, Cognition and Behaviour, The Netherlands

In conversational interaction, language provides us with explicit cues to acknowledge our interlocutor's expectations. For example, the Dutch discourse marker 'eigenlijk' ('actually') encodes non-alignment between what the speaker says and what the hearer is assumed to expect on the basis of the (extra)linguistic context. Its function is thus to manage common ground by marking the difference between interlocutors' models of the discourse. While discourse markers are generally well-studied in formal semantics, little is known about their role in language comprehension. We used event-related brain potentials (ERPs) to investigate whether comprehenders extract the pragmatic information encoded in discourse markers, and how this affects their predictions about and integration of upcoming information during online language processing. We hypothesized that if 'eigenlijk' functions as a cue for upcoming unexpectedness, then it will weaken discourse-based predictions about incoming words, as measured by modulations of ERP components. Our results indicate that 'eigenlijk' does not modulate semantic processing of (un)expected incoming words, but it does affect the online integration of linguistic input with the wider discourse model. A possible explanation for this finding is that 'eigenlijk' signals to comprehenders that a conflict with one's discourse expectations will follow, which results in postponed integration of subsequent input.

Keywords: *pragmatics, discourse markers, language comprehension, prediction, event-related potentials*

E-mail: marlou.rasenberg@mpi.nl

## An event-related potential (ERP) study of cognitive control in young adulthood

Martina Knežević, Psychology Department, Croatian Studies, University of Zagreb, Croatia

When competing responses are activated, but only one can be selected, response conflict arises and elicits a cascade of cognitive processes including selective attention, conflict detection, response selection and suppression, and post-response monitoring. These processes are often referred to as cognitive control. One of the classic and widely applied cognitive control tasks is the Stroop task, where participants need to filter out interfering information or suppress its further processing. The aim of this study was to investigate brain dynamic changes of cognitive control processes in young adulthood, using event-related (ERP) brain activity and a modified four-color Stroop task. A total of 109 participants were included in the study, divided into three age groups: late adolescents (ages 19 - 21), young adults (ages 23 - 27) and mid adults (ages 28 - 44). Performance results revealed that mid adults were overall more accurate compared to both late adolescents and young adults. ERPs showed age differences in P2 (selective attention) and N2 (conflict monitoring) amplitudes indicating less effective recruitment of cognitive control resources in late adolescents compared to mid adults after high-conflict trials. These findings point to the continuation of age-related differences in brain maturational processes underlying cognitive control well into adulthood.

*Keywords: cognitive control, young adulthood, event-related potentials, protracted brain maturation*

E-mail: [martina.knezevich@gmail.com](mailto:martina.knezevich@gmail.com)

## Functions of ostensive communicative stimuli of storytelling for children

Melinda Papp, Developmental and Neuropragmatic Research Group,  
University of Szeged

Lívía Ivaskó, Developmental and Neuropragmatic Research Group, University of Szeged

Our aim is to examine which ostensive communicative stimuli (Sperber–Wilson 1995) can help children to comprehend narratives. Ostensive signals of communicative storytelling are the guarantee (Sperber 1996) not to waste the mental processing effort humans need to get cognitive effect of relevant information of a story.

Hypothesis: the pragmatic pattern of telling tales to small children is similar to that of the universal features of motherese.

Method: 22 Hungarian children (average age: 70.5 months) had to listen to 7 tales while watching a storyteller on the monitor of a computer and to answer 6 questions on the content of the tale. The interlocutor used miscellaneous non-verbal signals in the tales: A) using the features of motherese (M)/non-conventional stress on irrelevant expressions of the text (NCS) /neutralized stress (NS) and B) keeping or avoiding eyecontact.

Results: After Bonferroni correction there was a statistically significant difference between storytelling with features of M and the storytelling with NS ( $p < 0.001$ ) and also between the storytelling with NCS and the storytelling with NS ( $p = 0.016$ ). Results of the comprehension subtests of the tales reveal the most efficient ostensive stimuli in the age group of 3-6 years old children.

Our research is supported by EFOP-3.6.1-16-2016-00008.

Keywords: *ostensive signals, verbal narratives, stress, motherese, cultural transmission*

E-mail: [pappmelinda54@gmail.com](mailto:pappmelinda54@gmail.com)

## The effect of an audience on dogs' performance

Orsolya Kiss, Institute of Cognitive Neuroscience and Psychology, Hungarian Academy of Sciences, Hungary

József Topál, Institute of Cognitive Neuroscience and Psychology, Hungarian Academy of Sciences, Hungary

Being watched by others has a strong effect on both human and non-human behavior, e.g. children tend to perform better with easy tasks, if an audience is present. In this study we propose the question if audience effect can be observed in case of domestic dogs (*Canis familiaris*). Specifically, we analyze if dogs have a better performance when being watched by a significant person (owner). The aim of the present study was to get a better insight of the complexity of dogs' social signaling and how that relates to the human's attentional state.

In order to examine dogs' behavior, we used a paradigm with two experimental conditions: "audience" and "mere presence" condition. We investigated whether the observation influences performance on a relatively monotonous task. It was examined how long the dog shows interest in a task, when the owner is showing attention versus when the owner does not watch the dog.

The results indicate that dogs recognize the owner's attentional states and modify their behavior accordingly. Furthermore, our results suggest, that the observation might have an effect not only on the control of behavior, but on the reward system as well.

*Keywords: audience effect, dog (Canis familiaris), dog-human interaction*

E-mail: [kisorsolia@gmail.com](mailto:kisorsolia@gmail.com)

## Can Eurasian jays (*Garrulus glandarius*) integrate others' desires and perspectives to protect their caches?

Piero Amodio, University of Cambridge, Cambridge, UK

Ljerka Ostojić, University of Cambridge, Cambridge, UK

Christopher Krupenye, University of Cambridge, Cambridge, UK

Nicola Clayton, University of Cambridge, Cambridge, UK

Eurasian jays employ a variety of cache protection strategies to minimise cache loss by either responding to the perspective (visual or auditory) or the desire of an observing conspecific. To date however, it is not known whether jays can integrate information about these different mental states of an observer to selectively protect those caches that are at most risk of being pilfered. In two experiments, we manipulated the observer's desire for food through specific satiety and the observer's perspective by providing the cacher with in-view and/or out-view cache sites. In Experiment 1, caching jays could hide only one type of food - either the same food the observer was sated on or a different food - but distribute it across an in-view and an out-of-view tray. In Experiment 2, jays could only cache in one location (either in-view or out-of-view) but could choose between two types of cacheable foods: one that was desired and one that was not desired by the observer. Across both experiments, the jays' caching pattern provided no evidence that they integrated information about the observer's desire and their perspective. Thus, jays may not be able to simultaneously process others' desires and perspective to protect their caches.

Keywords: *corvids, caching, Theory of Mind, desire, perspective*

E-mail: pa393@cam.ac.uk

She knows/ She thinks/ She doesn't know that X: Presuppositional effects  
trigger context sensitivity of language-induced motor activity:  
A grip-force study

Robert Reinecke, Institut des Sciences Cognitives – Marc Jeannerod;  
ENS de Lyon, France

Tatjana Nazir, Institut des Sciences Cognitives – Marc Jeannerod, France

Jacques Jayez, Institut des Sciences Cognitives – Marc Jeannerod; ENS de Lyon, France

In the domain of neurolinguistics, it is well-established that hand and foot-related action terms activate corresponding areas of the motor cortex. Crucially, the recent neuroscientific literature suggests that language-induced motor activation is task- and context-dependent (e.g. Raposo et al., 2009; Willems & Francken, 2012). These findings open up the question of whether sensori-motor activity is modulated by further contextual factors. Human languages possess a variety of linguistic devices, so-called presupposition triggers, which allow us to convey background information without asserting it. We investigate the effect of information-layering on grip force activation by comparing assertive information with information embedded under a presuppositional factive verb construction (Study 1) and a non-factive verb construction (Study 2). Furthermore, we examine whether the projection behaviour of a factive verb construction modulates grip force activation under negation (Study 3). The grip force sensor technique allows to measure the impact of language processing on motor activity. More precisely, it measures hand-related pressure correlated with action verbs in the auditory modality. The data show that the crosstalk between language and grip force is sensitive to presuppositional contexts: The presupposed factive complement triggers an increase in grip force, even under negation, whereas the non-factive complement does not.

Keywords: *presupposition processing, embodied semantics, pragmatics*

E-mail: [rreineck@isc.cnrs.fr](mailto:rreineck@isc.cnrs.fr)



## Nonverbal communication: People lower their voice frequencies when giving expert advice

Piotr Sorokowski, Institute of Psychology, University of Wrocław

Agnieszka Sorokowska, Institute of Psychology, University of Wrocław; Department of Psychosomatic Medicine, TU Dresden, Germany

David Puts, Department of Anthropology, The Pennsylvania State University, USA

Janie Johnson, Department of Anthropology, The Pennsylvania State University, USA

Katarzyna Pisanski, Institute of Psychology, University of Wrocław, Poland; Mammal Vocal Communication & Cognition Research Group, School of Psychology, University of Sussex, United Kingdom

Nonverbal communication is an important aspect of communication. Voice analysis has greatly advanced our understanding of the functions of nonverbal communication. Here, we investigated whether people actively modulate the frequency components of their voices in an authoritative context. Research assistants engaged scientists working as faculty members at various universities in two types of speech conditions: (1) spontaneous speech, wherein the subjects were asked how to get to the dean's office on that given campus; and (2) authority speech, wherein the same subjects were asked to provide commentary for a radio program for young scholars titled, "How to become a scientist, and is it worth it?". Our results demonstrate that men ( $n = 27$ ) and women faculty members ( $n = 24$ ) lower their voice pitch (mean, minimum and standard deviation in fundamental frequency) and their formant frequencies (formant spacing,  $\Delta F$ ) when asked to provide their expert opinion, compared to when giving directions, while raising their maximum pitch and pitch range. Our results support the prediction that people modulate their voices in everyday social contexts in ways that are likely to elicit favorable social appraisals.

*Keywords: nonverbal communication, authority, voice, voice modulation*

E-mail: sorokowskipiotr@yahoo.co.uk

## Putting complement clauses and false belief into context

Silke Brandt, Lancaster University, UK

Stephanie Hargreaves, University of Manchester, UK

Anna Theakston, University of Manchester, UK

Previous studies have found close relationships between children's acquisition of complement clauses (she thinks that Tom is sick) and false-belief. However, most of them have presented the sentences in isolation and have focused on comprehension only.

We tested English-speaking 4-year-olds (N = 25), 5-year-olds (N = 25) and adults (N = 24). Participants heard a total of 18 complement clauses embedded in more naturalistic story contexts (e.g. Dan wants to play football with Sue. But he thinks that she's on holiday). The belief was conveyed as true (she really is on holiday), false (she actually isn't on holiday), or left neutral (there's a blue star). The test question (Why doesn't Dan play football with Sue?) elicited complement clauses (because he thinks that she's on holiday) or simple clauses (because she's on holiday).

Overall, the 4-year-olds produced significantly fewer complement clauses than the 5-year-olds and the adults (4-year-olds: 37%; 5-year-olds: 57%; adults: 88%). However, each group used more complement clauses in false-belief contexts (49.72%; 75%; 100%) than in neutral-belief contexts (46.36%; 67.46%; 96.53%) and true belief-belief contexts (20%; 33.78%; 67.36%). Children with higher working memory also used more complement clauses. Surprisingly, false-belief scores did not predict children's production of complement clauses.

*Keywords: false belief, complement clauses, linguistic context*

E-mail: s.brandt@lancaster.ac.uk

## Infants' interpretation of direct approaches of human and non-human agents

Szilvia Biro, University of Leiden, The Netherlands

Recent research suggests that infants are not able to generate goal-directed expectations in a new situation if the agent's behavior provides ambiguous means selection information (i.e., a non-efficiently adjusted movement path). These findings drew attention to the ambiguity of goal-directed interpretation of direct approaches which, albeit efficient, do not provide direct evidence for efficient adjustment. Our study investigated 9-month-old infants' expectations about the future behavior of agents (human or non-human) who engaged in a direct approach toward another object. We found that neither a direct reach-and-grasp of a human hand nor a straight-line approach of a self-propelled non-human agent allowed infants to generate expectations for an efficiently adjusted behavior of the agent toward the goal in a new situation (Experiment 1/2). When however the direct approach was accompanied by contextual cues (multiple target objects), infants expected the hand to be able to adjust its path to achieve its goal (Experiment 3). The self-propelled agent generated such expectations only when evidence for the adjustability of its path was also provided (Experiment 4.) Taken together, in case of direct approaches prior knowledge about the adjustability of the actor's movement is necessary but not sufficient for generating specific expectations in a new situation.

Keywords: *infant, goal attribution, action interpretation, agency*

E-mail: [sbiro@fsw.leidenuniv.nl](mailto:sbiro@fsw.leidenuniv.nl)

## Being bilingual does not enhance the ability of preschool children to produce alternative names

Theodora Karadaki

Martin Doherty

Research has shown that the ability, given one name for an object (e.g. truck), to produce an alternative name (lorry) does not develop until children are about 4-years-old and is associated with false belief understanding. The present study tested the strong intuition that bilingual children will be better at producing alternative names thanks to their versatile linguistic environment. Three- to 5-year-old Greek-English bilinguals (N=40) studying in international schools in Athens were given this Alternative Naming Task in within- and across-languages versions. As found with monolingual children, bilingual performance on the Alternative Naming Task was associated with age and false belief understanding. This association was most strong for the cross-language alternative naming task, in which children were given one word in English and had to produce the corresponding word in Greek, or vice versa ( $r = .73$ ,  $p < .001$ ). Nevertheless, younger children who could not pass tests of false belief understanding also could not produce alternative names in either task. This suggests that bilingualism does not enhance the ability to produce alternative names, either within the same language or between them.

Keywords: *Theory of Mind, alternative naming, bilingualism*

E-mail: T.Karadaki@uea.ac.uk

## Lexicalization of orthographic representations: A pilot study

Vera Varga, Budapest University of Technology and Economics, Brain Imaging Centre,  
Research Centre for Natural Sciences, Hungarian Academy of Sciences, Hungary

Valéria Csépe, Budapest University of Technology and Economics, Brain Imaging Centre,  
Research Centre for Natural Sciences, Hungarian Academy of Sciences, Hungary

Automatic access to the orthographic lexicon is necessary for skilled reading; however, little is known about the emergence of orthographic representations. To track the process of lexicalization of novel written word forms, we used masked form priming as an index of orthographic learning. Priming effects depend on the lexical status of the prime: pseudoword primes facilitate, word primes inhibit the recognition of orthographically similar target words. Thus, as pseudowords become lexicalized words, inhibition should emerge. In our study, participants were presented with word and pseudoword primes and one-letter different (neighbor) target words in a masked lexical decision task (baseline). In the subsequent orthographic learning task, they were trained to read half of the pseudoword primes in a picture-word matching task. Finally, participants repeated the masked lexical decision task. Although the lexicality effect was not robust in the baseline, training resulted in slower responses for targets preceded by trained primes compared to untrained primes suggesting increasing integration of the novel word form into the orthographic lexicon. Relationship between lexicalization and individual differences in spelling ability and reading fluency is also discussed.

Keywords: *orthographic learning, lexicalization, masked neighbor priming, lexicality effect*

E-mail: [varga.vera@ttk.mta.hu](mailto:varga.vera@ttk.mta.hu)

## The role of Theory of Mind functions in language comprehension in adults

Zsuzsanna Üllei, Eötvös Loránd University, Hungary

Bálint Forgács, Eötvös Loránd University; Hungarian Academy of Sciences, Hungary

Judit Gervain, Université Paris Descartes, France

Eugenio Parise, Lancaster University, United Kingdom

Gergely Csibra, Central European University, Hungary

György Gergely, Central European University, Hungary

Lívia Elek, Eötvös Loránd University, Hungary

Ildikó Király, Eötvös Loránd University and Central European University, Hungary

14-month-old infants seem to detect the false belief of a potential communicative partner and evaluate utterances from their perspective. They not only show an N400 effect (an electrophysiological marker of semantic incongruity detection) when objects are named incorrectly for themselves, but also when they are incongruent from the perspective of an observer. To investigate the developmental course of this ability, we recorded adults' electroencephalogram (EEG), while we presented them with toys that we named in the presence of an observer. Toy labels were either congruent for both parties, incongruent for both, or incongruent for the observer, yet congruent for the participant. According to preliminary analyses, we have found a greater negativity in the incongruent both compared to the congruent for both condition in the 300-500 ms time window over centroparietal electrode sites, which signals an N400 effect, when participants experienced a semantic incongruity for themselves. However, in the incongruent other condition, we found an intermediate negativity relative between the congruent and incongruent for both conditions, but only if adults received explicit instructions. Data collection is still ongoing, but these preliminary results suggest that adults use their language comprehension system somehow differently to evaluate others' comprehension relative to infants.

*Keywords: Theory of Mind, language comprehension, semantic incongruity, N400*

E-mail: zsuzsi.ullei@gmail.com

Even 3-4 years-olds understand implicatures if the cognitive load of the task is reduced

Andrea Balázs, Budapest University of Technology and Economics, Hungary  
Anna Babarczy, Budapest University of Technology and Economics, Hungary; Research Institute for Linguistics of the Hungarian Academy of Sciences, Hungary

Children under the age of 8 do not generate implicatures in binary judgment tasks. They reject statements such as "Some giraffes have long necks" while adult accept them. Foppolo et al. (2012) argues that children's responses can be attributed to insufficient cognitive resources. According to Katsos & Bishop's pragmatic tolerance hypothesis this phenomenon is explained by children's greater tolerance toward pragmatic anomalies.

In our research we tested these theories. Using Hungarian sentences with distinct semantic and pragmatic meanings, we found that children aged 5-6 derive implicatures in an adult-like manner in a ternary judgment task. We further found a correlation between children's performance on the language task and their scores on a variety of executive function tasks. This lead to the hypothesis that a ternary task is easier for children than a binary task because the availability of a mid-way choice reduces the cognitive load.

To test this hypothesis, we ran a series of experiments with increasingly simpler tasks. With reducing the cognitive burden, even 3-4-year olds gave adult-like responses. We conclude that limited executive function decreases the accessibility of implicatures but even 3-4 year-olds can derive implicatures if the task does not place extra cognitive load on them.

*Keywords: implicature, executive functions, children, cognitive load*

E-mail: futrago@gmail.com

## Children's assessment of a speaker's attitude influences their understanding of the speaker's beliefs

Anna Babarczy, Budapest University of Technology and Economics

Marta Szucs, Budapest University of Technology and Economics

Andrea Balázs, Budapest University of Technology and Economics, Hungary  
(*presenting author*)

The study explores the development of irony comprehension in children and its relationship with some aspects of Theory of Mind. Three groups of typically developing children aged five, seven and ten participated in the experiment. The children heard short stories ending with a character uttering a statement. The statement was literally true, ironic or a lie. After each story, the children answered three Likert-scale questions: a belief, an intention and an attitude question.

Five year-olds had difficulty identifying speaker beliefs for all three statement types, ten year-olds performed at ceiling, while for seven year-olds lies were the most difficult, irony was somewhat easier and literally true statements posed no problems. For the intention question, answers to ironic statements were at chance level in the two younger groups. The intention to deceive was somewhat more likely to be identified. With respect to speaker attitude, none of the groups distinguished irony from deception.

Our results therefore show that in irony comprehension, young children have difficulty identifying not only the intentions but also the beliefs of the speaker; this difficulty also affects the recognition of deliberate deceit; and children's assessment of a speaker's beliefs is affected by their assessment of the speaker's intentions.

*Keywords: pragmatic development, irony comprehension, intention attribution, belief attribution, deceit comprehension*

E-mail: babarczy@cogsci.bme.hu



## Are all labels widely shared? Children's understanding of the boundaries of conventions

Begum Ozdemir, University of Toronto

Patricia Ganea, University of Toronto

Young children assume that object labels are widely shared. We examined children's sensitivity to the label type when deciding how widely it is shared. In Study 1, 2- to 4-year-olds (N = 120) watched videos in which one of two novel objects was labelled either conventionally, "I know what this is called. We call this a dax" or through a made-up scenario "I don't know what this is called. Let's make up a name for this, a dax". Then, a second speaker (either present or absent during the initial labeling phase) asked the child to point to the referent of a novel label ("zev"). Children were less likely to extend made-up labels to other speakers, especially when the speaker was absent during the initial labeling. Study 2 tested 3- and 4-year-olds (N = 80) to tease apart the effects of label type from speaker's knowledge and found that in the absence of knowledge-state cues, children were not sensitive to the difference between conventional and made-up labels. Together, the results suggest that preschool children are not yet sensitive to the differences in the extent to which labels are shared among speakers unless there is a salient cue for the speaker's ignorance.

Keywords: *object labels, conventionality, common ground*

E-mail: [begum.ozdemir@mail.utoronto.ca](mailto:begum.ozdemir@mail.utoronto.ca)

## The impact of movement-based classroom music education on cognitive development in first-grade children

Borbála Lukács, Doctoral School of Psychology, Eötvös Loránd University, Hungary;  
Brain Imaging Centre, Research Centre for Natural Sciences, Hungarian Academy of  
Sciences, Hungary

Emese Maróti, Budapest University of Technology and Economics, Hungary

Kata Asztalos, University of Szeged, Hungary

Ferenc Honbolygó, Brain Imaging Centre, Research Centre for Natural Sciences,  
Hungarian Academy of Sciences, Hungary; Institute of Psychology, Eötvös Loránd  
University, Hungary

Previous studies have revealed that regular, active engagement with music in early life leads to improvements in general auditory skills and in cognitive functioning. However, results from these studies indicate that both the intensity and the focus of music instruction can affect the development of cognitive abilities in school-aged children. Therefore, the main purpose of the present study was to discover the impacts of a specific, movement-based music education program on auditory and cognitive skills after six months of formal instruction in first-year classes. Musical auditory and sensorimotor synchronization skills, linguistic abilities, IQ, executive functions, creativity as well as empathy were measured in two groups of Hungarian elementary school students who either received intensive music instruction or specialized in mathematics. Psychological assessments were carried out at the beginning and at the end of the first school year. Results revealed enhanced abilities from pre- to post-test in both classes, however, these improvements proved to be non-significant. Moreover, the performance of the music and the mathematics class did not differ significantly, either. This may indicate that short-term music instruction in the school environment is not enough to support the appearance of cross-domain transfer effects in 6- to 7-year-old children.

*Keywords: movement-based music education, music perception, cognitive development, transfer effect of music, children*

E-mail: lukacs.borbala@ttk.mta.hu

Theory of Mind, working memory and math performance:  
A longitudinal study

Daniela Kloo, Ludwig-Maximilian University of Munich, Germany

Beate Sodian, Ludwig-Maximilian University of Munich, Germany

Susanne Kristen, Ludwig-Maximilian University of Munich, Germany

Christopher Osterhaus, Ludwig-Maximilian University of Munich, Germany

Both theory of mind and executive functioning have been related to children's academic progress. In a longitudinal study with 155 children, we investigated the influence of these two abilities on children's math performance (DEMAT; German Math Test) at 8 years of age. The main finding was that first- and second-order false belief understanding (but not emotion understanding or understanding strange stories) at 5 years of age predicted math performance at 8 years of age, even when concurrent working memory (backward digit span) at 8 years of age was taken into account ( $r = .310$ ,  $p = .001$ ). We argue that theory of mind and, in particular, understanding representations may be an important developmental precursor of math performance; in accordance with the importance of the use of representations in school mathematics.

Keywords: *Theory of Mind, working memory, mathematics, representation*

E-mail: [daniela.kloo@sbg.ac.at](mailto:daniela.kloo@sbg.ac.at)

## The role of shared space in the choice of spatial demonstratives

David Peeters, Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands

In everyday communication people often refer in speech and/or gesture to entities in their immediate environment, thereby expressing their communicative intentions and shifting their addressee's attention to an object, person, or event. Particularly spatial demonstratives and pointing gestures canonically co-occur in everyday spoken reference. The large majority of the world's spoken languages contain more than one type of spatial demonstrative (e.g. English *this* and *that*). In four behavioral experiments, we tested a recent claim that the choice of demonstrative (*this* versus *that*) depends on whether a referent is in the speaker's peripersonal ("in reach") or extrapersonal ("out of reach) space. Eighty participants referred in speech and gesture for an addressee to objects placed in different locations while the object's distance to the speaker, the position of the interlocutors (face-to-face versus side-by-side), and the number of available referents were manipulated orthogonally. When participants sat side-by-side, linear distance to speaker and addressee best explained variance in demonstrative choice. A significant increase of proximal demonstrative use was found when participants were face-to-face compared to when they sat side-by-side. These findings argue against a mapping of demonstratives onto peripersonal and extrapersonal space. Instead, they highlight the importance of shared space in everyday referential communication.

*Keywords: spatial demonstratives, pointing, space, referential communication*

E-mail: david.peeters@mpi.nl

## The director's task and camera controls: A second look

Edward W. Legg, University of Cambridge, UK

Robert W. Lurz, Brooklyn College, City University New York, USA

Nicola Clayton, University of Cambridge, UK

The director's task - where participants must ignore responding to instructions based on what they see because the instruction-giving director sees something else - was thought to measure mental state attribution. However, a previous study found that participants make equivalent numbers of errors when a camera replaces the director and the instructions require reasoning about what the camera can photograph (a non-mental state), suggesting performance need not be attributed to mental state attribution. Here we show that the within-subject design of the original camera control study, where conditions (director or camera) were presented in blocks, may mask differences in performance between conditions because participants show substantial improvement at the second block. Using a between-subject design, which avoided potential carry-over effects, we found that participants were less error prone in the director than the camera condition. This finding suggests that participants are more adept at reasoning about the director's perspective than what the camera can record and supports suggestions that social and communicative contexts (such as being instructed by a director) may facilitate or cue perspective taking. Finally, we report the results of an experiment designed to investigate whether the communicative context drives the difference found between director and camera conditions.

Keywords: *Theory of Mind, domain-general, director's task*

E-mail: ewl24@cam.ac.uk

## How does theory of mind understanding support children's peer interactions in a social pretend play context

Elian Fink, University of Cambridge, UK

Jenny Gibson, University of Cambridge, UK

There is a strong research tradition exploring the association between children's developing theory of mind understanding and their social competencies, however few studies have explored how theory of mind (ToM) supports adaptive peer interactions. Using a longitudinal design, the current study explores the associations between ToM understanding and specific features of children's social pretend play, namely (i) the degree to which play is negotiated and coordinated, (ii) the enactment of pretend play actions and, (iii) closeness of the peer interactions (amity). Given the importance of language ability for both ToM and peer interactions, expressive and receptive language skills were examined at both time-points. Participants comprised 234 five year-olds (Mage = 5.10, SD = .40). At both at Time 1 and Time 2 (one year later), children were observed playing with a nominated friend, and negotiation, pretend play enactment and amity were coded (Kappas from .70 to .85), first and second order ToM tasks, and a standardized language test were administered. Over and above the importance of language abilities, theory of mind had both a concurrent and longitudinal association with specific features of children's peer interactions. The implications of these findings in view of the broader ToM literature are discussed.

Keywords: *Theory of Mind, social competence, peer interactions, language*

E-mail: ef364@cam.ac.uk

## Referential entropy influences the production of overspecifications

Elli N. Tourtouri, Saarland University

Les Sikos, Saarland University

Matthew W. Crocker, Saarland University

Contra Grice's Maxim of Quantity, several studies indicate that speakers often overspecify their referring expressions. We investigated whether overspecifications are driven by information-theoretic factors like entropy reduction: When the referential domain is sufficiently complex, speakers may include 'redundant' information in order to help restrict the search space, reducing cognitive effort. In a visually-situated referential communication task, we manipulated the Necessary Adjective (colour or pattern) and the Entropy Reduction Advantage of each adjective (whether colour or pattern reduced entropy more, or equally), and measured the rate of overspecification. If referential entropy influences speakers' choices, then more overspecifications should be found when a redundant adjective reduces referential entropy more, relative to conditions in which the necessary adjective reduces entropy more or when both adjectives reduce entropy equally. Preliminary results indicate that speakers overspecified colour more often than pattern replicating a well-established bias, likely reflecting colour salience. Consistent with the above prediction, we also find an interaction between Necessary Adjective and Entropy Reduction Advantage: Speakers overspecified more often when the redundant adjective reduced referential entropy more than the necessary adjective. This finding suggests that speakers can use overspecification as a rational strategy, and converges with previous evidence indicating that overspecification can facilitate comprehension.

Keywords: *maxim of quantity, referring expressions, production, overspecification, referential entropy*

E-mail: [elli@coli.uni-saarland.de](mailto:elli@coli.uni-saarland.de)

## Belief updating processes in human adults

Ildikó Király, Eötvös Loránd University, Hungary

Barbara Pomiechowska, Central European University, Hungary

Gergely Csibra, Central European University, Hungary

Ernő Téglás, Central European University, Hungary

Ágnes Kovács, Central European University, Hungary

A crucial question in mindreading research is whether humans track others' beliefs in an online/prospective manner or whether they do so only post hoc (or 'on demand'), when they have to predict or explain others' behavior. Importantly, online belief tracking processes empower computing other's beliefs based on observing relevant events which lead to belief formation, as well as enable updating these beliefs if necessary. While most mindreading tasks use end-of-scenario measurements, here we targeted online belief update processes by measuring correlates of mental effort at various time-points in a modified referential communication task with adults. Specifically, we used pupil dilation to investigate whether it reflects real-time updating of another agent's belief. We introduced a situation where the observer discovers that the protagonist was wearing opaque sunglasses, and not transparent ones, when a location change happened. Thus, her belief about the location became outdated. We observed increased pupil dilation only in the condition when the revealed information required updating of the protagonist's belief, but not in a matched control. Additionally, we measured participants' behavioral responses based on the supposed updated beliefs at the end of the scenario. Our results suggest that belief updating might be taking place in an online manner.

Keywords: *Theory of Mind, online tracking, pupil dilation*

E-mail: kiralyi@caesar.elte.hu



## What counts as a fork anyway? A pragmatic account of classic counting error

Ivan Kroupin, Harvard University

Susan Carey, Harvard University

When shown a fork broken into three pieces and asked 'how many forks are there?' children under five consistently respond with 'three forks' (Shipley & Shepperson, 1983). This error has also been shown in comparing object quantities - children consistently judge one fork in three pieces as 'more forks' than two whole forks (Brooks et al., 2013).

This error has been attributed to developmental differences in sortal concepts (Brooks et al., 2013) or the ease with which children access alternative word forms ('broken', 'whole', Srinivasan et al., 2015). We offer an alternative, pragmatic, account of the error: Children (unlike adults) do not consider the whole/broken status of an object relevant to counting/comparing quantities - it is primarily an issue of relevance that prevents adult-like counting/comparing.

We test this hypothesis by providing four-year-olds with a vignette in which characters use the objects counted/compared. This framing highlights the relevance of whole objects since only whole objects can be properly used. Preliminary results show dramatically reduced error rates in both counting and comparison. Given the vignette neither alters the sortal concepts involved nor provides alternative word forms, these preliminary findings both weigh against existing theories and support a pragmatic account.

Keywords: *pragmatics, relevance, development, counting*

E-mail: [ikroupin@g.harvard.edu](mailto:ikroupin@g.harvard.edu)

## Climax, intention and goal spotting in sequences of others' actions

Josita Maouene, Grand Valley State University, MI, USA

Mounir Maouene, ENSA Tangier University, Morocco

The idea of embodied climax, intention and goal is derived from embodied cognition and the theory of mind reading. Authors have argued that adult speakers employ gaze, body parts, objects, body positions as deictic references in word-meaning associations in real time during quasi synchronic interactions. We wondered whether adults used these deictics for verbs on differed time. The first task asked 20 participants to order temporally eight sequences of an action for 10 actions. The second task presented another group of 20 participants with the same 10 actions of 8 temporally ordered sequences and asked for the best frame for spotting: the label, the intention, the goal, the action start and the action end. The main result of the first study indicates that the participants did not follow the real time development. They built a rising action and a climax but no falling action. The main results of the second task show that intentions are closer to the start and goal to the climax. Both tasks showed strongest agreements for action with objects with hand and mouth, followed by leg, and last eyes. The results suggest that participants employed deictics on differed time although some other constraints are at work.

Keywords: *embodied cognition, verbs, deictics, time*

E-mail: [maouenej@gvsu.edu](mailto:maouenej@gvsu.edu)

## The interpretative wiggle-room: The role of evidence in epistemic vigilance and plausible deniability

Julius Tacha, University of Vienna, Austria; Central European University, Hungary

Francesca Bonalumi, Central European University, Hungary

Thom Scott-Phillips, Central European University, Hungary

Christophe Heintz, Central European University, Hungary

Ostensive communication, as directing other's understanding, does not permit full interpretative certainty. Although individuals generally understand communicated content correctly, ambiguity remains ubiquitous and can be capitalized upon. For uncertainty and defeasibility, the current focus is on situations where speakers have a strategic interest in making their intentions understood without committing to them (Lee/Pinker 2010).

Construing from the hearer's perspective instead, epistemic vigilance, i.e. the ability to scrutinize pieces of evidence that are grounds for drawing inferences, aims to minimize the risk of being misinformed (Sperber et al 2010). Complementarily, 'possible deniability' (Lee/Pinker 2010) stresses that even an implausible interpretation can be perceived as plausible by third parties. We argue that plausible deniability is not sufficient to circumvent epistemic vigilance (cf. Reboul 2017). Rather, it results from the minimization of the evidence available as reasonable proof of intentions. It is unclear how hearers deal with seemingly certain statements, which's linguistic ground still allows for defeasibility.

We experimentally investigate reactions to falsehoods given varying degrees of evidence, i.e. (documented) linguistic and contextual information. We predict that participants will form their epistemic judgments about statements with less documented evidence than they deem necessary to prove speaker's meaning to a third party.

*Keywords: ambiguity, epistemic vigilance, falsehoods, ostensive communication, plausible deniability*

E-mail: julius.tacha@posteo.at

Is language required to represent others' mental states? Evidence from beliefs and other representations.

Krešimir Đurđević, University of Rijeka, Croatia

Steven Samuel, Department of Psychology, University of Cambridge, U.K.

Edward W. Legg, Department of Psychology, University of Cambridge, U.K.

Robert Lurz, Brooklyn College, City University New York, New York, U.S.A.

Nicola S. Clayton, Department of Psychology, University of Cambridge, U.K.

An important part of our Theory of Mind – the ability to reason about other people's unobservable mental states – is the ability to attribute false beliefs to others. We investigated whether processing these false beliefs, as well as similar but non-mental representations, is reliant on language. Participants watched videos in which a protagonist hides a gift and either takes a photo of it or writes a text about its location before a second person inadvertently moves the present to a different location, thereby rendering the belief and either the photo or text false. At the same time, participants performed either a concurrent verbal interference task (rehearsing strings of digits) or a visual interference task (remembering a visual pattern). Results showed that performance on false belief trials did not decline under verbal interference relative to visual interference. We interpret these findings as further support for the view that language does not form an essential part of the process of reasoning about false beliefs.

Keywords: *Theory of Mind, verbal interference, dual task, false belief, false photo*

E-mail: [kdurdevic@outlook.com](mailto:kdurdevic@outlook.com)

## Differential responses of socialized minipigs to their caregivers; attachment bond or social preference?

Linda Gerencsér, Department of Ethology, Eötvös Loránd University, Hungary; MTA-ELTE 'Lendület' Neuroethology of Communication Research Group, Hungarian Academy of Sciences –Eötvös Loránd University, Hungary

Melinda Lovas, Department of Ethology, Eötvös Loránd University, Hungary

Paula Pérez Fraga, Department of Ethology, Eötvös Loránd University, Hungary

Anna Gábor, Department of Ethology, Eötvös Loránd University, Hungary; MTA-ELTE 'Lendület' Neuroethology of Communication Research Group, Hungarian Academy of Sciences –Eötvös Loránd University, Hungary

Dóra Ujváry, Department of Ethology, Eötvös Loránd University, Hungary

Márta Gácsi, Department of Ethology, Eötvös Loránd University, Hungary; MTA-ELTE Comparative Ethology Research Group, Budapest, Hungary

Attila Andics, Department of Ethology, Eötvös Loránd University, Hungary; MTA-ELTE 'Lendület' Neuroethology of Communication Research Group, Hungarian Academy of Sciences –Eötvös Loránd University, Hungary

The construct of attachment was first used to explain the infant-parent bond in humans, and is claimed to be the basis of any group-living species' social structure. Former research has shown that dog-human attachment can be described in the framework of human attachment models based on behavioural phenomena measured in a modified version of the Ainsworth's Strange Situation Test (SST). Here we aim to further extend this concept to another species; we investigate the social relationship between minipigs living in human families (as companion animals) and their caregivers.

We use a social preference test and the already validated, modified version of the SST procedure to measure the behavioural responses of socialized young minipigs to their caregiver (owner) and an unfamiliar person (stranger). We hypothesize the appearance of differential reactions to the owner and the stranger.

According to preliminary results, pigs' behavior partially fulfills the operational criteria of attachment. Similarly to dogs, they exhibit a characteristic selective responsiveness, i.e. preference to the owner (proximity seeking and maintenance), however, their reaction to separation from and reunion with the owner seems to be less specific. These findings help to better understand human-animal relationships, and the underlying effects of domestication.

*Keywords: human-animal interaction, attachment, proximity seeking, social bond, pig*

E-mail: linda.gerencser@gmail.com

## Lessons from comparative cognition: What can non-human studies tell us about human Theory of Mind?

Ljerka Ostojić, University of Cambridge, UK

Edward W. Legg, University of Cambridge, UK

Claire Hughes, University of Cambridge, UK

Nicola S. Clayton, University of Cambridge, UK

Theory of Mind in humans is thought to develop in two steps: infants first gain an understanding of others' desires (around 18 months of age), which is later complemented by an understanding of others' beliefs (around 4 years of age). Here, we challenge this developmental trajectory by presenting data from an 'up-linkage' approach: we tested desire-state attribution in 4-, 5-, and 6-year old children using a behavioural paradigm developed for a non-human species, the Eurasian jay. Our results show that children of all three age groups correctly predicted another's desire when it was directly indicated through a behavioural cue. However, only 6-year olds correctly predicted another's desire when this desire needed to be inferred. Using behavioural criteria from comparative cognition, only 6-year olds' performance can be interpreted as evidence for desire-state attribution. In contrast, the performance of 4- and 5-year olds can be explained through the generalisation of previously learned behavioural contingencies. Consequently, our results raise the possibility that human Theory of Mind might not develop as a two-step process. Instead both desire-state attribution and belief-state attribution might develop in tandem at a similar age.

*Keywords: Theory of Mind, comparative cognition, desire-state attribution, behaviour, up-linkage*

E-mail: lo245@cam.ac.uk

## The development of nonverbal deception in 3-year-olds

Mareike Heinrich, University of Hamburg, Germany

Sebastian Dörrenberg, University of Hamburg, Germany

Ulf Liskowski, University of Hamburg, Germany

Are infants at the age of 3 years capable of creating false beliefs in others? In order to answer this question we designed an experiment inducing deceptive behavior in a natural interaction. 3-year old infants (N=33) were involved in a puppet play in one of two conditions. In the deception condition (n=18) a bear searched for a hidden toy to steal it from the child. In the helping condition (n=15) a frog searched the hidden toy to clean it and to bring it back afterwards.

Results indicate that children applied various strategies to prevent the bear from stealing the toy (e.g. lying, deceptive pointing, physical exclusion). In line with the expectations, children actively deceived the bear more often than the frog ( $t=2.65$ ,  $p < .05$ ,  $d=.92$ ). However, children more frequently informed than deceived the bear about the toy's location. Deception was strongly related to age ( $r=-.67$ ,  $p < .01$ ) and occurred particularly in children older than 42 months. These findings suggest that some children younger than 4 years are already able to actively deceive and implant false beliefs in others. The need to understand mental states in the experiment as well as implications for future research are discussed.

Keywords: *children, deception, deceptive pointing, helping behavior, false belief*

E-mail: [mareike.heinrich@gmail.com](mailto:mareike.heinrich@gmail.com)

## Developmental relations between early social-cognitive abilities

Marianna Jartó, University of Hamburg, Germany

Johanna Rüter, University of Hamburg, Germany

Ulf Liszkowski, University of Hamburg, Germany

According to one theory action-understanding and communicative-understanding are two separate systems in infants' first year of life. Others are interpreting both as goal-directed actions. Further, they are often either assessed with interaction-based measures or eye-tracking measures. First, we test if social-cognitive abilities are interrelated in early development. Second, we examine the relation of visual processing of social actions and behavioral abilities in social interactions. We conducted eye-tracking as well as interaction-based experiments in infants' first year of life in a longitudinal study. For the interaction-based tasks, we found robust correlations between point-following and helping behavior. For the eye-tracking tasks, there were no relations between the latency from a pointing-cue to an occluded referent and goal-anticipation for a failed reach. However, looking-time in incongruent trials of the cueing paradigm was related to infants' action-anticipation. Between interaction-based tasks and eye-tracking tasks, looking-time (but not latency) was related to infants' point-following behavior in live interaction. There were no relations between goal-anticipation and helping behavior. The study reveals more relation than a disunity, rather supporting a one system view. Differences in measures might suggest that they measure distinct aspects of infants' abilities, or they could also indicate less consolidated competencies in the emergent skills.

*Keywords: social cognition, action understanding, point following, eye tracking, behavioral tasks*

E-mail: marianna.jarto@uni-hamburg.de



## Default mode network of human brain supports theory of mind

Marta Marciniak, University of Warsaw, Poland

The brain's default mode network (DMN) consists of medial and lateral parietal, medial prefrontal, and medial and lateral temporal cortical areas of humans' brains.

The DMN appears to be active when the mind is not involved in specific behavioural tasks, so when individuals are engaged in stimulus-independent thoughts: when they make self-relevant morality-based affective decisions, construct imagined scenes based on a memory or during spontaneous acts of future-oriented thoughts. This is also well known that when DMN is activated, people focus on mental states of other people what means that they use a theory of mind. I claim that DMN has an adaptive role, supports development of theory of mind and improves communication between individuals. The poster investigates different patterns of interaction between default mode network and theory of mind phenomenon and shows how they make impact on each other.

*Keywords: default mode network, Theory of Mind*

E-mail: [mart.marciniak@gmail.com](mailto:mart.marciniak@gmail.com)

## Constructivist Theory of Mind and deception in early school age

Melania Moldovan, Developmental Psychology Lab, Babeş-Bolyai University,  
Cluj-Napoca, Romania

Narcisa Prodan, Developmental Psychology Lab, Babeş-Bolyai University,  
Cluj-Napoca, Romania

Laura Visu-Petra, Developmental Psychology Lab, Babeş-Bolyai University,  
Cluj-Napoca, Romania

Successfully instilling a lie requires the ability to navigate through other's mind. We aimed to investigate the relation between parental rearing behaviors, antisocial lies and constructivist theory of mind (ToMc), the ability to understand that people can come to different interpretations even when they are confronted with the same situation (Carpendale & Chandler, 2002). In a group of children aged between 7-13 years old (N=130) deception and ToMc are measured using a modified version of the Trivia Game, which addresses both constructs together and independently. Children are instructed to answer correctly and offer a possible justification in order to win the game, while they are also given the opportunity to transgress and lie about it. Results of this ongoing investigation will reveal if there is a link between ToMc and deception during this sensitive developmental window.

*Keywords: constructivist Theory of Mind, antisocial lies, parental rearing behavior*

E-mail: melaniamoldovan@psychology.ro

## Relationship between framing-effect susceptibility and sensitivity to perceived risk in doctors

Nataliya Bogacheva, Sechenov University, Russia

Elizaveta Pavlova, Lomonosov Moscow State University, Russia

Medics face the same cognitive biases as the non-specialist do. To help improve professional decision-making, it's important to understand how practitioners perceive risks in their everyday work.

Doctors (n=30) were interviewed about professional risks and asked to describe risky situations from their practice (the critical incident technique). Quantitative analysis found 10 risk sources, e.g. the doctor's cognition and 5 strategies of risk-reduction, e.g. information gathering. The stories were reformulated into 10 generalized situations, corresponding to the risk-sources, with the instruction to evaluate perceived riskiness in each situation (5-point Likert scale) and to choose the best risk-reduction strategy out of five. In the ongoing research of medical decision-making, medics (n=36) completed both variants of Kahneman's "Asian Decease" task (a verbal human life risk dilemma, formulated through gains or losses, with probabilistic and deterministic choices). 58% made probabilistic and 6% - deterministic choices only, while the others showed framing effects: 25% - reversed framing, 6% - regular framing, 6% - refused to answer in one condition. "Framing" participants showed higher "risk-sensitivity" in our inventory comparing to the "non-framing" participants ( $p=0.028$ ). Thus, doctors' framing susceptibility relates to their choices in risky professional situations.

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*Keywords: cognitive representations of risk, medical risks, decision-making in medical practice, cognitive framing*

E-mail: bogacheva.nataly@gmail.com

## Interpreting physical and mental metaphors: Is Theory of Mind associated with pragmatics in middle childhood?

Paola Del Sette, University of Pavia, Italy

Serena Lecce, University of Pavia, Italy

Luca Ronchi, University of Pavia, Italy

Luca Bischetti, School of Advanced Studies IUSS of Pavia, Italy

Valentina Bambini, School of Advanced Studies IUSS of Pavia, Italy

The present study aimed at investigating the relationships between Theory of Mind (ToM) and metaphor understanding in typically developing children. Echoing the difference between making an inference on mental, rather than on physical states in the ToM field, we distinguished between physical („Dancers are butterflies”) and mental metaphors („Daddy is a volcano”) and focused on the interpretation provided by the children, i.e., whether they would explain the metaphors by referring to physical or mental attributes. Our main hypothesis was that individual differences in ToM would be significantly associated with the interpretation of mental, but not physical, metaphors.

To reach this goal we recruited a sample of 218 typically developing children aged 9-12. Analyses showed that, over and above individual differences in working memory, receptive language, and socio-economic status, 9-years-olds, but not older children, who were better in ToM were also better in interpreting mental ( $p=.008$ ) but not physical metaphors.

Overall, these findings suggest that the link between metaphors and ToM is stronger when metaphorical interpretation involves mental aspects and that such link changes across development, being more evident in early rather than later childhood.

Keywords: *Theory of Mind, pragmatics, childhood*

E-mail: [paola.delsette01@universitadipavia.it](mailto:paola.delsette01@universitadipavia.it)

## A blind spot for desires: signature limits in the implicit system

Rachel Crosby, University of Cambridge, England

Ljerka Ostojić, University of Cambridge, England

Edward Legg, University of Cambridge, England

Nicola Clayton, University of Cambridge, England

While spontaneous response measures indicate sensitivity to false beliefs in infants before their first birthday, elicited response tasks are only passed consistently from 4 years of age. In adults these spontaneous responses may result from a minimal theory of mind (ToM) system, which trades off efficiency against flexibility and is susceptible to certain signature limits.

To date, studies investigating spontaneous responses in humans have focused on false beliefs. Early ToM competence accounts of spontaneous responses assume that the preference judgements employed in false belief tasks require implicit processing of desires. However, a minimal ToM account allows preferences to be encoded through “goal ascription”, without desire representation. Here, we test these hypotheses by investigating adults’ understanding of others’ satiety using both spontaneous and elicited measures.

Participants demonstrated an anticipatory looking response only when the desire state of the protagonist was verbalised. In contrast, when explicitly questioned participants were able to make behavioural predictions based on the protagonist’s satiety both with and without verbalisation. These results suggest that the implicit system does not represent desires, requiring direct behavioural cues to make predictions beyond simple preferences. Thus, our findings illustrate an important signature limit of spontaneous responses, supporting a minimal ToM account.

*Keywords: implicit, desire, satiety, Theory of Mind, goal*

E-mail: [rmc75@cam.ac.uk](mailto:rmc75@cam.ac.uk)

## Evaluating cognition through linguistic features

Sofia de la Fuente, University of Edinburgh, United Kingdom

Ricardo Olmos, Universidad Autonoma de Madrid, España

Saturnino Luz, University of Edinburgh, United Kingdom

Dementia prevention and care are paramount for global research. With an increasing scope on humanizing medicine and enhancing personal well-being, we aim to contribute to the development of alternative cognitive monitoring technologies, which would be less invasive and lower-cost than current screening processes.

This contribution would be based on automatic analysis of communication. Our hypothesis lies on the assumption that effective communication requires a relatively healthy cognitive state and a functional theory of mind. The rationale for our project is that language is impaired in dementia, and also relies on cognitive abilities, such as executive functions, which support discourse coherence, pragmatics, etc. Accordingly, we aim to identify both linguistic and conversational features associated with overall cognitive functioning.

In this study, we use word meanings and word-context relations (natural language processing; NLP) to analyse transcribed speech, generated by 461 healthy individuals aged 20-89 years old. Then, regression models based on the NLP features are used to predict participant's scores on a comprehensive neuropsychological assessment.

Preliminary results are promisingly accurate. Further work will involve comparative analyses of spoken dialogue generated by patients with dementia and healthy elders. This will enhance the robustness of the model by incorporating paralinguistic features and nonverbal cues, in order to automatically track cognitive functioning.

Research funded by the Medical Research Council, UK.

*Keywords: cognitive monitoring, computational linguistics, neuropsychology, discourse analysis*

E-mail: sofia.delafuente@ed.ac.uk

## Visual perspective-taking: How stepping into another's shoes can make you forget where you left your own

Steven Samuel, University of Cambridge, UK

Edward Legg, University of Cambridge, UK

Robert Lurz, CUNY, USA

Nicola S. Clayton, University of Cambridge, UK

Taking others' visual perspectives underpins a range of abilities, from hiding things to using language. Using a task where participants had to interpret another's verbal instructions based on their perspective we investigated both how we take perspectives and what sometimes makes it difficult. Adult participants were asked to locate a digit ('4' or '6') within a 2 x 2 grid from an avatar's perspective and then press a button corresponding to its location from the participant's (own) perspective. Results found that on trials where the avatar was oriented 90 degrees clockwise or anti-clockwise participants sometimes incorrectly pressed a response key that corresponded to the correct location from the angle the avatar was facing rather than their own. Additionally, on trials where the avatar took the opposite perspective, participants were slower to select an upside-down '6' than an upside-down '4,' suggesting that the delay was due to participants categorising the '6' as a '9'. Overall, these results suggest that we take perspectives by mentally simulating a new spatial relationship between our physical selves and our environment, and that some of the difficulty we have in perspective-taking can be accounted for by a difficulty integrating language with perception.

*Keywords: perspective-taking, referential communication, embodied cognition*

E-mail: [ss2391@cam.ac.uk](mailto:ss2391@cam.ac.uk)

## Domestic dogs may not be able to project their own visual experiences onto others

Ljerka Ostojić, University of Cambridge, UK

Yvette Kalaba, University of Rijeka, Croatia

Krešimir Đurđević, University of Rijeka, Croatia

Tea Jermaniš, University of Rijeka, Croatia (*presenting author*)

Edward W. Legg, University of Cambridge, UK

The 'gogglestest' is an experience projection paradigm, that has been suggested as a promising behavioural task to test whether non-verbal individuals (non-human animals and pre-verbal children) possess the ability of perspective taking. In the 'gogglestest', individuals have to use their own visual experience of wearing two types of goggles – one of which affords vision and one of which does not – to predict the visual experience and subsequent behaviours of others wearing the same goggles. Here, we employed the 'gogglestest' with domestic dogs, a species known for their highly flexible responses to cues of human perception and knowledge. To this end, we integrated the 'gogglestest' into two well-established tasks testing dogs' use of human perception. Across both tasks, dogs did not correctly use their own visual experiences with the goggles to predict the perceptual state of humans wearing the same goggles. Our results suggest that the dogs' ability to respond to cues of human perception and knowledge reported in previous studies may not be based on an understanding of others being able to see (and thus know). Instead, the results of previous studies might be explained by dogs using previously learned contingencies that are generalised across situations.

*Keywords: dogs, experience projection, perspective taking, mental state attribution*

E-mail: [tea.jermanis@gmail.com](mailto:tea.jermanis@gmail.com)



## The relationship between mindreading and nonverbal humor comprehension in deaf children

Timea Budai, University of Pécs, Hungary

Zsuzsanna Schnell, University of Pécs, Hungary

Kata Lénárd, University of Pécs, Hungary

Szabolcs Kiss, University of Pécs, Hungary

We studied theory of mind (ToM) skills of deaf children of hearing parents and their relationship with children's pragmatic competence based on the theory which argues that theory of mind ability is a prerequisite for a successful pragmatic competence. In our theory, we argue that the developmental delay in the ability of reading others' minds in deaf children of hearing parents, as many previous research has proven, is a result of using either the wrong method or the inappropriate form of language in the testing methodology. It is known that these children have a disadvantage in verbal tasks, thus using nonverbal tasks could be a solution for this methodology problem. In our study, we used nonverbal tasks to see if we can eliminate the disadvantage deaf children have in verbal tasks. Considering the nonverbal ToM task, we found no significant difference in the performance of deaf and hearing children, while in the nonverbal humor task, deaf children performed significantly better than hearing subjects. We used a verbal ToM task as well, Wellman and Liu's Theory of Mind Scale. When comparing the performance at the ToM Scale in total we found that hearing subjects performed significantly better than deaf subjects.

*Keywords: ToM Scale, mindreading, nonverbal humor comprehension, deaf children*

E-mail: budai.timea@pte.hu

## Personal attitudes towards ambiguity and risk in relation to the framing effect in Russian and Azerbaijani doctors

Yulia Krasavtseva, Lomonosov Moscow State University

Tatiana Kornilova, Lomonosov Moscow State University

Selena Kerimova, Baku Branch of Lomonosov Moscow State University

Medical doctors undergo an extensive and fundamental education, yet their decision-making in ambiguous conditions may be subject to cognitive biases, such as the framing effect. Susceptibility to the framing effect was studied in Russian (N=48) and Azerbaijani (N=40) doctors. Both groups were educated under equivalent systems in the same language. Therefore, the established dissimilarities may be attributed to cross-cultural differences.

Participants completed the following measures. (1) The Asian Disease Problem. (2) The Personal Decision-Making Factors Questionnaire, assessing rationality and risk-readiness. (3) The Melbourne Decision Making Questionnaire, assessing vigilance, hypervigilance, procrastination and buck-passing. (4) Budner's questionnaire for assessing tolerance and intolerance of ambiguity.

The framing effect was shown in 52% of the Azerbaijani doctors and in 36% of the Russian doctors. Azerbaijani doctors were more prone to ineffective patterns of coping with decisional conflict: buck-passing, procrastination and hypervigilance. Medical doctors in Azerbaijan showed more intolerance to ambiguity that was linked with unproductive coping patterns in both samples. Azerbaijani doctors, demonstrating the framing effect, were less risk-ready and showed higher hypervigilance. In Russian doctors, demonstrating the framing effect, riskiness was positively related to tolerance of ambiguity, while rationality was associated with vigilance.

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E-mail: julia.k7@gmail.com



















