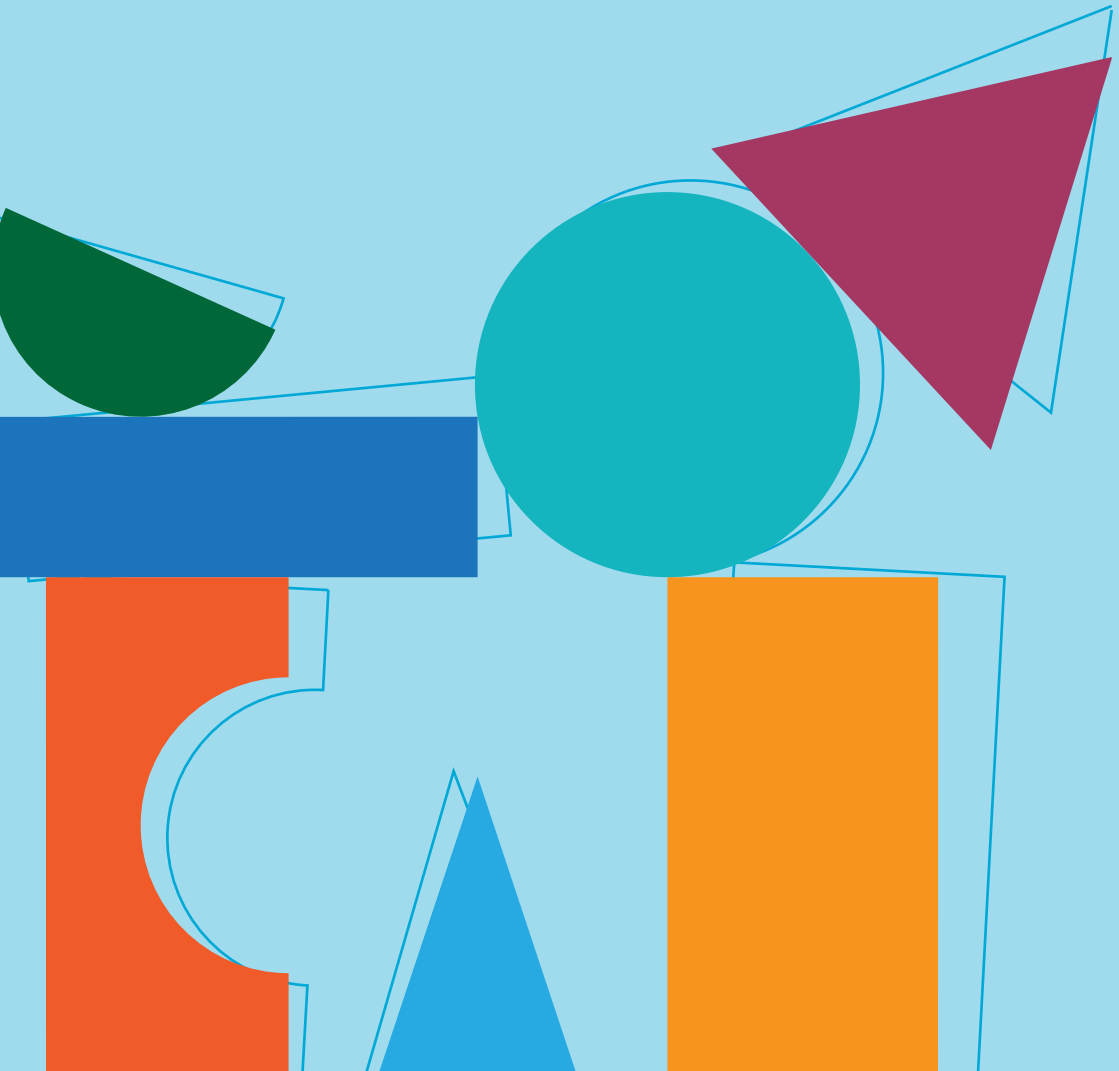
BC3D

BUDAPEST
CEU CONFERENCE
ON COGNITIVE
DEVELOPMENT

2020

PROGRAM AND ABSTRACTS



	Thursday, January 9	Friday, January 10	Saturday, January 11
9:00	**CDC Anniversary Workshop** *Auditorium*	Invited Lecture 2 **Michael Tomasello** ***Becoming Human: A Theory of Ontogeny*** *Auditorium*	Invited Lecture 3 **Susan Gelman** ***How Children Look Beyond the Obvious*** *Auditorium*
10:15		Coffee break + Group Photo *Lobby*	Coffee break *Lobby*
10:45	**Registration** *N15 Registration desk*	Paper Session 2 **Comparative Cognition** *Auditorium*	Paper Session 4 **Social Categories** *Auditorium*
11:45		Lunch break	Lunch break
13:00	**BCCCD20 Welcome** *Auditorium*		
13:15	Symposium 1 ***Towards a More Diverse Science of Theory of Mind*** *Auditorium*	Symposium 2 ***How Infants and Children Understand Agents' Interventions on the Physical World*** *Auditorium*	Symposium 4 ***Epistemic Uncertainty in Development: Implicit Encoding & Information-Seeking*** *Auditorium*
14:30	**Poster Session A** with coffee & snacks *1st floor*	**Poster Session B** with coffee & snacks *1st floor*	**Poster Session C** with coffee & snacks *1st floor*
16:30	Paper Session 1 **Metacognition** *Auditorium*	Paper Session 3 **Pragmatics** *Auditorium*	Paper Session 5 **Speech Perception** *Auditorium*
17:30	Short break	Short break	Short break
17:45	Invited Lecture 1 **Susan Carey** ***The Acquisition of Logical Operators*** *Auditorium*	Symposium 3 ***The Development of Attention: Interaction of Higher- & Lower-Level Systems*** *Auditorium*	Paper Session 6 **Representing Alternatives** *Auditorium*
19:00	**Welcome Reception** 19:00-21:00 *Lobby*	**Mulled Wine Reception** 19:15-21:00 *CEU Rooftop terrace*	**Gala Dinner & Closing Party** 20:00-3:00 *Radisson*

BCCCD 2020

Budapest CEU Conference
on Cognitive Development

Program and Abstracts

ORGANIZED BY
Cognitive Development Center
Central European University

January 9-11, 2020
Budapest, Hungary
http://bcccd.org/

CONFERENCE ORGANIZATION

The BCCCD is organized by the Cognitive Development Center at the Department of Cognitive Science, Central European University: http://cdc.ceu.edu/

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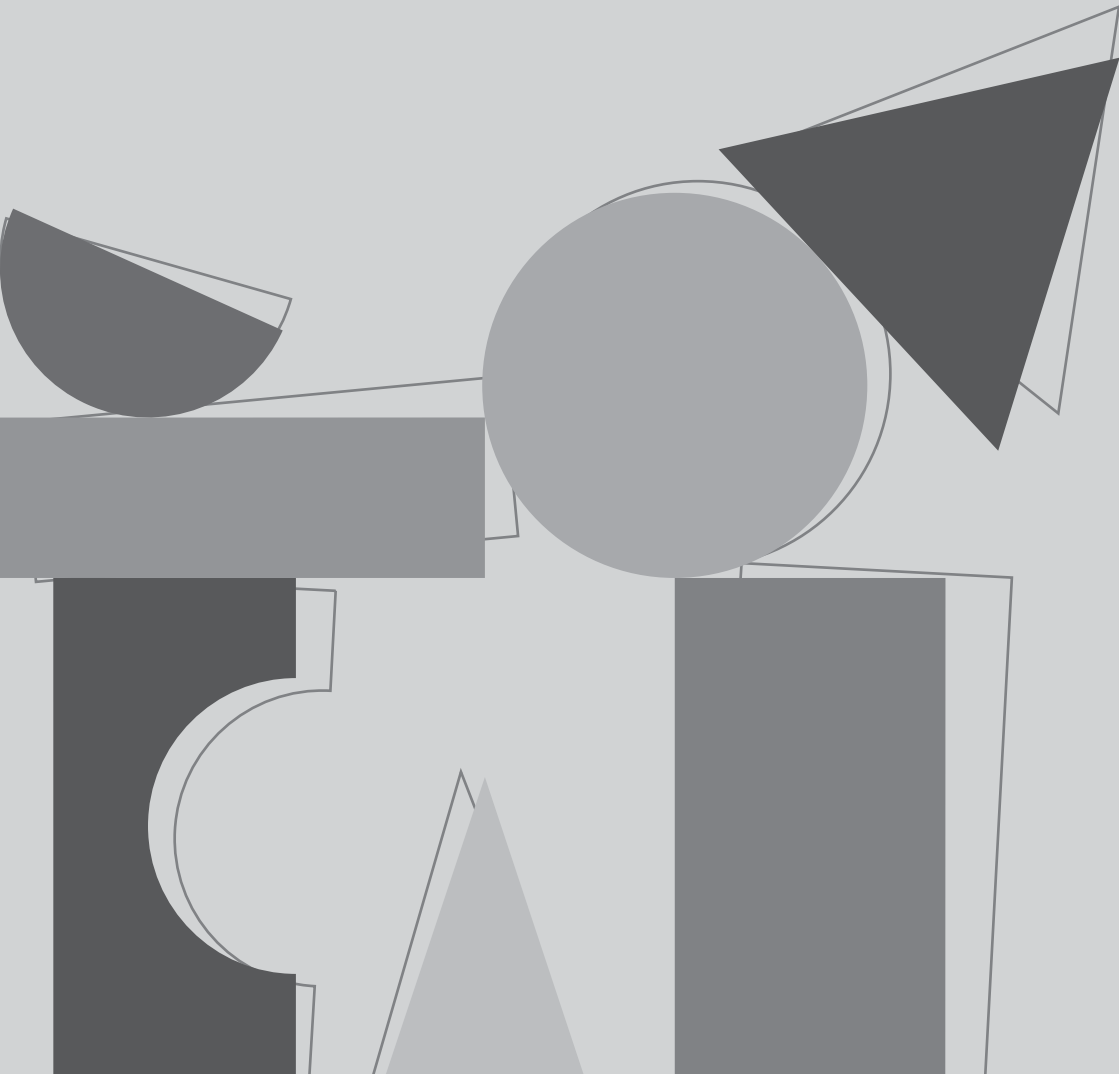

SCHEDULE

WEDNESDAY, JANUARY 8

CEU Cognitive Development Center Anniversary Pre-Conference Workshop

9:00 **Opening**
Gergely Csibra
Michael Ignatieff (Rector and President of CEU)

9:30 **Ágnes M. Kovács** (Central European University)
How do infants make inferences about other minds?
Nominated and introduced by **Gergely Csibra** (Central European University)

10:30 Coffee break

11:00 **Olivier Mascaro** (CNRS - Paris)
The early ontogeny of trust in communication
Nominated and introduced by **Dan Sperber** (CEU & Institut Jean Nicod, Paris)

12:00 **Melissa Kibbe** (Boston University)
Object representations from the concrete to the abstract
Nominated and introduced by **Alan Leslie** (Rutgers University)

13:00 Lunch break

14:30 **Marjorie Rhodes** (New York University)
How differences become different kinds
Nominated and introduced by **Susan Gelman** (University of Michigan)

15:30 **Teodora Gliga** (University of East Anglia)
Thinking outside the lab: mechanisms of conceptual development
Nominated and introduced by **Mark H. Johnson** (University of Cambridge)

16:30 Coffee break

17:00 **Hannes Rakoczy** (University of Göttingen)
The development of implicit and explicit theory of mind in early childhood and beyond
Nominated and introduced by **Michael Tomasello** (Duke University)

THURSDAY, JANUARY 9

9:30 **Lisa Feigenson** (Johns Hopkins University)
Folk theories drive learning: Evidence from scientists and evidence from infants
Nominated and introduced by **Susan Carey** (Harvard University)

10:30 **Ernő Téglás** (Central European University)
Prelinguistic representations of multiple possibilities in early inferences
Nominated and introduced by **György Gergely** (Central European University)

11:30 **Closing**
György Gergely

THURSDAY, JANUARY 9

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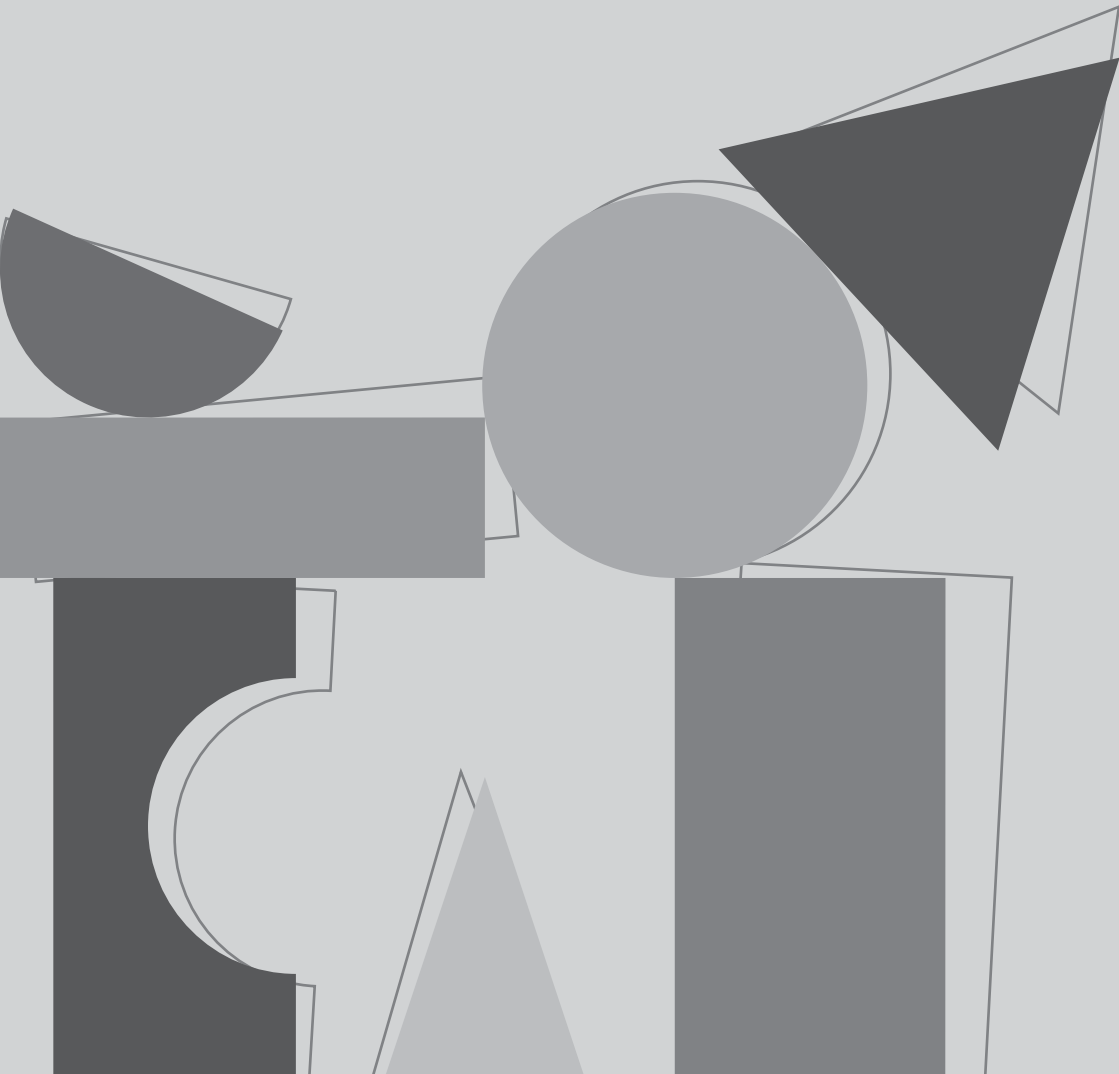

INVITED PROGRAM

INVITED LECTURE 1

The Acquisition over Infancy and Early Childhood of Logical Operators: Disjunction, Negation, and Modal Concepts

Thursday, January 9, 17:45-19:00

Susan Carey
Harvard University

At least since Descartes, philosophers have debated the origins of abstract combinatorial thought, both over evolution and over ontogenesis. Some (e.g., Descartes and Davidson) argued that such thought, the kind that underlies logical inference, scientific and moral debate, and many other aspects of human reasoning, crucially depends upon language, and is therefore not available to non-linguistic (nonhuman animals) or pre-lingusitic (human infants) creatures. Others (e.g., Fodor) argue that such thought predates hominid evolution by millions of years, and that infants must have such thought in order to learn language. This debate will not be settled by one-line arguments, nor from the philosophers' armchair. Theoretical analysis of the kind of thought in question, and empirical progress on establishing whether pre-linguistic creatures deploy it, must precede case study by case study. Here I review the current state of the art on the ontogenetic origins of logical operators: disjunction, negation, and the modal concept possible.

INVITED LECTURE 2

Becoming Human: A Theory of Ontogeny

Friday, January 10, 9:00-10:15

Michael Tomasello
Duke University

Over the past two decades, my colleagues and I have documented many differences in the cognitive and social abilities of human children and their nearest great ape relatives. In this talk, I attempt to bring these studies together into a coherent theory of the ontogeny of uniquely human psychology. For each of eight uniquely human developmental pathways - four cognitive and four sociomoral – there are two key transitions: one at 9 months (joint intentionality) and one at 3 years (collective intentionality). The hypothesis is that these transitions result from the new kinds of social coordination, sociocultural experience, and social self-regulation that the maturation of the capacities for joint and collective intentionality make possible.

INVITED LECTURE 3

How Children Look Beyond the Obvious

Saturday, January 11, 9:00-10:15

Susan Gelman
University of Michigan

A hallmark of human cognition is the capacity to think about observable experience in ways that are non-obvious -- from scientific concepts (genes, molecules) to everyday understandings (germs, soul). Where does this capacity come from, and how does it develop? I argue that, contrary to what is classically assumed, young children often extend beyond the tangible “here-and-now” to think about hidden, invisible, abstract entities. I give examples from three lines of research: essentialism, generics, and object history.

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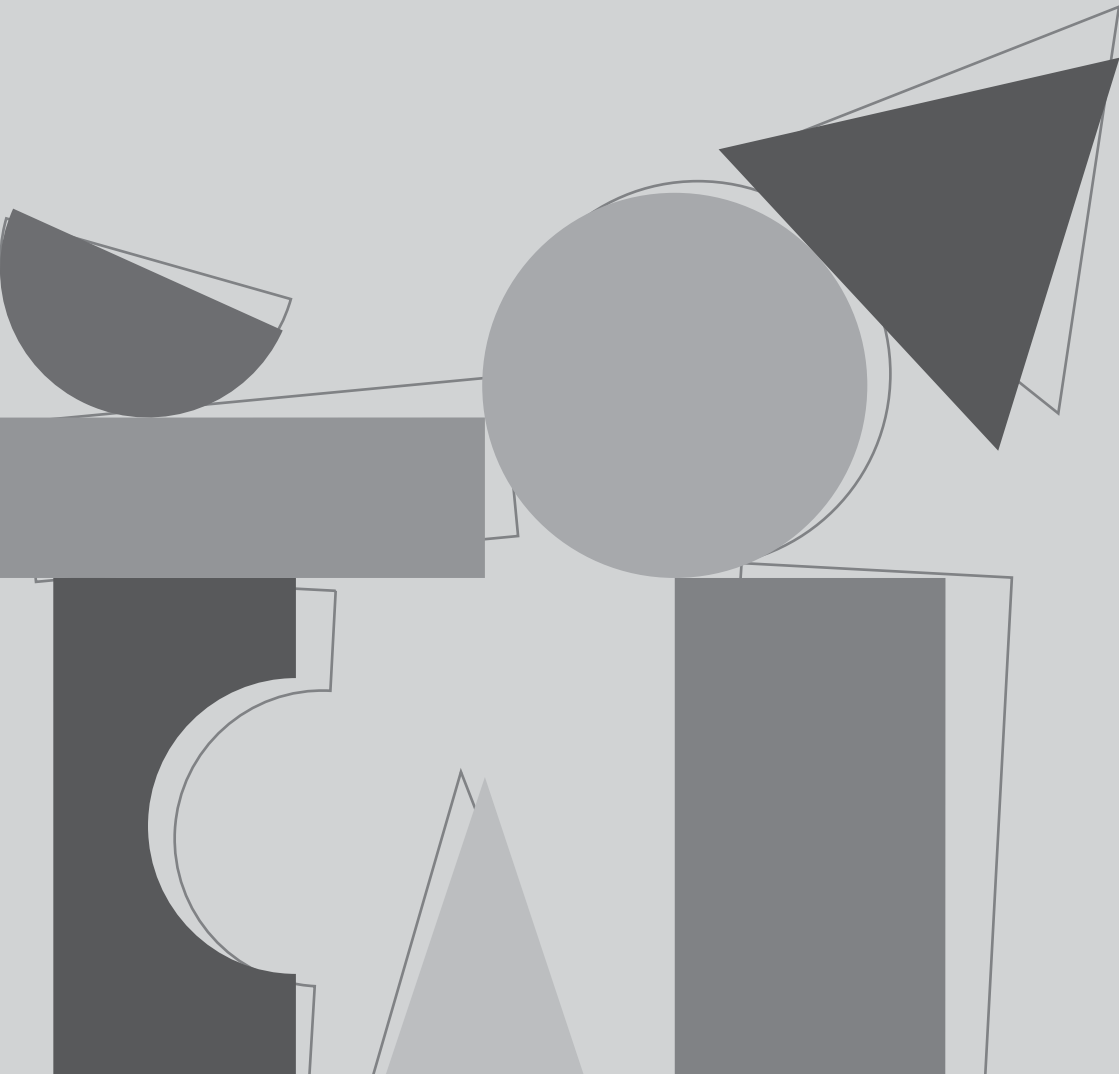

SYMPOSIA AND PAPER SESSIONS

SYMPOSIUM 1

TOWARDS A MORE DIVERSE SCIENCE OF THEORY OF MIND: MEASUREMENTS, MECHANISMS, AND FUNCTIONS

Thursday, January 9, 13:15-14:30

Organizer:
Hyowon Gweon, Stanford University
Mika Asaba, Stanford University

Discussant:
Michael Tomasello, Duke University

Speakers:
Hannes Rakoczy, University of Gottingen
Ildikó Király, MTA-Momentum Social Minds Research Group, Eötvös Loránd University
Mika Asaba, Stanford University

As humans, we are fascinated by the contents of others' minds. The ability to represent and reason about others' mental states—broadly referred to as Theory of Mind (ToM)—underlies a range of sophisticated social behaviors that are distinctly, or even uniquely, human. One of the most critical milestones in ToM development is belief-attribution, often assessed with false-belief tasks. Although earlier findings suggested that genuine belief-attribution emerges between 3 to 5 years of age, more recent work with infants and toddlers paints a more nuanced picture of false-belief understanding in the first few years of life. Collectively, this literature has had a tremendous impact on our understanding of when belief-attribution capacities develop and how they can be assessed by explicit (e.g., verbal response) and implicit (e.g., looking-time) measures. Yet, the focus on the age of "success" might have also constrained the kinds of tasks used to assess ToM and the scope of theoretical questions these tasks are designed to address.

In this symposium, we take a step back from the arms race of identifying earlier competence for false-belief reasoning to reflect on aspects of ToM that also deserve our attention: What does it mean to "succeed" or "fail" on standard measures of ToM? What computations underlie belief-attribution, and how do these computations influence children's social interactions beyond what is typically considered as the "standard" function of ToM (i.e., action prediction and explanation)? To address these questions, we bring together researchers

whose work represents diverse approaches to understanding ToM development.
Paper 1 provides a fresh perspective on standard measures of belief attribution, focusing on the puzzling "decline" in children's performance on true-belief tasks. Findings suggest that children's developing ToM supports rich, pragmatic interpretations of the task, ironically leading to unexpected, counterintuitive failures on true-belief questions which are presumed to be easier than false-belief questions. Paper 2 takes a deeper look at the computations that underlie belief-attribution, recognizing that humans not only prospectively ascribe belief-states but also revise them in a retrospective manner. Findings suggest that even 18-month-olds retrospectively revise the contents of others' past beliefs given new contextual information. Paper 3 extends the scope of belief representations handled by Theory of Mind; while most ToM tasks involve beliefs about the physical states of the world (e.g., location of Sally's ball), this study finds that children readily represent and revise others' beliefs about the self, and that the desire to improve these beliefs may manifest as behaviors akin to reputation management.
Finally, our discussant (Michael Tomasello) will contextualize the studies in light of the history and recent research trends in cognitive development. As an expert on social cognition and communication in humans and nonhuman primates, he will provide broad perspectives on the phylogenetic origins and ontogenetic development of ToM. By synthesizing the latest work on the measurement (Paper 1), mechanisms (Paper 2), and functions (Paper 3) of ToM, this symposium will encourage the audience to reflect on how humans use ToM in various ways to cooperate, communicate, and build relationships with others.

The protracted development of Theory of Mind and pragmatics

Hannes Rakoczy
University of Gottingen

Explicit false belief (FB) tasks, once litmus tests for meta-representational Theory of Mind (ToM), have recently come under attack. Most well-known is the concern that they produce false negatives. Much less well-known is the opposing concern that they create false positives. Two accounts along such lines argue that children initially, lacking meta-representational ToM, solve FB tasks by using simple heuristics which, however, would lead to characteristic failures in some other, even simpler tests such as true belief (TB) control tasks (Fabricius et al., 2010; Perner et al., 2015). In a first study, we tested the predictions of these accounts and found predicted paradoxical performance patterns: children up to age 3 solve TB but fail FB tasks; between 4 and 8 years the pattern reverses (pass FB/fail TB), and only from age 8-10 are both tasks reliably solved. We then tested in a second

series of studies whether these patterns are best explained by conceptual competence limitations, or merely reflect pragmatic performance factors. TB tasks are pragmatically peculiar since they pose trivial academic questions about the perspective of a perfectly informed agent. The results of 7 studies with 4- to 7-year-olds (N>300) clearly speak in favor of pragmatic performance limitations. Once TB tasks are made less trivial (e.g., by emphasizing that the protagonist may have been mistaken) or administered non-verbally, difficulties disappear. These findings corroborate the standard interpretation of the FB task as tapping meta-representational ToM, and open new questions/avenues regarding the protracted development of ToM and pragmatics beyond early childhood.

Do 18-month-old revise attributed beliefs?

Ildikó Király[1], Kata Oláh[1], Gergely Csibra[2], Ágnes Kovács[2]

[1]MTA-Momentum Social Minds Research Group, Eötvös Loránd University;[2]Department of Cognitive Science, Central European University

Belief attribution can be performed or revised in a retrospective manner by retrieving the details of the events that might have generated the beliefs. Previously we found that 3-year-olds did attribute beliefs retrospectively, but 18-months did not. Here we tested whether 18-month-olds could revise an attributed false belief (FB) when they learned that the person could have witnessed the situation that they initially thought had not been perceived by her. The infants observed two novel objects hidden by Experimenter 1 (E1) into two boxes. Then E1 left the room, and while she was away, the location of the objects were swapped. Infants were then asked to accompany Experimenter 2 (E2) to the adjacent room to invite E1 back. When they entered the room, infants in the FB-TB condition observed E1 peeking into the experimental room through a one-way mirror, while in the FB-FB condition she was reading (the window was covered). When E1 was back, she requested an object from the children by pointing to one of the two boxes. In response to the request, 15 of the 17 infants chose the non-referred box in the FB-FB condition, but in the FB-TB condition, in which they witnessed E1 peeking through the one-way mirror, 13 of the 15 children chose the referred box. So, 18-month-olds can revise an already attributed false belief after having learnt that its attribution might have been wrong. This suggests that the flexible use of ToM capacity requires the combination of belief-relevant information originating from different sources.

Young children actively revise others' beliefs about the self

Mika Asaba Hyo Gweon
Stanford University

Humans care about and strive to improve what others think of them. However, the ability to reason about others' beliefs about the self is a double-edged sword: While essential for navigating social interactions and building healthy self-representations, the desire to improve others' beliefs about the self can also hinder other important goals. Here we find that even young children use others' observations of their own failures and successes to infer others' beliefs about the self and strategically communicate to revise these beliefs. Three- and four-year-olds (N=132) initially failed but eventually succeeded at activating two different toys in the presence or absence of a confederate. Though children generally preferred to demonstrate a toy that is novel to the confederate, they were more likely to demonstrate a familiar toy when the confederate had a false, undesirable belief about the child's ability to activate that toy (i.e., "the child cannot activate the toy" when, in fact, they can). When the confederate already knew how the toys work, however, children preferentially communicated their success on the toy the confederate observed them fail, suggesting that children are attributing contentful, propositional attitudes rather than mere ignorance about the child's success. These findings suggest that children infer others' beliefs about the self and rationally trade-off opportunities to improve these beliefs vs. provide new information about the world. Building on prior work on Theory of Mind and reputation management, this work emphasizes the role of belief-attribution in how we present and communicate about the self in social interactions.

PAPER SESSION 1

METACOGNITION

Thursday, January 9, 16:30-17:30

Chair:

Maayan Stavans, Central European University, Hungary

Infants track learning progress and allocate their attention based on it: an eye-tracking study

Francesco Poli[1], Rogier B. Mars[1,2], Sabine Hunnius[1]

[1]Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, the Netherlands;[2]Wellcome Centre for Integrative Neuroimaging, Centre for Functional MRI of the Brain (FMRIB), Nuffield Department of Clinical Neurosciences, John Radcliffe Hospital, University of Oxford, Oxford, United Kingdom

Infants' stunning learning abilities allow them to quickly master a wide number of complex cognitive skills. However, the cognitive mechanisms underlying infant learning are still unclear. The present study uses an eye-tracking task in conjunction with computational modeling to shed light on how infants learn. Fifty 8-month-old infants were presented with sequences of cue-target couplings. In each sequence, the cue consisted of a simple shape appearing in the middle of the screen. The target was the same shape appearing in one of four quadrants with a certain probability. Infants could learn to predict the target location based on the cue type. Through an ideal learner model (Behrens et al., 2007), we computed trial-by-trial measures how surprising a trial was, how unpredictable the sequence of trials was and how much learning progress the individual trial offered. We report two main findings. First, infants' saccadic latencies were related to how surprising and unpredictable an event is, while looking time to the target was related to the learning progress. Second, infants made active use of whether the trial offered learning progress (and to a lesser extent of event surprise and sequence unpredictability) to decide whether to keep looking at a sequence. Specifically, infants were more likely to keep looking at a sequence as the estimates of learning progress increased. These results show that infants possess advanced learning strategies and shed light on the cognitive mechanisms that allow infants to learn so much so quickly.

Intuitive statistics and metacognition in children and adults

Madeline Pelz, Kelsey Allen, Joshua Tenenbaum, Laura Schulz
Massachusetts Institute of Technology Cambridge, MA, USA

Across six experiments, we asked whether participants represent the relative difficulty of discrimination problems and systematically ask for more samples as populations become harder to discriminate. To test this, we showed participants two populations of balls and asked them how many balls they would need to see in order to know which of two populations the sample was drawn from (see Fig. 1). Critically, participants never saw any samples, so they had to make a priori, metacognitive judgments rather than just asking for more samples when they were uncertain. Adults successfully requested larger samples for more difficult discriminations across ten discriminability contrasts (ranging from 90/10 vs. 10/90 to 49/51 vs. 51/49; order randomized) both when there was no explicit cost of sampling (Exp. 1: N = 30) and when there was (Exp. 2: N = 30). When given the option to skip questions, adults preferentially skipped the most difficult discrimination problems (Exp. 3: N = 50; Exp. 4; N = 50). Six- to eight-year-olds (Exp. 5: N = 24, M = 7;6, range: 5;11-8;11; Exp. 6 (pre-registered replication): N = 24, M = 7;2, range: 6;1-8;10) succeeded both in a simplified version of the task and in a version nearly identical to the adult task. The results suggest that both adults and children can perform "intuitive power analyses": they represent the degree to which populations overlap and ask for more samples when trying to distinguish less discriminable populations.

Development of strategic social information seeking in children

Kirsten H Blakey, Christine A Caldwell
University of Stirling, Stirling, Scotland

Selective social learning allows human adults to filter out less useful aspects of available information, therefore enabling them to actively seek and effectively use that which is most relevant. The majority of developmental social learning paradigms examine children's responses to information specifically provided for use in a particular task, but do not address children's ability to seek out the information for themselves. To assess 3-to-8-year-old children's ability to seek out and use the most appropriate social information we presented children with a box locked with a distinctive padlock and two keys (one correct). Children had to select and watch one of four possible demonstration videos before selecting one of the keys in an attempt to unlock the box. In each trial a single target video depicted

a demonstrator with the same box and keys as the child, while three non-target videos showed demonstrators with different boxes and keys. The age and gender of the target demonstrator varied across four trials, as did the success of the target demonstration. Results revealed that appropriate social information seeking improved significantly with age, and that target video selections were more likely when the genders of the child and the target demonstrator were congruent. Following successful information seeking, social information use was found to improve with age after both successful and unsuccessful demonstrations, though was higher following successful demonstrations.

PAPER SESSION 2

COMPARATIVE COGNITION

Friday, January 10, 10:45-11:45

Chair:

Barbara Pomiechowska, Central European University, Hungary

How do causal knowledge and sensitivity to intentions influence copying behaviour in infants, pre-schoolers, chimpanzees, capuchin monkeys and dogs?

Emma Tecwyn[1], Elisa Felsche[2], Amanda Seed[2], Daphna Buchsbaum[3]

[1]Cardiff University;[2]University of St Andrews;[3]Univserity of Toronto

Using a comparative, developmental and computational approach we explored the role of causal knowledge and sensitivity to social cues when deciding which actions to copy from others to reproduce an observed effect. Here, 18-to 30-month-old toddlers (N=42), 3-to 5-year-old children (N=38), chimpanzees (Pan troglodytes; N=29), capuchin monkeys (Sapajus sp.; N=21) and domesticated dogs (Canis familiaris; N=36) saw a demonstrator perform a 2-action sequence on a puzzle-box, which then dispensed a reward. We manipulated the causal plausibility of the first action and the demonstrator's intentionality. Following a pedagogical demonstration, older pre-schoolers copied faithfully, including the causally implausible action. With decreasing cues to the demonstrator's intent, children showed greater sensitivity to the actions' causal plausibility. Their behaviour was best captured by a computational model of a learner who inferred that a pedagogical demonstrator was a helpful teacher and rationally integrated this information with the causal evidence. Toddlers differentiated between an intentional and a non-intentional demonstration, but were not copying more faithfully following ostensive cues. All non-human species showed sensitivity to the first action's causal plausibility but were best described by a formalized learner with no conception of intentional action. In conclusion, species differences in copying can in part be explained by differences in understanding of intentions and the ability for pedagogical inference. Thereby, a receptivity to ostension (toddlers and dogs) or intentionality (chimpanzees and monkeys) does not automatically trigger an interpretation of the according action selection process and may thus be not sufficient for the transmission and maintenance of cumulative culture.

Expectations of relevance induced by ostension can override perceived efficiency in great apes

Hanna Marno[1], Christoph Völter[2], Brandon Tinklenberg[3], Josep Call[4], Dan Sperber[1,5]

[1]Central European University, Budapest, Hungary;[2]University of Veterinary Medicine Vienna, Vienna, Austria;[3]York University, Toronto, Canada;[4]University of St Andrews, St Andrews, Scotland;[5]Institut Jean Nicod, Paris, France

Ostensive cues, such as eye-contact or calling the other's name are typically used to inform the addressee about our communicative intention. Furthermore, they can elicit an expectation of relevance about the communicated information, both in the case of adults and infants. For example, when young children observe action demonstrations in the context of ostensive cues, they tend to copy the communicatively demonstrated action even if is not the most efficient way to achieve the apparently intended outcome. Would this expectation of relevance, induced by ostensive signals be a unique feature of the human communication system, or does it also occur in non-human communication? To answer this question, we presented great apes two demonstrators operating a device. In the baseline conditions one demonstrator was successful and the other never managed to achieve the intended outcome, but either both demonstrators were ostensively communicating with the apes, or none of them used any ostensive signals. In the experimental condition, however, the successful demonstrator did not use any ostensive cues whereas the unsuccessful demonstrator introduced her action demonstration with ostensive cues. We found that compared to the baseline, where apes tended to copy the efficient method significantly more often than the inefficient one, in the experimental condition they copied equally often the method of the inefficient, but communicative demonstrator as the method of the efficient, non-communicating demonstrator. These results suggest that the ostensive demonstration elicited an expectation of relevance that modified apes' interpretation of the situation, as it does in human children.

Capuchins' and children's use of information from social, virtual, and individual sources in a stimulus choice task

Elizabeth Renner, Delia Couper, Donna Kean, Mark Atkinson, Christine Caldwell

University of Stirling, Stirling, UK

Is the uniqueness of human culture attributable to what or how humans learn from others? We used a touchscreen task to directly compare information use from different sources

by capuchin monkeys (Sapajus apella; N=15) and 3- to 5-year-old children (N=28). In the task, an array of stimuli (2 or 3) was presented on the screen. Information about one of the stimuli (whether it was the rewarded item) was provided on the first trial (T1). In the social condition, the experimenter selected a stimulus on T1; in the virtual condition, an animated hand selected a stimulus; and in the individual condition, the participant selected a stimulus. In half of problems, the stimulus selected on T1 was the rewarded stimulus, and in the other half, it was unrewarded. On the second trial (T2), participants were given a raisin or sticker for selecting (touching) the rewarded item. Following a rewarded T1, T2 was scored as successful if the participant selected the same stimulus (i.e., repeated). Following an unrewarded T1, T2 was scored as successful if the participant selected a different stimulus. Children and the two task-proficient capuchin monkeys (with >80% performance overall) both repeated after rewarded T1s more than unrewarded T1s. Both groups' performance also showed an interaction between information type (rewarded vs. unrewarded T1s) and source; the difference in repeating after rewarded and unrewarded T1s was greatest in the individual condition and smallest in the virtual condition. In conclusion, it appears that neither group used social information in a distinctive way.

SYMPOSIUM 2

MAKING THINGS HAPPEN: HOW INFANTS AND CHILDREN UNDERSTAND AGENTS' INTERVENTIONS ON THE PHYSICAL WORLD

Friday, January 10, 13:15-14:30

Organizer:

Shari Liu, Harvard University

Discussant:

Laura Schulz, Massachusetts Institute of Technology

Speakers:

Shari Liu, Harvard University

Parvaneh Adibpour, Institute for Cognitive Sciences-Marc Jeannerod, CNRS, Lyon, France

Hyowon Gweon, Stanford University

Causal reasoning is central to our commonsense understanding of the world. One billiard ball striking another is not just two objects coming into contact, but also the first object launching the second, which itself was launched by a billiard cue, wielded by a person who undertook this action in order to score a point. In other words, our basic understanding of events entails how agents act on objects in order to generate desirable states of the world. There has been a substantial amount of previous work investigating the origins of infants' causal perception (e.g. Leslie & Keeble, 1987; Muentener & Carey, 2010; Luo, Kaufman, & Baillargeon, 2009; Pauen & Trauble, 2009; Saxe, Tenenbaum, & Carey, 2005). This body of work shows that by 8 months of age, infants appreciate that both self-propelled agents and inert objects can participate in causal events, but have a distinct set of powers: Whereas agents and objects can set objects into motion on contact, only agents can cause objects to change state on contact (e.g. Muentener & Carey, 2010). This symposium addresses deep and open questions about where our concepts of causal agency come from, whether and how they interact with our causal understanding of inanimate objects, and what these representations buy us in childhood and adulthood. Paper 1 investigates the origins of causal agency representation in 3-month-old infants, who lack first-person experience causing changes in objects, and shows that they nevertheless see others' reaching actions on objects as intentional, causal, and physically constrained. This work

suggests that our understanding of causal agency emerges early, earlier than causal perception of inanimate objects (Cohen & Amsel, 1998; Desrochers, 1999), and raises the question of how these two concepts of causation relate to each other. Paper 2 shows that 8-month-old infants can represent second-order causal chains, whereby an animate agent launches one object, which then contacts and causes a state change in another object. Even though infants at this age do not consider state change as part of the causal powers of objects (Muentener & Carey, 2010), they nevertheless appreciate that agents can pursue state change goals in multiple ways, either by acting on objects directly, or by setting a chain of events in motion in order to realize this outcome. Paper 3 explores children and adults' understanding of task difficulty and competence. This work combines cross-cultural, computational, and empirical approaches to show that from early childhood, and independent of particular experiences with specific tasks, we use representations of causal intervention infer what is hard and easy, and for whom. In sum, this symposium sheds new light on the origins and nature of interventionist causation: To see A cause B, is to understand that A interrupted a natural state of affairs and made B happen instead. The work from this symposium suggests that we use exactly this conception of cause to reason about agents acting on the world, and raises the question of how we come to see purely physical events (e.g. the moon pulling the tides) in this way as well.

Prereaching infants' understanding of others as causal agents

Shari Liu, Neon Brooks, Elizabeth Spelke
Harvard University

We view ourselves and others as causal agents who pursue goals, have limited energy, and make things happen, but where do these intuitions come from? We investigated the origins of these intuitions in 3-month-old ("prereaching") infants, who do not yet reach for, grasp, or manipulate objects. Across 5 experiments, N=152 prereaching infants viewed object-directed reaches that varied in efficiency (following the shortest physically possible path vs. a longer path), goal (moving an object vs. causing a change in its state), and causal structure (action on contact vs. action at a distance and after a delay). When infants saw a person reach for and pick up an object, they did not reliably interpret this action as physically constrained, looking equally when the person reached directly for the object and when she reached inefficiently. But when instead, infants saw the person reach for and change an object's state on contact (touching the object and making it light up), they robustly looked longer when it was inefficient than efficient. Importantly, this looking preference hinges on infants' causal understanding, because this effect disappeared when a

short spatial and temporal gap separated the person's hand from the object's state change. At 3 months, infants might not know which actions are hard and easy, what objects are potential goals, or how grasping an object can cause it to lift, but their learning is enabled by the intuition that costs, goals, and causes are worth learning about in the first place.

Early building blocks of tool-use: Combined representation of causal relations

Parvaneh Adibpour, Jean-Rémy Hochmann

Institute for Cognitive Sciences-Marc Jeannerod, CNRS, Lyon, France

The human capacity to use tools requires representing a chain of causal events that are combined to form an integrated event (e.g., hand moving a brush + the brush changing the wall color = hand painting the wall). First, we show that pupillometry can be used to investigate infants' causal representations for isolated events. Infants watched a series of partially occluded causal events involving an agent and a patient. In interleaved infrequent test trials two types of unoccluded events were shown: contact events, where the agent contacted the patient; and gap events, where a spatio- temporal discontinuity was introduced between the agent's movement and the effect on the patient. We found that infants' pupil dilation was greater in response to gap events, relative to contact events, suggesting that they represented the causal relationship between the agent and patient. Next, we explored whether infants represent a chain of several events (an agent launching one object, which then causes a second object to change state). Previous research found that infants attribute powers of state change only to intentional agents, and not inanimate objects. Here, we show that infants do understand a state-change event caused by an inanimate ball, when the ball is itself launched by an intentional agent. This implies that the causal power of the intentional agent is transmitted to the ball, suggesting that infants combined two causal events into a single, multi-step chain. Such integrated representation constitutes an important mechanism to understand tool-use.

Young children's intuitive understanding of task difficulty and agent competence

Hyowon Gweon[1], Mika Asaba[1], Grace Bennett-Pierre[2]

[1]Stanford University;[2]Temple University

Representations of costs (i.e., task difficulty) are foundational to many real-world decisions, but how do we know how hard it is to complete a goal before actually attempting it? Crucially, task difficulty not only reflects the objective properties of the world (e.g., lifting a 50kg weight is harder than lifting a 1kg weight) but also the subjective properties of the agent performing the task (i.e., lifting a 50kg weight is easier for a stronger agent than for a weak agent). Acquiring an abstract understanding of the relationship between the objective task difficulty and the subjective competence of agents is a critical milestone in cognitive development, as it requires the ability to seamlessly integrate one's intuitive knowledge of objects and agents in order to simulate how agents' actions causally intervene on the physical states of the world. In this talk, I will present a series of studies that uses simple engineering goals (i.e., building block structures) to systematically investigate the emergence of this understanding. When asked to judge the relative difficulty of various block-building goals, U.S. preschoolers showed both compelling success and developmental change across a wide range of trials. Furthermore, results from Bolivian Tsimane' children suggest that prior exposure to these particular tasks are not necessary for accurate judgments. By combining developmental and computational modeling approaches, this body of work demonstrates how our early understanding of objects and agents gives rise to a rich causal model of how agents act on the physical world.

PAPER SESSION 3

PRAGMATICS

Friday, January 10, 16:30-17:30

Chair:

Rachel Dudley, Central European University, Hungary

The development of pragmatic reasoning from multiple information sources

Manuel Bohn[1,2], Michael Henry Tessler[3], Megan Merrick[1], Michael C. Frank[1]

[1]Stanford University, Stanford, CA, USA;[2]Leipzig University, Leipzig, Germany;[3]Massachusetts Institue of Technology, Cambridge, MA, USA

The messages that speakers convey go beyond the literal semantics of words, and listeners must reconstruct a speaker's meaning using pragmatic reasoning (Sperber & Wilson, 2001). During language acquisition, pragmatic reasoning can help children to learn the meaning of novel words (Tomasello, 2003). Yet, pragmatic inferences require integrating information about the current utterance with information stored in common ground. How does information integration proceed? We formalize information integration during word learning using the Rational Speech Act model, a Bayesian model of Gricean pragmatics. RSA models are characterized by their structure in which hypothetical interlocutors make inferences about the interpretation of literal utterances based on the assumption that partners communicate in an informative way (Goodman & Frank, 2016). In a series of 7 experiments, we tested model predictions against data from three to five year old children (N = 219) and adults (N = 694). All experiments, models, and analysis were pre-registered. The results indicated that a model in which information sources flexibly traded off with one another provided a much better fit to the data compared to alternative models considering only one information source (all Bayes Factors > 577). Model predictions and data were more closely aligned to the behavior of older children.

This research shows that children and adults consider and integrate multiple information sources during pragmatic word learning. RSA models provide a way of thinking about the process by which information is integrated. In ongoing work, we use RSA models to explore how children integrate semantic knowledge with common ground information.

Children use presupposition to infer new word–referent mappings

Claire Bergey[1], Daniel Yurovsky[2]

[1]The University of Chicago, Chicago, USA;[2]Carnegie Mellon University, Pittsburgh, USA

Discourse structure follows predictable patterns, backgrounding old information and foregrounding the new. The ability to track this structure is not only key to effective communication, but a tool for extracting more information from language. For instance, the question "Is that a new spoon?" allows the listener to infer that the object is a spoon, regardless of the answer to the question—the identity of the object is presupposed. The similar question "Is that a spoon?" does not license this inference unless the answer to the question is "yes." We asked whether 3- to 6-year-old children are sensitive to this kind of presupposition and able to use this skill to make new word–referent mappings. Children (n = 74) watched videos in which one person asked another if a toy on the table in front of them was "a blicket" or "a new blicket," and the other person responded "yes" or "no." Children then saw two toys—the one from the video and a novel competitor—and were asked to "Find the blicket." As predicted, we found an interaction between question type and speaker's response: "No" responses made children significantly more likely to select the novel competitor when the question was "Is that a blicket?," but not when the question was "Is that a new blicket?" (beta = 1.00, $p < 0.05$). Our results show that children are sensitive to the presupposition implied by description in questions, and can use this skill to learn new words.

Expectations of reciprocity in referential communication: how do children respond to conversational rule violations?

Myrto Grigoroglou, Patricia A. Ganea

University of Toronto, Toronto, Canada

In everyday interactions, speakers often violate conversational expectations (e.g., by offering less information than listeners need; Grice, 1975). Although children, as comprehenders, appear sensitive to such violations (Gweon & Asaba, 2018; Morisseau, Davies & Matthews, 2013; Katsos & Bishop, 2011), how they respond to them in a reciprocal conversational setting is currently unknown. Here, we ask whether children tailor the informativeness of their speech based on the informativeness of an interlocutor in a prior interaction. In an informativeness rating task, 4- and 5-year-old children were asked to locate hidden stickers by following two puppets' instructions (one puppet always gave informative instructions; the other always under-informative instructions) and rate each puppet's helpfulness (with

a big/small reward). Then, in a referential communication task, roles were reversed, and children helped either the informative or the under-informative puppet uniquely identify a target object by using the appropriate modifier (e.g., “It’s the blue (vs. yellow) bag”). Data collection is ongoing. Preliminary results (n=26) show that children were sensitive to each puppets’ informativeness (i.e., both 4- and 5-year-olds gave them appropriate rewards significantly above chance, p’s<.05). Crucially, children mentioned modifiers more frequently when communicating with the informative than the under-informative puppet (.29 vs. .13; β=3.26, SE=1.28, z=2.5, p=.011). Thus, children were not only sensitive to violations of informativeness but also used this partner-specific information to guide their own linguistic behavior. These findings support theoretical views that similar cooperative expectations underlie conversation and social action (Grice, 1975).

SYMPOSIUM 3

THE DEVELOPMENT OF ATTENTION: INTERACTIONS OF HIGHER & LOWER-LEVEL SYSTEMS IN INFANTS & CHILDREN

Friday, January 10, 17:45-19:05

Organizer:

Jean-Rémy Hochmann, Institut des Sciences Cognitives Marc Jeannerod - CNRS

Speakers:

Lauren L. Emberson, Princeton University

Jean-Rémy Hochmann, Institut des Sciences Cognitives Marc Jeannerod - CNRS

François Leroy, INSERM, Cognitive Neuroimaging Unit U992, Gif-sur-Yvette, France

Nicole Wetzel, Leibniz Institute for Neurobiology, CBBS Research Group Neurocognitive Development

Young children and infants are not passive receptacles of knowledge. On the contrary, research on development and learning has recently insisted on the importance and efficiency of active learning. Early on, children and toddlers explore toys and games in a flexible way. Moreover, even young infants appear to show flexible strategical behaviour and self-correction behaviour. Active learning relies on cognitive and neural architectures that integrate higher-level systems and lower-level perceptual systems. A core component of such ability is the capacity to control attention and direct its focus and, relatedly, predict upcoming sensory events. This symposium explores the evidence that such architecture is already present in young infants and children.

The first contribution explores the importance of top-down predictions in visual perception, showing how visual perception is already contextually-specific in very young infants. Using a combination of neural and behavioural data, Emberson shows that higher-level systems influence perception after mere minutes of exposure to a specific situation. Such effect can already be observed in 6-month-olds and in neonates.

The next two contributions explore the architecture of attention in young infants. In adults, higher-level areas are only able to process one stimulus at a time. As long as higher-level systems are busy processing the first stimulus, a second stimulus will remain undetected, unattended and not consciously perceived. Hochmann & Kouider and Leroy et al. demonstrate that such “attentional blink” (AB) is already present in young infants. Analysing gaze fixation and pupil dilation, Hochmann & Kouider show that 5-month-olds exhibit an

AB, that is impaired detection if the second stimulus appears early rather than late after the first stimulus. They further show that, like adults, infants exhibit lag-1 sparing, that is unimpaired detection of the second stimulus if it appears immediately after the first. Analysing the EEG signal and pupil dilation, Leroy and colleagues show that 3-month-olds exhibit an AB. Both series of studies further converge on the timing of the AB. Whereas the AB lasts about 300 ms in adults, results suggest that the neural dynamics responsible for the AB are three time slower in young infants.

Finally, using behavioural measures and pupillometry, Wetzel & Widmann investigate the development of attentional control in infants and children, as the ability to focus one's attention on a specific task ignoring distracting stimuli. This contribution further expands the focus of our symposium investigating infants' pupil response to various distracting sounds, showing that the sympathetically mediated component of pupil dilation is selectively enhanced in response to highly arousing distractor sounds.

Altogether, this symposium suggests that the core architecture of the attentional system, relying on the interaction between lower-level perceptual systems and higher-level cognitive systems, are present early in life and allow even very young infants to engage in active learning. Nevertheless, the symposium will also stress a number of differences with what is known in adults, in particular different temporal dynamics and reduced attentional control in younger populations.

Early Availability of Top-down Sensory Predictions: Neural and Behavioral Evidence

Lauren L. Emberson
Princeton University

Perceptual development has largely been considered as either a bottom-up, experience-driven process or one where maturational constraints, such as biologically-determined critical periods, determine perceptual specialization. I will argue that there is a third route by which perceptual development can occur: Top-down sensory predictions. Top-down sensory prediction is the process by which prediction or anticipation about upcoming stimuli results in modification in perceptual systems. These predictions are top-down because feedback neural connections are necessary for perception to be modified and arise from the influence of higher-level cognitive systems, such as the frontal lobe, on lower-level perceptual systems. Importantly, these top-down processes are distinct from either bottom-up experience or maturational constraints as they arise rapidly (after minutes of exposure) and result in highly flexible, contextually-specific changes in perception. Using

a combination of neural and behavioral data, I will show that infants as young at 6 months show both neural and behavioral modifications of their visual systems after mere minutes of experience. These findings are consistent with an early availability of top-down sensory predictions. Moreover, recent neuroimaging recordings with neonates have suggested that top-down sensory prediction is online in the first days of postnatal life. Overall, these findings suggest that top-down processes are a potentially powerful method by which experience can shape perceptual development and where higher-level cognitive systems can influence the development of lower-level ones. Findings that higher-level systems influence lower-level ones challenges the classic view that development is purely bottom-up with perception developing initially and in isolation from other systems.

Attentional blink in infancy

Jean-Rémy Hochmann[1], Sid Kouider[2]

[1]Institut des sciences cognitives Marc Jeannerod - CNRS; [2]LSCP – Ecole Normale Supérieure – CNRS

The attentional blink (AB) is a phenomenon, in which the second of two target stimuli is not consciously perceived if it appears in a specific time window following the first target stimulus. This phenomenon is well explained by a model, in which higher-level areas are busy processing the first target when the second target is processed by lower-level areas. In adults, an AB is observed when the two targets are separated by about 300 ms. Our aims are to document and AB in young infants and measure its temporal dynamics. We designed an AB task that requires no instruction whatsoever and can be employed with very young infants. In each trial, a series of images were presented in parallel in three locations on the screen: left, middle and right. Most images were masks (scrambled faces). Among those masks, two faces appeared. The first face (T1) appeared in the middle. The second face (T2) appeared either left or right. We measured infants' tendency to gaze in direction to T2. Five-month-olds (but not 8-month-olds) exhibited an AB around 900 ms; i.e., they missed T2 more often when it was presented 900 ms after T1 than when it was presented later (i.e., 2100 ms) or immediately after T1, a phenomenon known in adults as lag-1 sparing. These results suggest that the core structure of attention is already functional at a young age, but that the neural dynamics that are responsible for the AB are about three times slower.

Attentional blink in infants: An electrophysiological and eye tracking study

François Leroy, R. Gulbinaite, L. Parkkonen, M.Palu, A. Jobert, S. Marti, Ghislaine Dehaene-Lambertz

INSERM, Cognitive Neuroimaging Unit U992, Gif-sur-Yvette, France

In a multitask paradigm, we asked whether attentional blink i.e., our failure to attend to a task when actively engaged in another one, is present early in life. While a distracting teddy bear is presented at the center of the screen to 3 to 4 months old infants, a peripheral cue is triggered at various stimulus onset asynchronies (SOA). The cue is a pair of stimuli made of a face and a scrambled face, each appearing either on the left or on the right side of the screen. Screen is flickering at a given frequency. We registered eye movements, event related potentials (ERP) and neural entrainment at the tagged frequency. Trials with cue were compared to control trials without cue at every SOA. We have found an increase in both pupil size and the amplitude of P400 ERP as well as a change in neural entrainment at long soa but not at short soa. Thus, converging evidence from electrophysiological and behavioral measurements strongly suggests a temporal constraint on the order of one second for attending to two consecutive stimuli. Besides, we report that this time window is shorter in the left hemifield. Indeed, change in neural entrainment as well as an increase in performance of saccadic eye movements have been found at intermediate soa, only when faces were presented on the left side of the screen.

Auditory Attention in Early Childhood: Insights from Behavior and Pupil Dilation

Nicole Wetzel[1], A. Widmann[2]

[1]Leibniz Institute for Neurobiology, CBBS Research Group Neurocognitive Development; [2]Institute of Psychology, University of Leipzig, Leibniz Institute for Neurobiology, CBBS Research Group Neurocognitive Development

New sounds occurring outside the current focus of attention can involuntarily capture attention and impair performance in a task at hand. A behavioral and a pupillometry study focused on the development of auditory attention in young children.
The behavioral study investigated attentional distraction in four groups of children aged four, five, six, nine-to-ten years and in adults. Participants performed a visual categorization task and were asked to ignore a sound sequence containing frequent standard and

rare novel sounds (oddball paradigm). Task-irrelevant novel sounds captured attention and impaired performance. This distraction effect substantially decreased from age four to six years and further declined until the age of 10 years. Results characterize the developmental pathway of attention control and the impact of distraction on performance. To investigate attention mechanisms in even younger children, we measured changes in pupil size, that have been discussed to reflect the activity of the Locus Coeruleus-Norepinephrine system (LC-NE system). An oddball sound sequence including standard and four types of distractor sounds with different arousing potential was presented to 14-months-old infants and an adult control group. Distractor sounds evoked a strong pupil dilation response in both age groups. A principal component analysis separated two components. Component scores of the late, presumably sympathetically mediated component, were selectively enhanced in response to highly arousing distractor sounds in the infant group. These results provide new insights in the processing of attention catching stimuli and add a developmental perspective on recent theories emphasizing the role of the LC-NE system in attention processes.

PAPER SESSION 4

SOCIAL CATEGORIES

Saturday, January 11, 10:45-11:45

Chair:

Denis Tatone, Central European University, Hungary

Social Cognition in Context: 15- and 8-Month-Olds' Evaluations of Helpers in Means-End Sequences

Brandon M. Woo[1,2], Elizabeth S. Spelke[1,2]

[1]Department of Psychology, Harvard University, USA;[2]The Center for Brains, Minds, and Machines, McGovern Institute for Brain Research, Massachusetts Institute of Technology, USA

Imagine a bear-puppet struggling to open a transparent box containing a toy. Two helpers open it, and the bear-puppet grasps the toy. Next, as the helpers observe, the toy switches positions with a different toy in a second transparent box. One helper opens the original box; the other opens the second box now containing the original toy. Who is more helpful? Critically, one's evaluation depends on what goal one attributes to the bear-puppet. By 12 months, infants understand multi-step action plans: agents open boxes to access their contents. The present studies investigate whether means-end understanding informs infants' evaluations of the above helpers. Currently, 21/24 fifteen-month-olds and 3/18 eight-month-olds have reached for a helper who opened the box containing the original toy over one who opened the original box with the new toy. (Preregistered data collection will continue to 24 eight-month-olds). This differential evaluation by age is consistent with findings that means-end understanding develops at 12 months.

We are now investigating 15-month-olds' sensitivity to helpers' mental states in the above multi-step action. Procedures are identical to those above, except boxes are opaque and helpers are absent when the toys switch; infants cannot accurately attribute knowledge of the switch to helpers. Currently, 9/11 fifteen-month-olds have reached for the helper who opened the original box; preferences reversed from when boxes were transparent. These preliminary data suggest that infants' evaluations incorporate mental states: Infants only prefer a helper who provides access to the original toy if the helpers had observed the toys switch.

Can infants form a negative stereotype of a novel group based on the antisocial actions of an individual within the group?

Melody Buyukozer Dawkins[1], Olivia Spence[1], Peipei Setoh[2], Renee Baillargeon[1]

[1]University of Illinois at Urbana-Champaign, USA;[2]Nanyang Technological University, Singapore

Several mechanisms have been proposed to explain the acquisition of stereotypes. One such mechanism involves a tendency to draw generalizations about groups when exposed to psychologically highly salient information about a few members of the group. For example, adults generally believe that sharks attack bathers, even though such events are very rare. If this tendency emerges early in life, then even infants might form a negative stereotype about a novel group after observing salient antisocial actions by a member of the group. Our research tested this prediction with 18-month-old infants. Infants watched videos involving individuals in green or pink shirts. A green-group member deliberately destroyed a tower built by the pink group. Next, a member of a blue group fell and was helped by either a new green-group member (harmful-group event) or a new pink-group member (neutral-group event). Infants looked significantly longer if shown the harmful-group event, suggesting that they had formed a negative stereotype of the green group and found it unexpected when someone from that group acted prosocially. This effect was eliminated when the tower's destruction was accidental or when the test videos ended before helpful actions occurred. Thus, even infants can form stereotypes based on salient negative information.

When generic language does not promote essentialism

Nadya Vasilyeva[1], Alison Gopnik[2], Tania Lombrozo[1]

[1]Princeton University, Princeton, USA;[2]University of California Berkeley, Berkeley, USA

Generic language has been argued, on both empirical and theoretical grounds (Gelman, 2010; Rhodes, Leslie, & Tworek, 2012), to promote an essentialized construal of categories, with adverse consequences for reasoning about social groups. However, we argue that generics are compatible with two construals, internalist and structural. For example, "women have trouble getting tenure in math" can attribute the category-property association to the deep category nature; but under a structural construal, it is attributed to stable external constraints affecting category members in virtue of their position in a larger structure. We report a study with 3-8-year-olds and adults testing this claim. Adapting the method from Rhodes et al. (2012), we taught participants about novel social groups using generic

("Zarpies sleep in trees") or non-generic language. Half of the participants in the generic condition also learned about structural constraints acting on category members (e.g., Zarpies live in a land of giants and need to take precautions against getting stepped on). Both generic conditions supported generalization and further use of generics in speech. However, the structural framing largely precluded essentialization of the social category, as measured by explanations of category properties and intuitions about property heritability in a "switched-at-birth" task. In sum, hearing generics does not necessarily prompt essentialized category representations; one way to block essentialist assumptions is to offer structural cues. We discuss methodological, theoretical, and practical implications of these findings, including the use of structural construal to mitigate negative consequences of generic language.

SYMPOSIUM 4

EPISTEMIC UNCERTAINTY: IMPLICIT ENCODING AND INFORMATION SEEKING FROM INFANCY TO PRESCHOOL

Saturday, January 11, 13:15-14:30

Organizers:

Marina Bazhydai, Lancaster University

Discussant:

Paul L. Harris, Harvard Graduate School of Education

Speakers:

Moritz Köster, Freie Universität Berlin

Marina Bazhydai, Lancaster University

Tone K. Hermansen, Norwegian Center of Child Behavioral Development

From infancy, children are sensitive to indices of plausibility, congruency and validity in the information they obtain about the world (Harris, 2012; Stahl & Feigenson, 2019). This symposium will focus on cognitive mechanisms underlying implicit encoding and explicit information seeking following an experience of epistemic uncertainty in early childhood. Epistemic uncertainty takes many forms; it includes the violation of expectation scenarios which span both physical and social domains, such as events that defy the natural laws of physics or false claims provided by previously reliable people, as well as general informational uncertainty, such as counterintuitive or contradicting testimony, lack of valid and timely information, or being asked questions one cannot answer.

Encountering an unexpected or an incongruent event has been shown to elicit distinct neural (e.g., Kouider et al., 2015; Parise & Csibra, 2012; Reid et al., 2009) and behavioural responses (Dunn & Bremner, 2018; Goupil, Romand-Monnier, & Kouider, 2016; Koenig & Echols, 2003; Harris, Bartz, & Rowe, 2017; Stahl & Feigenson, 2017; Walden, Kim, McCoy, & Karrass, 2007). In addition to information seeking through exploration following such events, young children turn to their social partners, assessing their informative potential and tracking the claims they make (Harris & Lane, 2014; Poulin-Dubois, & Brosseau-Liard, 2016), show readiness to learn from best information sources (Begus, Gliga & Southgate, 2016), and actively use communicative cues to obtain information (Begus & Southgate, 2018). As they mature, children are able to utilize a more complex and precise repertoire

of independent and social information-seeking strategies (Harris, Koenig, Corriveau, & Jaswal, 2018).

Here, we aim to discuss children's implicit sensitivity and explicit response to epistemic uncertainty and their active, developmentally available strategies for resolving it in social contexts. The talks comprising the symposium will address the developmental change in these cognitive mechanisms, spanning the age range from 9-month-olds to preschoolers, and showcase methodological advances in eye-tracking, EEG, visual entrainment, physiology, and novel behavioural paradigms.

Talk 1 will focus on implicit encoding of epistemic uncertainty, presenting eye-tracking, neural oscillatory and visual entrainment analyses of 9- to 10-month-old infants' processing of unexpected events, and discuss these data in the light of the predictive processing account.

Talk 2 will demonstrate 11- to 12-month-old infants' communicative, behavioural and physiological responses to false labeling events and their propensity to selectively seek unavailable information from more knowledgeable social partners in situations of referential uncertainty.

Talk 3 will extend the discussion to preschool-aged children's behavioral response to unverified information, their subsequent active information-seeking, and their transfer of inferences regarding the reliability of different information sources.

The discussant will then integrate the presented empirical evidence in light of distinct theoretical views, considering both lean and rich interpretations of the data from predictive coding, Bayesian updating, statistical learning and development of mental representations perspectives.

The symposium will provide a comprehensive account of epistemic uncertainty in early childhood, highlighting a range of methodological approaches and advancing theoretical understanding of cognitive mechanisms of knowledge acquisition from a developmental perspective.

The neural dynamics of processing the unexpected in the infant brain

Moritz Köster[1], Miriam Langeloh[2], Christine Michel[2], Stefanie Hoehl[3]

[1]Freie Universität Berlin;[2]Max Planck Institute for Human Cognitive and Brain Sciences;[3]University of Vienna

Infants form basic expectations about their physical and social environment, indicated by their attention towards events that violate their expectations. Infants processing of unexpected events is particularly interesting from a predictive processing perspective,

since infants have to integrate novel information into existing knowledge and update their internal models. Yet, little is known about the neural processing of unexpected events in the infant brain. Across two studies we looked at the neural dynamics while infants watched a series of violation of expectation events (i.e., a ball falling through a table or a person putting a pretzel to their ear instead of the mouth), versus plausible events. In the first study with 10-month-olds (N = 34) we analyze the specific relevance of the 4Hz theta rhythm for the processing of unexpected events, in the scalp electroencephalogram (EEG), and how it relates to infants' pupillary response. In study 2, we used rhythmic visual brain stimulation in 9-month-olds (N = 38) to elicit oscillations at the theta (4 Hz) and the alpha (6 Hz) rhythm, while presenting events with unexpected or expected outcomes. We found that visually entrained theta oscillations sharply increased for unexpected outcomes, in contrast to expected outcomes, in the EEG. The visually entrained alpha rhythm did not differ between conditions. We will discuss the utility of visual brain stimulation techniques to investigate the functional relevance of neuronal oscillatory dynamics in early development. Furthermore we will discuss the relevance of the infant theta rhythm for learning within a predictive processing theoretical framework.

Preverbal infants' selectively use social referencing in response to referential uncertainty

Marina Bazhydai, Gert Westermann, Eugenio Parise
Lancaster University

Infants exhibit epistemic vigilance in social contexts. In response to epistemic uncertainty, preverbal infants' active communication has been proposed to serve an interrogative function. Among such communicative cues are pointing, social referencing, and babbling. While pointing has been the focus of extensive experimental investigation, little is known about this cognitive function in pre-verbal and pre-pointing infants' social referencing behaviour. Here, we demonstrate infants' active and selective social referencing in response to referential (labeling) uncertainty.
In Experiment 1, 11-month-olds (N = 48) were presented with familiar objects, with caregivers enabling three between-subject conditions: Congruent (caregiver providing a matching label to the object), Incongruent (mismatching label), and No Label. Infants engaged in more social referencing in Incongruent compared to both No label and Congruent condition, with physiological response (heart rate and skin conductance) analyses in progress. In Experiment 2, 12-month-olds (N = 30) were introduced to two adults, an Informant (reliably labeling objects) and a Non-Informant (equally socially engag-

ing, but ignorant about object labels) and asked to locate a novel referent among two novel objects. In such a situation of high referential uncertainty, infants selectively looked at the Informant rather than the Non-Informant, but showed no such preference when no uncertainty was present at other phases of the procedure. These results suggest that preverbal infants generate social looks in situations of epistemic uncertainty to actively and selectively seek information from more knowledgeable others as part of their interrogative communicative toolkit.

Children use counter-evidence to revise and make use of their trust in an informant's claim, both in ongoing and future tasks

Tone K. Hermansen[1], Samuel Ronfard[2], Paul Harris[3], Francisco Pons[4], Imac M. Zambrana[5]

[1]Norwegian Center of Child Behavioral Development;[2]University of Toronto;[3]Harvard Graduate School of Education, Harvard University;[4]University of Oslo, Department of Psychology;[5]University of Oslo, Department of Special Needs Education

When confronted with two conflicting and concurrent claims children are able to judge whom they should trust for information. However, in their everyday lives' children may typically acquire some information at one point in time and then only later receive information that is contrary to this. Across two experiments, we show that when preschoolers (N =220; 34-71 months) are exposed to a claim that conflicts with later empirical evidence, they are able to 1) revise their trust in the informant's claim, 2) make predictions for future tasks, and 3) apply these predictions to new tasks. Children were first presented with either a correct or an incorrect claim about how to activate a music box. They were then given the opportunity to explore and gather information about the music box. When later asked about the music box's function, children previously exposed to an unreliable claim shifted from relying on the informant's testimony to relying on knowledge gained from empirical evidence, whilst children in the reliable condition maintained their trust in the informant's claim (E1, E2). These patterns emerged both when children were asked about the ongoing task (E1), and when making predictions for a future event (E2). Furthermore, children exposed to an unreliable informant continued to disregard the content of the informant's claim in a subsequent, similar task (E2). These findings suggest that preschoolers reassess an informant's misleading claim in light of later empirical evidence, and subsequently transfer their conclusions regarding the validity of that claim to future tasks.

PAPER SESSION 5

SPEECH PERCEPTION

Saturday, January 11, 16:30-17:30

Chair:

Péter Rácz, Central European University, Hungary

Pitch cues boost non-adjacent rule learning in infancy

Anna Martinez-Alvarez[1], Elena Koulaguina[2,3], Ferran Pons[2,3,4], Ruth de Diego-Balaguer[2,3,4,5], Judit Gervain[1]

[1]CNRS-Université Paris Descartes, France;[2]University of Barcelona, Spain;[3]Cognition and Brain Plasticity Unit, Spain;[4]Institute for Brain, Cognition and Behaviour, Spain;[5]ICREA

One crucial mechanism suggested to underlie grammar acquisition is rule learning. Previous repetition-based learning studies (ABB; “mubaba,” “penana”) found increased responses to repetition in temporal and frontal regions in neonates (Gervain et al., 2008). In the absence of repetition-based cues (AxB; “pel wadim rud” “pel loga rud”) learning is only observed after the first year of life (Gómez & Maye, 2005). Recent proposals postulate that infants’ attentional system accounts for this developmental trajectory (de Diego-Balaguer et al., 2016). This study reports four experiments, testing the hypothesis that prosodic cues promote rule learning. Pitch manipulation is used as a proxy of attention capture. We predict that attentional mechanisms will allow young infants to learn the rules. Two behavioural and two functional near-infrared spectroscopy (fNIRS) experiments tested 8-10-month-old infants (n = 83) with AxB sequences (“pedibu”, “pegabu”) or random control (“dibupe”, “bugape”). The stimuli either contained or lacked pitch cues in the dependent (A and B) elements. A Central Fixation Procedure and fNIRS measured rule discrimination at a behavioral and neural level, respectively. Without pitch cues, infants are unable to learn the rules, and a larger activation (oxyHb) is observed in temporal areas but no difference between conditions arises, suggesting that infants’ brain processes the auditory stimuli similarly. When prosodic cues highlight the dependent elements, infants show successful learning behaviourally and a larger activation (oxyHb) for the rule condition in bilateral fronto-temporal areas. These results suggest that infants’ use of prosodic cues present in the input facilitates their learning of rules.

"Poverty of the stimulus" bounds on accounts of phonetic development

Daniel Swingley, Joshua Nouriyelian
University of Pennsylvania, Philadelphia, USA

How does cognitive development happen? Observational studies in the home or lab, characterize real behavior over developmental time, setting targets for explanation. _Learning experiments demonstrate potentially explanatory patterns of cognitive capacities (and relations among them). Such experiments aim for positive results, often opening explanatory options. A third approach, the engineering_ approach, grounds theory another way, often by setting limits on possible explanations. Cognitive capacities revealed in demonstrations and proposed as solutions to learning problems might be enough to account for development—but only if sufficient support appears in the real environment.

Poverty of the stimulus arguments can trim the theoretical space, but they require precise specification of learning environments and outcomes. PoS arguments are familiar in syntax, but their logic also works elsewhere. As a case study, we present a PoS argument in phonetic learning.

Conventionally, infants learn their language's phones via distributional learning over speech-sound tokens. This hypothesis is supported by laboratory demonstrations of infant ability.

However, we and others have suggested that speech doesn't present categories in a distributionally learnable form: they overlap too much. Following earlier work on Spanish, we show here the difficulty of discovering English vowels distributionally in both infant- and adult-directed speech. If conventional distributional learning is impossible, then what? In new analyses, we show how knowing word-forms could guide infants to the structure of English vowels, and we test whether early notions of word meaning are required for explaining phonetic perception. We discuss the implications for early language and for developmental research.

Language experience impacts brain activation for spoken and signed language in infancy: Insights from unimodal and bimodal bilinguals

Evelyne Mercure[1,2,3], Samuel Evans[2,4], Laura Pirazzoli[3,5], Laura Goldberg[2], Harriet Bowden-Howl[2,6], Kimberley Coulson-Thaker[2,7], Indie Beedie[2], Sarah Lloyd-Fox[3,8], Mark H Johnson[3,8], Mairéad MacSweeney[2]

[1]Goldsmiths, University of London;[2]University College London;[3]Birkbeck, University of London;[4]University of Westminster;[5]Boston Children's Hospital;[6]University of Plymouth;[7]University of Hertfordshire;[8]University of Cambridge

Recent neuroimaging studies suggest that monolingual infants activate a left lateralised fronto-temporal brain network in response to spoken language, which is similar to the network involved in processing spoken and signed language in adulthood. However, it is unclear how brain activation to language is influenced by early experience in infancy. To address this question, we present functional near infrared spectroscopy (fNIRS) data from 60 hearing infants (4-to-8 months) with different language experience: 19 monolingual infants exposed to English, 20 unimodal bilingual infants exposed to two spoken languages, and 21 bimodal bilingual infants exposed to English and British Sign Language (BSL) from their deaf mothers. Across all infants, spoken language elicited activation in a bilateral brain network including the inferior frontal and posterior temporal areas, while sign language elicited activation in the right temporo-parietal area. A significant difference in brain lateralisation was observed between groups. Activation in the posterior temporal region was not lateralised in monolinguals and bimodal bilinguals, but right lateralised in response to both language modalities in unimodal bilinguals. This suggests that experience of two spoken languages influences brain activation for sign language when experienced for the first time. Multivariate pattern analyses (MVPA) could classify distributed patterns of activation within the left hemisphere for spoken and signed language in monolinguals (proportion correct = 0.68; $p = 0.039$) but not in unimodal or bimodal bilinguals. These results suggest that bilingual experience in infancy influences brain activation for language, and that unimodal bilingual experience has greater impact on early brain lateralisation than bimodal bilingual experience.

PAPER SESSION 6

REPRESENTING ALTERNATIVES

Saturday, January 11, 17:45-19:05

Chair:

Eszter Szabó, Central European University, Hungary

Preverbal logical reasoning aids infants' social inferences

Nicolò Cesana-Arlotti[1], Ernő Téglás[2], Ágnes Melinda Kovács[2]

[1]Department of Psychological and Brain Sciences, Johns Hopkins University, Baltimore, MD, USA;[2]Cognitive Development Centre, Central European University, Budapest, Hungary

In their first years of life, infants have to acquire an incredible amount of information about the physical and the social world. They have to do so despite the fact that the available data are often scarce or ambiguous. Logical reasoning opens an alternative route to knowledge acquisition, functioning as a source of evidence for further inferences and learning. Here we investigate whether even infants can take advantage of this epistemic function of logic. Specifically, we ask whether 14-month-olds can use the conclusion of a preverbal disjunctive inference for understanding others' actions and goals, before mastering the logical vocabulary of natural language. In our task, infants watched reaching actions directed toward a hidden object whose identity was ambiguous between two alternatives and had to be inferred by elimination. Infants applied disjunctive inference to identify the hidden object and used this information to assess the consistency of the action with previous demonstrations of the agent's goal (Experiments 1 to 3). Moreover, they were able to encode a deductively identified new goal and form expectations about the agent's future actions accordingly (Experiment 4). Thus, infants successfully integrated a logical conclusion with the representation of an agent's action. They efficiently used logical operations not only for evaluating the agent's behavior but also for acquiring new knowledge regarding her goals. These findings suggest that, early in life, preverbal disjunctive inferences have an epistemic function that can support social learning by offering a logical route for knowledge acquisition.

Toddlers hold multiple possibilities in mind simultaneously

Mariel K. Goddu[1], J. Nicholas Sullivan[2], Caren M. Walker[3]

[1]University of California, Berkeley, USA;[2]Stanford University, Palo Alto, CA, USA;[3]University of California, San Diego, USA

The ability to track multiple, distinct possibilities underlies powerful cognitive processes such as future hypothetical thinking and counterfactual reasoning. Previous research suggests that school-aged children struggle to consider multiple, equally likely possibilities: instead, they tend to fixate on a single outcome. By contrast, however, a large literature on early *causal* reasoning demonstrates that even toddlers can track the likelihoods of multiple hypotheses and infer both individual causes and higher-order, relational causes like 'same' and 'different.' Can toddlers simultaneously track multiple, equally probable hypotheses in an ambiguous causal learning task?

In four experiments, adults and 18–30-month-olds observed a sequence of causal evidence that was equally consistent with two hypotheses, each occupying a different level of abstraction (individual vs. relational causation). Experiment 1 established that adults (N=34) had no prior preference for either hypothesis. Experiments 2 (adults, N=61) and 3 (toddlers, N=30) demonstrated that participants learned and applied either of the correct causal hypotheses in a force-choice task. Experiment 4 demonstrated that a new sample of toddlers (N=48) flexibly applied *both* hypotheses in the same experimental session.

Taken together, these results suggest that learners generate more than one potential cause, hold both possibilities in mind, and flexibly apply the appropriate hypothesis to inform their inferences at test. These findings challenge previous suggestions that the ability to consider multiple, equally probable possibilities does not emerge until much later in development, and introduces the idea that the precursors to higher order, evolutionarily advantageous skills like future planning may originate in causal reasoning.

Representing the possible and the impossible

Brian Leahy, Susan Carey

Harvard University

Acting successfully demands that we keep track of what is true, what is not true, and what might be true and might be false. Our cognitive systems have conceptual tools for marking representations merely possible, so that the system can distinguish possible states from

(a) states that are accepted as actual and (b) states that are impossible.
Are these conceptual tools innate or constructed through learning? Recent findings suggest that 36-month-olds, unlike 30-month-olds and great apes, recognize when the world holds multiple possibilities (Redshaw and Suddendorf 2016). However, Redshaw and Suddendorf did not show that participants could tell the difference between the possible and the impossible. We provided this opportunity, and found that few children succeeded before their fourth birthdays. Further followups suggest that 36-month-olds were using simple strategies to succeed on Redshaw and Suddendorf's task. They do not seem to have concepts for marking representations as merely possible.
How do these tools develop? We explored the relationship between children's performance on this task and their ability to answer questions about possibilities and impossibilities. We found that even 36-month-olds were sophisticated in their responses, identifying all possibilities as possible and impossibilities as impossible. But they were unable to take those facts into account when it came time to act. We propose that learning to talk about possibilities provides a workspace that helps children figure out what possibilities are, and how the possible contrasts with what is fully accepted and with the impossible.

Young children consider others' physical constraints to infer their unobserved actions

Sophie Bridgers, Teresa Garcia, Hyowon Gweon
Stanford University, Stanford, USA

Predicting and responding to others' actions requires understanding what others can and cannot do. Do children consider others' physical constraints to infer what actions others' executed and plan their own? Three-year-olds (N=32; pre-registered within-subjects) learned that while they could easily reach inside two boxes—one with a big opening, the other with a small opening—the experimenter could only physically reach into the big-hole box. One of two identical toys was lost in each box; the experimenter withdrew one toy without children seeing from which box and asked for help retrieving the other. Children searched in the small-hole box (69%; $p=0.03$), suggesting they used the experimenter's physical constraints to infer that she retrieved the toy from the big-hole box. Children did not simply prefer the small-hole box; when given a clear reason to approach the big-hole box (the experimenter could reach inside both boxes, different toys were lost, and the experimenter withdrew the toy in the small-hole box), children readily searched in this box (94%; $p<0.001$). An ongoing pre-registered replication manipulates only the experimenter's

physical constraints (she either cannot reach in the big-hole box, or cannot reach in the small-hole box); pilot (N=32) and preliminary (N=14; planned 64) data suggest children flexibly respond to these constraints (76% correct in each condition). Integral to successful joint-action, the ability to reason about what others can and cannot do emerges early, laying the foundation for future successful helping, cooperation, and even competition.

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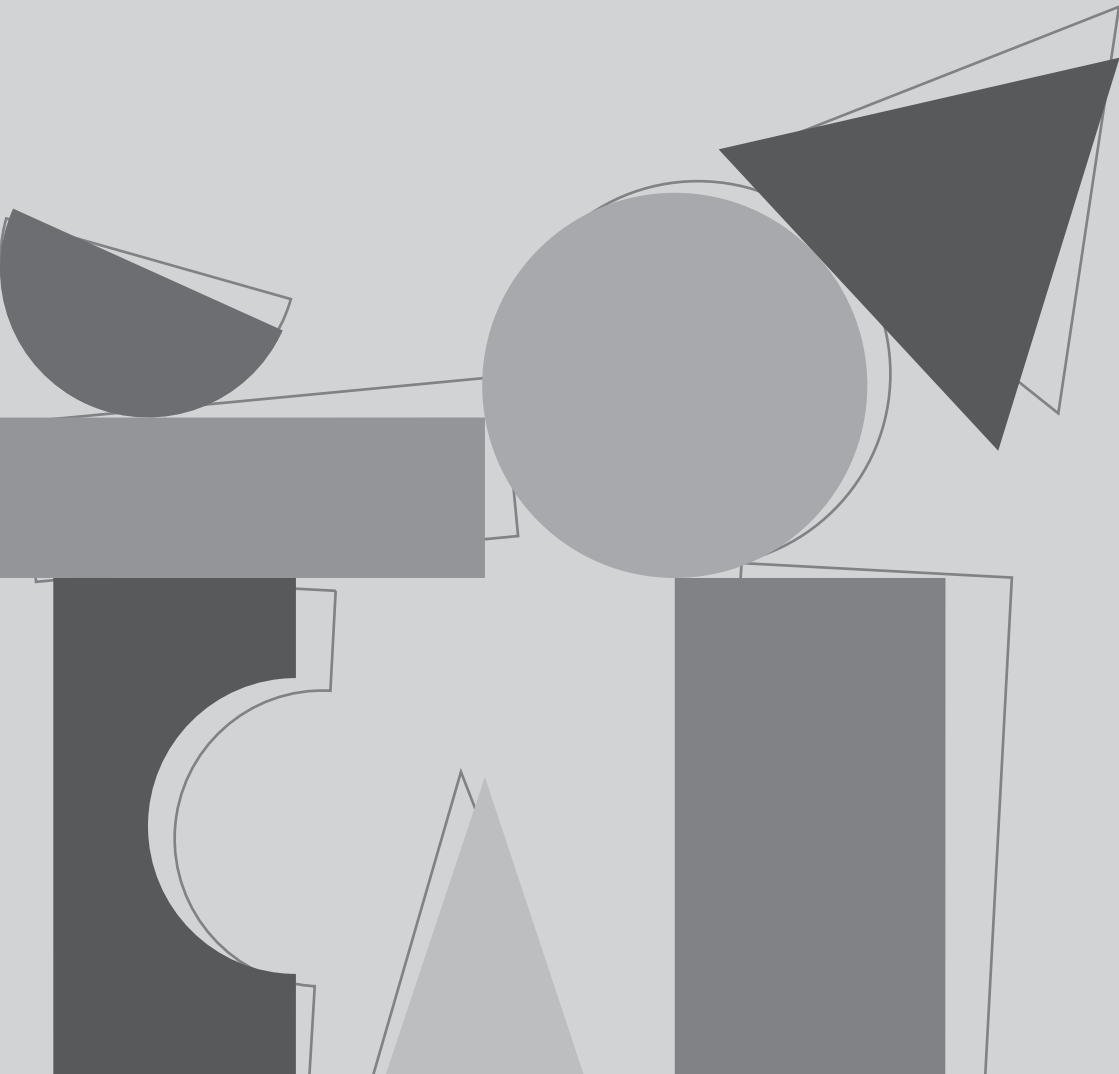

POSTER SESSION A: THURSDAY

PA-001 Maternal Behaviors and Joint Attention Mediate the Link between Maternal Education and Language Development

Sümeyye Koşkulu[1], Aylin C. Küntay[1], Berna A. Uzundağ[2]

[1]Koç University, İstanbul, Turkey; [2]Kadir Has University, İstanbul, Turkey

PA-002 Mother-infant interactions, maternal mental health and infant cognitive outcomes in The Gambia

1 Bosiljka Milosavljevic,[2] Maria Magdalena Crespo-Llado,[3] Laura Bozicevic,[4] Christine Bartram,[5] Catherine Southard,[6] Dr Sarah Lloyd-Fox,[7] The BRIGHT Team

[1]Birkbeck, University of London; [2]Birkbeck, University of London; [3]University of Liverpool; [4]University of Warwick; [5]Birkbeck, University of London; [6]Cambridge University

PA-003 Toddlers and great apes connect through shared experiences, but only toddlers connect through social engagement during shared experiences.

Wouter Wolf, Michael Tomasello

Duke University, Durham, North Carolina, USA

PA-004 The effect of source claims on statement believability and speaker accountability

Johannes Mahr[1,2], Gergely Csibra[2,3]

[1]Department of Psychology and Department of Philosophy, Harvard University, Cambridge MA, USA; [2]Cognitive Development Center, Department of Cognitive Science, Central European University, Budapest, Hungary; [3]Department of Psychological Sciences, Birkbeck, University of London, United Kingdom

PA-005 Dynamic modulation of frontal theta power predicts cognitive ability in infancy: a pre-registered analysis

Eleanor K. Braithwaite[1,2], Emily J.H. Jones[1], Mark Johnson[1],3, Karla Holmboe[4]

[1]Centre for Brain and Cognitive Development, Birkbeck College, University of London; [2]University College London; [3]Department of Psychology, University of Cambridge; [4]Department of Experimental Psychology, University of Oxford

PA-006 What will I feel? Anticipatory Neural Responses in Infants, Children & Adults

Staci Meredith Weiss[1], Guannan Shen[2], Peter Marshall[1], Andrew Meltzoff[3]

[1]Temple University, Philadelphia, PA; [2]Children's Hospital of Philadelphia, Philadelphia, PA; [3]University of Washington, Seattle, WA

PA-007 The early emergence of belief justification in young children

Ildikó Király[1], Réka Schvajda[2], Mikołaj Hernik[3], Dan Sperber[4], Krisztina Andrási[2,5], György Gergely[6]
[1]MTA-ELTE Lendület Social Minds Research Group; [2]Institute of Psychology, ELTE Eötvös Loránd University, Budapest, Hungary; [3]UiT The Arctic University of Norway; [4]Social Mind Center, Central European University, Budapest, Hungary; [5]Doctoral School of Psychology, ELTE Eötvös Loránd University, Budapest, Hungary; [6]Cognitive Development Center, Central European University, Budapest, Hungary

PA-008 Influence of caregiver's visual exploration on infant's cognitive outcome in India and UK

Prerna Aneja, Samuel H. Forbes, John P. Spencer
University of East Anglia

PA-009 Metacognitive monitoring among native and non-native speaking children. A longitudinal study.

Florian Bühler, Mariëtte van Loon, Natalie Bayard, Martina Steiner, Claudia Roebers
University of Bern, Switzerland

PA-010 Preschool children's evaluations of the fairness of their own requests.

Owen Waddington[1], Robert Hepach[2], Iain Jackson[1], Bahar Köymen[1]
[1]University of Manchester, UK; [2]University of Leipzig, Germany

PA-011 Many roads lead to Rome – Problem solving and response inhibition during toddlerhood

Sarah Eickmeyer[1], Tilman Reinelt[1], Birgit Mathes[1], Sabina Pauen[2], Franz Petermann[1], Claudia Zierul[1]
[1]Universität Bremen, Center for Clinical Psychology and Rehabilitation, Bremen, Germany; [2]Universität Heidelberg, Heidelberg, Germany

PA-012 Novel reflective reasoning tasks for age 4 transition

Bartuğ Çelik, Jedediah WP Allen
Bilkent University, Ankara, Turkey

PA-013 Effects of comparison and distinctiveness in preschoolers' categorization

Yannick Lagarrigue, Luc Augier, Jean-Pierre Thibaut
LEAD CNRS UMR5022, Université Bourgogne Franche-Comté (UBFC), Dijon, France

PA-014 Not a lack of abstraction, but rather just distraction: Spontaneous success on a classic relational reasoning task in four-year-olds when shape/color information is removed

Ivan Kroupin

Harvard University

PA-015 Social interaction targets enhance 13-month-old's visual learning

Maleen Thiele[1], Robert Hepach[1], Christine Michel[2], Gustaf Gredebäck[3], Daniel Haun[1,4]

[1]Leipzig Research Center for Early Child Development, Leipzig University; [2]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig; [3]Uppsala Child and Baby Lab, Uppsala University; [4]Max Planck Institute for Evolutionary Anthropology, Leipzig

PA-016 Young children can integrate tool efficiency information in false belief reasoning

Paula Fischer, Ágnes Melinda Kovács, Ernő Téglás

Central European University, Budapest

PA-017 Three-year-olds think you can see round corners

Martin J Doherty, Charlotte Liddle

University of East Anglia

PA-018 The Effects of a Multimodal Music Training Program on Children's Working Memory: Results of an RCT

Jennifer Bugos, Darlene DeMarie

University of South Florida, Tampa, FL, USA

PA-019 Predictability of contingently exchanged signals can indicate agency for preverbal infants

Tibor Tauzin, György Gergely

Central European University, Budapest, Hungary

PA-020 Pragmatic inference across domains

Jessica Sullivan, Blair Goldstein

Skidmore College, USA

PA-021 Can humanoid robots be informative partners like humans?: An eye-tracking study on infants' gaze understanding

Federico Manzi[1,2], Mitsuhiko Ishikawa[3], Shoji Itakura[4], Takayuki Kanda[5],6, Hiroshi Ishiguro[6,7], Cinzia Di Dio[1,2], Davide Massaro[1,2], Antonella Marchetti[1,2]

[1]Research Unit on Theory of Mind, Department of Psychology, Università Cattolica del Sacro Cuore, Milan, Italy; [2]Human-Robot Laboratory, Università Cattolica del Sacro Cuore, Milan, Italy; [3]Department of Psychology, Graduate School of Letters, Kyoto University, Kyoto, Japan; [4]Centre for Baby Science, Doshisha University, Kyoto, Japan; [5]Human-Robot Interaction Laboratory, Graduate School of Informatics, Kyoto university, Kyoto, Japan; [6]Advanced Telecommunications Research Institute International, Hiroshi Ishiguro Laboratories and Intelligent Robotics and Communication Laboratories, Kyoto, Japan; [7]Department of Adaptive Machine System, Osaka University, Toyonaka, Japan

PA-022 Heart rate increase partly explains contextual modulation of infant gaze following

Mitsuhiko Ishikawa[1], Atsushi Senju[2], Masaharu Kato[3], Shoji Itakura[3]

[1]Kyoto University, Japan; [2]Centre for Brain and Cognitive Development, Birkbeck, University of London, UK; [3]Center for Baby Science, Doshisha University, Japan

PA-023 Do children show referential pact sensitivity? A systematic review

Nera Bozin, Erika Nurmsoo

University of Kent, United Kingdom

PA-024 Do ostensive cues have more impact on infants' gaze following than attentional cues?

Yuko Okumura[1], Yasuhiro Kanakogi[2], Tessei Kobayashi[1], Shoji Itakura[3]

[1]NTT Communication Science Laboratories, Kyoto, Japan; [2]Otemon Gakuin University, Osaka, Japan; [3]Doshisha University, Kyoto, Japan

PA-025 To Teach Better, Learn First

Oana Stanciu[1], Mate Lengyel[1,2], Jozsef Fiser[1]

[1]CEU, Hungary; [2]University of Cambridge, UK

PA-026 Action familiarity and action efficiency modulate goal emulation in 18-month-old infants

Chi-Tai Huang, Wei-Ping Wang

Chengchi University, Taipei, Taiwan

PA-027 Does cooperation promote re-identification in 13-months old infants?

Liza Vorobyova, Ernő Téglás, György Gergely

Central European University, Budapest, Hungary

PA-028 Observing inefficient action can induce visual preferences in 4-month-old infants

Masahiro Hirai[1], Yasuhiro Kanakogi[2], Ayaka Ikeda[1,3]

[1]Jichi Medical University, Japan; [2]Otemon Gakuin University, Japan; [3]Senshu University, Japan

PA-029 Play nice! Investigating infants' understanding and expectations of cost-minimising and -maximising behaviour in third-party joint actions.

Katarina Begus[1],2, James Strachan[1], Gyorgy Gergely[1], Guenther Knoblich[1]

[1]Central European University, Budapest, Hungary; [2]Rutgers University, Newark, New Jersey

PA-030 Links between agents and order in 12-month-old infants

Eszter Körtvélyesi, Ernő Téglás

Central European University, Budapest, Hungary

PA-031 What are you looking at? Examining means and outcome focus in an eye-tracking task

Lea Moersdorf, Alexandra M. Freund, Moritz M. Daum

Department of Psychology, University of Zurich, Switzerland

PA-032 Do young children ascribe false belief or ignorance in an interactive change-of-location task?

Lisa Wenzel[1], Pamela Barone[2,3], Marina Proft[1], Hannes Rakoczy[1]

[1]Department of Cognitive Development, University of Göttingen, Göttingen, Germany; [2]Department of Psychology, University of the Balearic Islands, Palma, Spain; [3]Human Evolution and Cognition Group (EvoCog), UIB, IFISC, Associated Unit to CSIC, Palma, Spain

PA-033 The influence of group membership on false-belief attribution in preschool children

Sarah Witt[1], Sabine Seehagen[2], Norbert Zmyj[1]

[1]TU Dortmund University, Germany; [2]Ruhr-Universität Bochum, Germany

PA-034 Newborn infants discriminate speech registers

Gábor P. Háden[1], Katalin Mády[2], Miklós Török[3], István Winkler[1]

[1]Research Centre for Natural Sciences, Budapest, Hungary; [2]Research Institute for Linguistics, Budapest, Hungary; [3]Honvédkórház, Budapest, Hungary

PA-035 Infants interpret requests for objects in terms of kinds rather than tokens

Otávio Mattos[1], Cristina I. Galusca[2],3, Dorottya Meszegeto[1], Iulia Savoş[1], Zsuzsanna Karap[1], Marianna Nagy[1], Patricia Ganea[4], Gergely Csibra[1]

[1]Cognitive Development Center, Central European University, Budapest, Hungary; [2]CNRS – Institut des Sciences Cognitives Marc Jeannerod – UMR 5304, Lyon, France; [3]Center for Brain and Cognition, Universitat Pompeu Fabra, Barcelona, Spain; [4]University of Toronto, Toronto, Canada

PA-036 More than a form: The role of morphology in preschooler's categorization and word learning

Niveen Omar, Karen Banai, Bracha Nir

University of Haifa, Haifa, Israel

PA-037 Fifteen-month-olds can productively combine two newly learned functions of a tool

Barbara Pomiechowska, Erno Teglas, Agnes-Melinda Kovacs

Central European University, Budapest, Hungary

PA-038 Meta-representation and complex syntax in children with ASD and TD

Kristen Schroeder[1], Stephanie Durrleman[2], Wolfram Hinzen[1,3,4]

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PA-039 The speech expression of fear in early childhood

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PA-040 The effects of relational language on children's spatial cognition

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PA-041 Kindergarteners Actively Use Implicitly Acquired Category Knowledge

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PA-042 Conceptual understanding of quadrangles in four- to six-year-olds

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PA-043 Measuring sensitivity to social and non-social information across the visual field

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PA-044 Infant gross motor rhythmic synchronisation and relationships with language

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PA-045 Keeping the beat – Rhythmic synchronization and its relation to language and reading acquisition

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PA-046 The Magical Book: Pretend Play and Language Competence Relation Through a New Pretense Task

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PA-047 Do Young Children React Selectively to the Emotional Distress of Others?

Diane Austry, Zanna Clay

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PA-048 The social N400 effect: when semantic processing enters social cognition

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PA-049 Effects of 'We'-framing on Children's Commitment, Sharing, and Helping

Jared Vasil, Michael Tomasello

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PA-050 Should I stay or should I go? Three-year-olds' sensitivity to appropriate motives to break a commitment

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PA-051 Infants represent tolerated taking as a cue of communal sharing relations

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PA-052 Metaphor comprehension and intention attribution

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PA-053 Intent-based morality in a non-WEIRD sample

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PA-054 From equality to equity: The roles of ability and effort in distributive justice decisions of children

Naziye Güneş Acar, Gaye Soley
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PA-055 Children's trust in individuals who speak in a familiar regional accent and those who speak in the standard accent used on TV

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PA-056 Children manage their reputation with regard to gossip

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PA-057 Children's early understanding of moral consistency in using decision rules.

Hannah Hok, Alex Shaw
University of Chicago

PA-058 Children consider mental states for lying

Mareike Heinrich, Ulf Liszkowski
University of Hamburg, Hamburg, Germany

PA-059 Infants represent 'like-kin' affiliation

Ashley J. Thomas[1,2], Rebecca Saxe[2], Elizabeth Spelke[1]
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PA-060 Adolescent welfare tradeoff psychology: More valued friends and more despised enemies

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PA-001 Maternal Behaviors and Joint Attention Mediate the Link between Maternal Education and Language Development

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Time spent in joint attention (JA), i.e. shared attention between a person and a social partner on an object or event, is positively associated with infants' language development (Carpenter et al., 1998). Factors that might affect the initiation, frequency, duration, and termination of JA episodes in infant-caregiver dyads have been understudied. This study investigates whether maternal education and maternal positive (e.g., responsiveness) and negative (e.g., intrusiveness) behaviors affect JA episodes in mother-infant dyads and in turn affect infants' language development. Fifty mother-infant dyads (12 months) were videotaped during 5-minute free play. JA features (frequency, total/average duration, initiated by maternal follow-in/directing, terminated by mother/infant) and maternal behaviors (sensitivity, positive/negative affect, cognitive stimulation, control) were coded. Infants' receptive and expressive vocabulary were measured at 14 months with the Turkish CDI (Aksu-Koç et al., 2007).

More controlling mothers initiated JAs more frequently by directing rather than following their infants' attention (r=.39). Mothers with higher sensitivity (r=.63), cognitive stimulation (r=.54) and positive affect (r=.52) scores had longer JAs with their infants. More sensitive mothers terminated JA episodes less frequently (r=-.44). A serial mediation analysis showed that mothers with lower education were more controlling and initiated JA by directing rather than following their infants' attention more frequently, which resulted in lower productive vocabulary scores for infants (ß=.58, SE=.37, 95% CI=[.12,1.73]).

In sum, (1) maternal behaviors were related to the quality of JA episodes and (2) maternal behaviors and JA characteristics mediated the relationship between maternal education and infants' productive vocabulary.

PA-002 Mother-infant interactions, maternal mental health and infant cognitive outcomes in The Gambia

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One third of children in developing countries fail to reach their developmental milestones, with the largest number in sub-Saharan Africa. Parent-infant interactions are posited to contribute to infant cognitive outcomes, yet within this region, caregiving styles are relatively poorly understood. The Brain Imaging for Global Health (BRIGHT) project is delivering longitudinal measures of brain and cognitive development from 0-24 months in Gambian and UK infants. Further, we are investigating

the impact of environmental factors, including caregiving practices, maternal mental health, lower income and educational level, and poorer family health and nutrition on infant development. Here we examine characteristics of early mother-infant interactions during a naturalistic interaction, when infants are 1-month of age in The Gambia (N=102) and the UK (N=54). Mothers in The Gambia showed lower levels of sensitivity, higher levels of remoteness and more depressive symptoms than mothers in the UK (all ps<.001). Additionally, within the Gambian sample, we examined the association between maternal interactive characteristics at 1-month and mental health during pregnancy, as well as associations with infant cognitive and motor development at 12-months. Remoteness and depressive symptoms were associated with maternal self-reported antenatal depressive symptoms (rs range from .28 to .24). Additionally, maternal sensitivity was associated with infant gross motor skills at 12-months (r(69)=.29, p=.02). Future work will assess how parent infant interactions develop as infants grow older and how these may relate to population specific and poverty associated factors.

PA-003 Toddlers and great apes connect through shared experiences, but only toddlers connect through social engagement during shared experiences.

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Humans connect with one another through social activities, many of which are based on creating shared experiences. Adult research shows that even simply watching a video together causes participants to feel closer to each other. Yet it remains unknown how fundamentally human this form of social bonding is. Our first comparative studies show that both children and great apes behave more socially (i.e. approach faster/spend more time together) towards an interaction partner after having watched a video together than in a control condition. This is surprising, as many have argued that sharing experiences is a uniquely human phenomenon. However, the question remains how similar human and ape shared experiences are. In particular, one component of sharing that seems prototypically human is the active sharing of experiences through social engagement (e.g. through looking, gesturing, and language). In a subsequent comparative study we found that toddlers, but not apes behaved more socially to an experimenter after that experimenter had socially engaged them (i.e. established common ground about watching the video together) with a look at the beginning of the video than when the experimenter did not look at them at the beginning of the video, but instead looked at them later in the procedure. Together these studies suggest that (1) the psychology underlying connecting with others through co-experiencing something (i.e. inferring that you are experiencing the same thing) might have much deeper evolutionary roots than previously thought, but that (2) the capacity to share experiences through social engagement might be uniquely human.

PA-004 The effect of source claims on statement believability and speaker accountability

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How do claims about the evidential basis of assertions affect the believability of these assertions? Intuitively, source claims affect the believability of statements such that claims to more direct forms of evidence (e.g. perception) increase believability and forms of indirect evidence (e.g. testimony) ceteris paribus reduce believability. However, it remains unclear why source claims should influence the believability of assertions in this way. On one account, speakers claiming to have direct evidence thereby commit more strongly to the truth of their assertion and therefore make themselves more accountable compared to speakers claiming indirect forms of evidence. In two, vignette-based experiments with adult participants we tested (1) how different source claims (seen vs. told vs. no source) modulate the perceived believability of a statement in comparison to its prior likelihood and (2) how these source claims, in turn, modulate the perceived accountability of the speaker for the truth of the assertion. Results demonstrate that (1) direct forms of evidence increase both believability and accountability, (2) indirect forms of evidence decrease both believability and accountability, and (3) a statement increases in believability compared to its prior likelihood merely by being asserted. Additional analyses will test whether source claims have a direct, independent causal influence on both believability and accountability. It has sometimes been found that young children prioritize second-hand over first-hand information in belief formation. This might suggest that children are either less sensitive to a speaker's modulation of commitment through source claims or compute this commitment differently than adults.

PA-005 Dynamic modulation of frontal theta power predicts cognitive ability in infancy: a pre-registered analysis

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Cognitive ability is a key factor that contributes to individual differences in life trajectories. Identifying early neural indicators of cognitive ability may enable us to better elucidate the mechanisms that shape individual differences, eventually aiding identification of infants with an elevated likelihood of less optimal outcomes. Individual differences in the neural states accompanying focused attention may provide one route. Indeed, one study found a link between a measure of neural activity (theta

EEG) at 12-months and nonverbal cognitive ability at ages two, three and seven in infants with older siblings with autism (Jones et al., under review). In a pre-registered study (https://osf.io/v5xrw/), we replicate and extend this finding in a younger, low-risk infant sample. EEG was recorded during presentation of a non-social video to a cohort of 6-month-old infants and behavioural data was collected at 6 and 9 months. Initial analyses replicated the finding that frontal theta power increases over the course of video viewing, extending this to 6-month-olds. Further, individual differences in the magnitude of this change significantly predicted non-verbal cognitive ability at 9 months, but not early executive function. EEG theta change 6 months may therefore be an early indicator of later cognitive ability. This could have important implications for identification of and interventions for children at risk of poor cognitive outcomes.

PA-006 What will I feel? Anticipatory Neural Responses in Infants, Children & Adults

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The ability to predict events is seen as central to cognition and goal-directed behavior (Csibara, 2007; Clark, 2015; Pezzulo, 2012; Vernon, 2014). Anticipation is understood as the preparation of the bodily senses for upcoming events in the environment, evident in the behavioral and neural activities observed in expectation of an upcoming target stimulus (Ondobaka & Bekkering, 2007; Allen & Friston, 2016). To interrogate the relevance of sensory anticipation to goal-directed behavior, we measured preparatory changes in electrographic (EEG) responses ahead of tactile stimuli, delivered to the right or left hand as indicated by spatial visual and auditory cues. We recruited a cross-sectional sample of 160 participants aged 6 months to 25 years, directing adults and children to report how many tactile stimuli they perceived. Alpha-range responses at central electrode sites (C3, C4, Cz) were examined in the 1s window prior to onset of tactile stimulation. Mu modulation of shorter duration and greater magnitude was hypothesized to reflect narrower, more precise window of event prediction, facilitating goal-directed action (Van Ede et al., 2014). In a sample of 30 infants with usable data, we found mu desynchronization in 6 month-olds to be less consistent and spatially-specific compared to 13-month olds. Children aged 6-8 (n=50) exhibited an earlier onset of mu desynchronization compared to adults (n=50). Children and adults with shorter durations of anticipatory response had more rapid reaction times in response to tactile stimuli. Implications of these findings are discussed for theoretical and computational models of cognitive development and bodily awareness.

PA-007 The early emergence of belief justification in young children

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In our study, we plan to test whether children adjust their communicative actions in a false belief situation in order to justify their behaviour, when the task at hand allows them to take into account the desires of another person. Two age-groups are tested: 18- and 42-to-48-month-olds. During the procedure, the child and an experimenter (E) sit behind two containers with snacks (apples and carrots), which are occluded from the protagonist (P). P states which food she prefers, E shares a piece with her and P leaves the room. In P's absence E eats some snacks, which results in only one piece remaining: either from P's preferred or un-preferred kind. Upon returning, P requests a snack, and in case the child gives one, she prompts them to justify their behaviour. We record whether the participant shares any food with P, as well as participant's communicative behaviour. Our predictions are that older children will provide the preferred food, but in case there remains only a piece from the non-preferred kind, they will be more likely to decline giving one to P, and to demonstrate the absence of the favoured kind in order to justify their behaviour. However, toddlers will give a snack regardless of whether it is favoured or not. But they will nonverbally validate their behaviour by revealing the preferred food's empty container more frequently, than that of the non-preferred food.

PA-008 Influence of caregiver's visual exploration on infant's cognitive outcome in India and UK

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Research on visual cognition has noted the importance of measuring individual differences in lab-based task and is predictive of academic achievement. How these lab-based measures relate to the development of visual cognition outside the laboratory is an open question. We present data from an ongoing study of dyadic interactions between caregiver-infants in Low and relatively High SES samples from India, and UK. Ten-minute naturalistic play sessions with 60 caregiver-infant dyads (six-month-olds) from each group were recorded. Distribution of attention was measured via head-mounted eye-trackers. Preliminary analyses include caregivers mean fixation duration, fixation switch rate, and dispersion of fixation on normalised X and Y positions (N=68). Low SES groups often held all the toys together, centrally, placed in a way that's between their

face and the infant's, presumably to keep the child entertained. Importantly, caregivers from Low SES Indian sample showed longer fixations; suggesting slow visual information processing. Regardless of the group, caregiver's performance in naturalistic task correlated with infant's cognitive performance in the laboratory. There was a negative correlation between caregiver's switch rate and infant's mean look duration ($r = -0.24$, $p = 0.04$) suggesting that the lower the visual information processing in parents, the lower it also is for their infants. Previous research shows that infants tend to learn more when their caregivers follow and hold their gaze at a location. Additionally, we discuss how these data fit with prior ethnographic research indicating that caregiver-infant interactions embody cultural goals and values reflective of differing cultural values related to child development.

PA-009 Metacognitive monitoring among native and non-native speaking children. A longitudinal study.

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The educational literature suggests that native speaking students outperform non-native students in terms of their academic achievement. Furthermore, academic achievement is often linked to an individual's ability to metacognitively monitor performance accurately. Moreover, metacognitive monitoring skills are typically represented and assessed verbally ("how sure are you that you answered this question correctly?"). Hence, we compared performance and monitoring in a sample of native and non-native speaking fourth graders, longitudinally. We examined 44 native German speaking children (age at T1: M = 10.14 years) and 44 non-native German speaking children (age at T1: M = 10.15 years) from Public schools in the German-speaking part of Switzerland. We assessed the children three times within one year. We used a paired-associate task with a recognition test and assessed metacognition with prospective (Judgments of Learning) and retrospective (Confidence Judgments) monitoring measures. We confirmed the literature in that native-speaking students outperformed non-native students in the recognition task. However, counter expectations we did not find any differences in monitoring between native and non-native speakers. Both groups were relatively well able to metacognitive discriminate between correct and incorrect recognition. While recognition increased over time, metacognition did not, independent of native language. Results are discussed with respect to metacognitive processes being responsible or not for the differences in performance in native and non-native elementary school children.

PA-010 Preschool children's evaluations of the fairness of their own requests.

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Young children are remarkably prosocial and help others in myriad ways (Tomasello, 2016). Around age 3 however, children's prosocial acts start becoming more selective. For instance, they avoid helping those whose distress is unjustified or an overreaction to a minor inconvenience (Hepach et al., 2013). Nonetheless, whether preschool children apply this selective prosociality to themselves – when they are the ones asking for help – remains little explored. In the present study, 3- and 5-year-old children (N = 67) were made to request various stickers from an adult experimenter in order to complete a task. We manipulated whether 1) the child (the requester) needed the requested item, and 2) whether the experimenter (the requestee) needed the requested item. We investigated whether children display any emotion, such as guilt, measured through changes in upper-body posture (e.g., shrinking in posture) as well as other behavioural measures including displays of hesitation (e.g., checking with the other experimenter in the room) and the delay in executing the request. Data collection is ongoing, but preliminary results suggest that when the request is unjustified (i.e., the child does not need the sticker but the experimenter does), children display greater degrees of guilt and reluctance compared to when the request is justified (i.e., the child needs the sticker and the experimenter does not). The results will have implications for how, starting at age 3, preschool children consider the perspective of their social partners, self-regulate their social actions, and express "guilt" when they act unfairly.

PA-011 Many roads lead to Rome – Problem solving and response inhibition during toddlerhood

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As one of the basic executive functions, response inhibition (RI) specifies the suspension of dominant actions. This is essential for anticipating and solving complex problems. The Detour Reaching Task (DRT) has been proven to be a fruitful method to assess RI in early childhood. In this task, children are supposed to retrieve a toy from an acrylic glass box with only one side being open. When the open side of the box is turned away from the children, they have to restrain from reaching straight on for the toy. The current pilot study, as part of the Bremer Initiative to Foster Early Childhood Development (BRISE), is investigating children's RI as well as their strategies to solve the DRT. We analyzed data of 28 children with a mean age of 17 months. Preliminary results show that almost all children were able to solve the task, yet they differed in the way they tackled the problem. All children used more than one strategy to get to the toy, like looking at all sides of the box (96 %), touching the left

and ride side of the box simultaneously (79 %), trying to move the box (57 %), pulling the box closer (50 %), or trying to disassemble the box (39 %). Furthermore, we found that no child could restrain from reaching straight on for the toy in at least one trial (M = 3 out of 9 trials), even though it has seen before, that this side was not open.

PA-012 Novel reflective reasoning tasks for age 4 transition

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It has been suggested that age 4 transitions in social and cognitive domains result from a domain-general development called "reflection" (Allen & Bickhard, 2018). The empirical basis for this claim was an object-reasoning task called Leaning blocks (LB). The LB task was claimed to be a relatively pure measure of reflection because it involves reasoning about a novel situation with minimal Executive Functioning (EF) demands. However, the relation between LB and EF tasks has not been empirically tested. In the current study, 3- to 5-years-olds (N=71) participated on EF tasks, LB, and a newly invented reflection task, Candy Monster (CM). In the LB task children were asked what would happen if two blocks held opposite of each other on inclines were released. In the CM task three candies of different colors were put into a transparent tube that was horizontal. Then children were asked which of the candies would a monster eat first, second, and third after rotating the tube 180 degrees from the monsters position. Both LB and CM tasks showed an age-4 transition such that 3-years-olds differed from 4- and 5-year-olds but 4- and 5-years-olds did not differ from each other. After controlling for children's age, cognitive flexibility, working memory, and inhibition, LB task performance was correlated with the CM task. We conclude that LB is a relatively pure measure of reflection and that the new CM task might be also a good measure of reflection. Further, reflection is something different than EF.

PA-013 Effects of comparison and distinctiveness in preschoolers' categorization

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Our main objective is to design presentation formats that promote children's discovery of conceptually relevant dimensions among a set of examples. Our central hypothesis is that understanding of conceptual content is facilitated when children compare multiple stimuli illustrating the category rather than a single stimulus.
In Experiment 1, we tested the role of feature saliency (high vs. low) in comparison paradigms, involving either same-class and/or different-class comparisons. Four hundred 3-to-6-year-old children were tested on a word-extension task in which three factors were manipulated: type of comparison

(same-class/different-class), stimuli distinctiveness (high/low) and age (3-4 years old/5-6 years old). Significant interactions of Comparison with Age and with Distinctiveness suggest that the benefits of same-class comparison were more pronounced for older children than for younger children, and in the high rather than in the low distinctiveness condition.

In Experiment 2, we wondered if the ability to categorize along a low saliency dimension (texture) would be influenced by prior training. Eighty children were first trained either with high or low distinctiveness stimuli (i.e., Trainings) from the first experiment and thereafter tested with low distinctive stimuli. Significant effect of Trainings suggests that presenting stimuli with high distinctive features positively influenced the discovery of the low distinctiveness version of the same dimension (texture). Our findings contribute to the understanding of how comparison can affect children's categorization and generalization to novel and less distinctive situations.

PA-014 Not a lack of abstraction, but rather just distraction: Spontaneous success on a classic relational reasoning task in four-year-olds when shape/color information is removed

Ivan Kroupin

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Relational-Match-to-Sample (RMTS) is a classic relational reasoning task. Each trial is composed of three pairs of geometric figures-one sample pair and two choice pairs. The figures-pairs are either identical or different and the correct choice pair has the same relationship between figures (identical/different) as the sample pair. Children under five years persistently fail the classic version of RMTS (Hochmann et al., 2017). Such failures have been interpreted as an inability to represent/reason with relations (Penn et al., 2008).

Four-year-olds focus on the shape and color of objects when matching (Chen & Mazzocco, 2017). Thus, though no figures across pairs in RMTS are identical on shape/color, children may be inferring that partial matches on shape/color (e.g. 'shapes here and here are pointy') are correct. If the problem of RMTS is children are able to match on relations, but likely to infer (partial) shape/color matches as correct, simply removing the possibility for partial shape/color matches in RMTS should produce success.

Data collection is ongoing, however, in a modified RMTS task where partial shape/color matches are impossible (but is otherwise identical), four-year-olds successfully, spontaneously deploy relational reasoning (77% correct), where they otherwise fail to (41% correct in control). This result has implications for accounts of what underpins successful relational reasoning: Not only must we specify representational resources required, but also inferential processes required to identify when relational reasoning is relevant. How these inferential processes differ/change across populations/development is a focus of future research.

PA-015 Social interaction targets enhance 13-month-old's visual learning

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Infants preferentially attend to people engaging in social interaction with one another. Given its importance for early observational learning processes, it is conceivable that this preference for social interactions is accompanied by an increased readiness to learn—in a similar way as attention-grabbing human actions increase infants' responsiveness to referential social cues in first-person interactions. In testing this assumption, we investigated 13- to 14.5-month-old infants' visual learning performance in an associative learning task (N = 32). During 24 trials, two different non-social cues (geometrical shapes) were repeatedly paired with two kinds of target videos: two adults interacting with one another, or the same agents acting individually (non-interactive control). We found faster saccadic latencies toward the cued target region during social interaction trials (M = 1107.35 ms, SD = 331.68) compared to non-interactive control trials (M = 1284.79 ms, SD = 198.04, $\chi 2(1) = 9.57$, p = .002, estimate = -172.57, SE = 52.48). Moreover, the number of anticipatory eye-movements was significantly greater in social interaction trials (mean proportion = .45, SD = .35) compared to control trials (mean proportion = .17, SD = .20; $\chi 2(1) = 8.78$, p = .003, estimate = 1.90, SE = .62). Our findings suggest that infants' visual learning performance is enhanced when having the opportunity to watch social interactions between other people. We discuss this pattern as an adaptive mechanism to maximize the learning benefit from observing others' interactions.

PA-016 Young children can integrate tool efficiency information in false belief reasoning

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Studies involving simple belief-tracking scenarios (e.g. relating to the presence or absence of objects) suggest that young children compute another person's belief, for instance, to predict someone's actions. Yet, it is unclear, whether the representational apparatus responsible for the early developing belief tracking capacity can grasp contents with different complexity, for instance beliefs about relational contents, e.g., tool efficiency.
We tested this question in 3-, 4- and 5-year-olds. Children were first familiarized with inefficient and efficient tools operated by a character, such that different tools had different causal contributions in obtaining a reward (long, but not short sticks led to successful outcomes). After the character placed a short and long stick in two boxes, respectively, we used two different false-belief scenarios. In one we aimed to eliminate a possible reality bias, and in the absence of the character, we broke the long

stick so it became like the short one and put it back into the box. In the other, more complex scenario, we broke a piece from the long stick so that it became short, and attached the broken part to the other short stick in the other box (which now became more efficient), unbeknownst to the character. Results (N=72) suggest that 5-year-olds predicted the character's behaviour based on his false belief in the complex task, whereas 3-4-year olds passed only the simplified task. These data, together with data from on-going controls indicate that young children, similarly to adults, could integrate various information in false-belief reasoning.

PA-017 Three-year-olds think you can see round corners

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Do preschool children understand that, when looking along a wall, one cannot see around a corner or an equally extensive curve? For 3-year-olds, the answer is 'no', even when given feedback. We used scale models of 14cm high walls. Each wall had a corner with a 60 or 90 degree angle, or an equivalently occluding curve. Three- to 5-year-old children (N=78) viewed the models from the side, and were asked whether they or a doll looked through a doorway at the start of the wall, they could see an object around the curve/corner. Three-year-olds incorrectly judged they could for both corners (43% correct) and curves (18% correct).
After being allowed to look through the doorway and asked about similar scale models (identical except for colour), improvements were modest (57% and 32% correct for corners and curves). Four- and 5-year-old performance was better, although 4-year-olds were still only 30% correct on the pre-feedback curves, rising to 68% correct after feedback.
Performance was compared with judgements of eye gaze (Doherty et al. 2009) and false belief understanding (Wimmer & Perner, 1983) controlling for chronological age. Gaze judgement was significantly associated with pre-feedback performance on the corners/curves task. False belief understanding was associated with both pre-and-post-feedback performance, most strongly for curves. We conclude that the concept of line-of-sight reflects a more sophisticated understanding of vision arising with metacognitive developments around age four years.

PA-018 The Effects of a Multimodal Music Training Program on Children's Working Memory: Results of an RCT

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In the United States, music training programs for young children typically focus on vocal skills or instruction with one specific instrument. We hypothesized a multimodal music program that integrated vocal development, bimanual coordination, and creative improvisation, would enhance

executive functions in 4- to 6-year-old children. A multimodal music program may engage children with shortened attention spans in a group setting, thus transferring to within domain skills (e.g., pitch accuracy), and over cognition (e.g., executive functions). The purpose of this study was to assess the impact of a 10-week multimodal music training program in a randomized controlled design. Eighty-four children were randomly assigned to a multimodal music training program, active control Lego training program, or no treatment control condition. All participants completed standardized measures of music achievement and executive functions (i.e., EF Touch) pre- and post-training. Results revealed enhanced pitch accuracy and working memory for children in the music training as compared to the active and no treatment control conditions. Children enrolled in the Lego active control condition demonstrated significant enhancements in spatial working memory. Contributions to the literature include the randomized controlled design, the group multimodal music program appropriate for 4-6 year-old children, and executive function measures sensitive to individual differences. Future research should include these key elements when evaluating the impact of arts-based interventions on children's cognitive development.

PA-019 Predictability of contingently exchanged signals can indicate agency for preverbal infants

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The contingent exchange of variable sound sequences between unfamiliar entities can lead infants to attribute agency, therefore, when such an agent exhibits a turning action to be in line with one of two lateral objects, infants produce an orientation-following gaze response to look at the same referent. We investigated whether 10-month-olds are also sensitive to the predictability of contingently exchanged signal sequences when ascribing agency to interacting entities. Our results supported the hypothesis that agency attribution and subsequent orientation-following gaze responses can only be induced, when the predictability of signal sequences is medium-high not too low or perfect. The non-linear relation between the perceived amount of predictability in exchanged signals and agency attribution suggests that preverbal infants expect the reactions of an agent to be partially predictable from the preceding action of its partner, since the potential of communicative information transfer must rely on co-dependence and cooperation to be effective.

PA-020 Pragmatic inference across domains

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Pragmatic inferences allow us to use our understanding of communicative intentions to go beyond the literal meaning of a symbol to the intended meaning (Grice, 1975). Although there is substantial

research on the role of pragmatics in language interpretation, it is unclear whether inferences about non-linguistic symbols (e.g., drawings) are structured similarly to those about language. Here, I ask: are the inferences about the intended meaning of symbols (in general) guided by pragmatics? To test this, participants saw three fish (yellow, blue, red) and heard a request for one of them. Critically, the request always appeared -- at its surface -- to be irrelevant: in one condition, the puppet verbally requested the "black fish", while in another the puppet drew a picture of a black fish. Importantly, children attended to the options that the puppet had when communicating, and used this to constrain their inferences about the puppet's utterances. When the puppet only had access to a red, blue, and black marker, children successfully interpreted the request for "black" as being for the yellow fish (N = 139, p<.0001): the idea here is if the puppet had wanted the red or blue fish, they coudl have (and should have) used the red or blue marker. Performance was comparable to when children heard verbal requests for the "black fish" (N = 134, p<.0001). These data suggest that children can compute pragmatic inferences about seemingly irrelevant utterances, and that the processes supporting these inferences are similar in language and in drawing.

PA-021 Can humanoid robots be informative partners like humans?: An eye-tracking study on infants' gaze understanding

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Human's understanding of referential gaze emerges at an early stage of development (Brooks and Metlzoff, 2005), underlining its crucial role in social interactions (Csibra and Gergely, 2006). Within psychological research, robots have been implemented with human-like gaze so as to be perceived as social partners (Admoni & Scassellati, 2017; Marchetti et al., 2018). Okumura and colleagues (2013) compared the infants' understanding of the referential nature of human gaze to robot gaze and found that infants held referential expectations specifically from humans. Following from this work, the present study aimed at analysing the referential nature of human gaze and robot gaze in 16-months-old infants (N=32) by exploring the effect of gaze expectations from both agents. Infants watched videos of a human or robot dropping a cup from a table with the hand. The preliminary results of a repeated measures GLM analysis, with Eye-Contact (present, absent), Looking-at-Object (Congruent or Incongruent with respect to the action) and AOIs (Face, Hand, Target) as within-subjects factors

and Agency (Human, Robot) as the between-subjects factor, showed infants' faster focus on the target when the human is acting ($p<.005$). This result suggests that infants prefer the human agent as informative partner as compared to the robot. Additionally, infants looked at the target faster during the human gaze congruent condition with respect to the human gaze incongruent condition ($p<.005$). The specific role of human as an informative partner with respect to the robot is in line with the previous results found in Okumura and colleagues (2013).

PA-022 Heart rate increase partly explains contextual modulation of infant gaze following

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It has been suggested that infant gaze following manifests as an adaptive response to adult's communicative intent conveyed by ostensive signals. According to natural pedagogy theory, ostensive cues facilitate infants' learning from communication. However, there is a critique of the natural pedagogy theory claiming that other's trustworthiness should be considered in context of infant social learning (Nakao & Andrews, 2014). In this study, we examined how other's reliability and ostensive cues influence infant gaze following. We also measured infant heart rate (HR) during gaze following events, which in our previous study predicted frequency of gaze following behaviour. Forty-one 6-9-months-old infants participated in this study. In the training phase, infants repeatedly observed either a reliable face, which always gazed to the location of a peripheral object, or an unreliable face, which always gazed away from the location of a peripheral object. After that, infants watched a video of the same model made eye contact (EC) or not showing any ostensive cues, before shifting her gaze towards one of two objects in the scene. As a result, infant gaze following was more frequent when the model was a reliable person, or when the model made EC prior to referential gaze. We also found that the reliability and EC independently led to an elevation in the HRs. Increases in HR, in turn, predicted gaze following regardless of reliability or EC. The results suggest that contextual modulation of infant gaze following, either by reliability or ostensive cues, could be partly mediated by physiological arousal.

PA-023 Do children show referential pact sensitivity? A systematic review

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Research with adults has shown that in conversation, interlocutors use referential pacts (Brennan & Clark, 1996). This means that interlocutors jointly agree on how to conceptualise a referent, reuse previously used expressions within a conversation, and expect their conversational partners to do

the same. Although the empirical work with adults consistently shows that adults show referential pact sensitivity (e.g. Metzing & Brennan, 2004), research with children has not been so clear. There is very little empirical work on referential pacts in children. Three studies found that 3- to 6-year-olds show this linguistic effect; children reuse previously used expressions and expect their partners to do the same (Graham, Sedivy, & Khu, 2014; Koymen, Schmerse, Lieven, & Tomasello, 2014; Matthews, Lieven, & Tomasello, 2010). In contrast, recent studies found that children do not show referential pact sensitivity (e.g. Ostashchenko, Deliens, Geelhand de Merxem, Bertels, & Kissine, 2018; Ostashchenko, Geelhand, Deliens, & Kissine, 2019). To synthesise the commonalities in these apparently conflicting findings, our review presents a comprehensive picture of children's referential pact sensitivity via a systematic review, which includes unpublished findings collated via developmental mailing list requests. We evaluate the factors found to be critical for adult participants, such as context (Ibarra & Tanenhaus, 2016) and the role of interaction (Brown-Schmidt, 2009) and discuss the extent to which these factors should be included in developmental designs. We attempt to explain divergent results in terms of methodology and use this to create guidelines for future studies.

PA-024 Do ostensive cues have more impact on infants' gaze following than attentional cues?

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According to natural pedagogy theory, infants are sensitive to ostensive cues that indicate others' communicative intent (Csibra & Gergely 2009). While infants follow the gaze direction of others in the presence of ostensive cues (Senju & Csibra, 2008), other research indicates that infants' gaze-following behavior occurs even in the presence of attention-grabbing cues regardless of the communicative intent (Gredebäck et al., 2018). However, since the previous studies only focused on gaze-following behaviors, it failed to discriminate whether ostensive and attentional cues affect infant learning at different levels. To detect the different effects of cues, we conducted a test by discriminating gaze-following behavior from referential learning about a target object (object processing and object preference). We tested 9-month-olds' behaviors under three conditions (N = 60) that varied the actor's actions before gazing at one of two objects. The Ostensive condition provided infant-directed speech cues, the Attentional condition provided shivering cues, and the No cues condition did not provide additional cues. Our results demonstrated that although both ostensive and attentional cues elicited the same amount of visual orientation to the actor's face and affected infants' gaze-following, only ostensive cues facilitated their object learning: Infants showed enhanced processing of, and preferences for, the target object gazed at by the actor with ostensive cues but not with attentional cues. Our findings suggest that ostensive cues play a more distinctive role than attentional cues for infant learning, confirming that learning based on ostensive cues assists infants to effectively acquire information from others.

PA-025 To Teach Better, Learn First

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While the relative merits of active exploration and pedagogical instruction have been at the centre of the developmental literature, there has been limited recognition of their extensive conceptual similarities. The current study aims to bridge the gap by showing that engaging in active learning can influence subsequent teaching performance. In a one-dimensional boundary teaching task, participants who first took the role of an active learner went on to become better teachers than participants who did not. In order to disentangle the effect of active selection of samples from their information content, the performance of active learners was compared to that of yoked passive learners. While prior passive learning also significantly boosted teaching performance, it did so to a lesser extent. However, in paired comparisons, teachers with active learning experience did not differ significantly from their yoked-passive learning counterparts. Based on the current results we cannot argue for a teaching benefit specific to active learning as opposed to a more general improvement caused by experiencing the task from the learner's perspective. However, we propose a more complex task to better capture the effect of interest and show promising preliminary results.

PA-026 Action familiarity and action efficiency modulate goal emulation in 18-month-old infants

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Infants tend to simplify others' act to ensure that the goal of the act is copied. This tendency for goal emulation implements the assumption of efficient action. The present research investigates whether familiarity with actions and understanding of efficient action constrain the priority of goal over action in imitation. We modified the Carpenter, Call, and Tomasello (2005) task. Eighteen-month-old infants (N = 72) saw an adult hop or slide a toy animal into one of two boxes. In the direct-path/efficient condition, the adult took the shortest route between the toy and the box. In the turning-path/inefficient condition, the adult took an unfamiliar path by moving the toy along the midline and turning to the goal when it was in between two boxes. In the turning-path/efficient condition, a T-shaped matt was used to provide the adult's reason for taking the turning route. Infants were overall likely to ignore the adult's action style, and ready to put the toy into the box. However, they matched the adult's choice more than chance only in the direct-path/efficient condition ($M = .64$, $SD = .25$, $p = .01$). There was a borderline effect ($p = .056$) in the turning-path/efficient condition ($M = .61$, $SD = .28$), and no effect in the turning-path/inefficient condition ($M = .57$, $SD = .30$, $p = .24$). While there is some evidence that they benefit from task constraints to justify the efficiency of the unfamiliar approach, goal emulation is most likely when both familiarity and efficiency cues are available.

PA-027 Does cooperation promote re-identification in 13-months old infants?

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Joint activities, like cooperation, provide a benefit to the involved individuals. Cooperation, however, provides not only immediate advantages, but also lasting fitness benefit of long-term cooperative relationships if there is a mechanism available allowing to track the identity of the cooperators. In order to test whether infants posses such mechanism, we carried out three studies. The first tests our hypothesis that infants are able to track the identity of cooperative partners. Infants were presented with the animations depicting a cooperative chase scenario. At the end of the test trials one of the chasers was either exchanged for a different agent or stayed the same. Two further studies were performed to control for the possibility that the results of the Study 1 are due to the fact that at this age infants are already able to individuate agents even without cooperative element (Study 2), or that it is the chase pattern that helps infants to re-identify agents and not the cooperation itself (Study 3). Sixty 13-months old infants were tested. Looking time analysis showed that infants in the cooperative condition looked longer if the agent behind the occluder was different from the original, while in Studies 2 and 3 looking times were similar in both outcomes suggesting that the infants did not detect the change. These results suggest that cooperative pattern boosts infants' ability to track the identity of agents involved in such interactions.

PA-028 Observing inefficient action can induce visual preferences in 4-month-old infants

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According to existing theories, infants acquire new flexible skills and belief systems that are built upon core foundations, known as core knowledge. These consist of separate systems for basic knowledge, such as objects, agents, numbers, and geometry. A recent seminal study demonstrated that a violation of physical knowledge in the object system could induce infant learning. However, it is unknown whether other domains of core knowledge, such as an agent system associated with knowledge of agent actions, can also induce infants' preferences. The current study focused on action efficiency and investigated how the violation of action efficiency can induce infant learning. To this end, we first investigated the visual preference for the violation of action efficiency in 4-month-old infants. Across four experiments (N =96), we found that 4-month-old infants preferred inefficient action to efficient action. The subsequent experiments confirmed that the preference for inefficient action was not due to differences in action trajectory. Notably, inefficient actions were preferred only when the actor was facing the infant. These findings suggest that infant preference was invoked by a violation of action knowledge, located within the agent system of core knowledge.

For the next phase, we are now collecting the data regarding infant learning induced by observing a violation of action efficiency.

PA-029 Play nice! Investigating infants' understanding and expectations of cost-minimising and -maximising behaviour in third-party joint actions.

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Infants are sensitive to costs of observed actions, and expect agents to maximise their utility by minimising costs in pursuit of rewards (Gergely & Csibra, 2003; Jara-Ettinger et al., 2016). In sequential joint actions, where an actor's decisions affect the difficulty of their partner's upcoming action, adults compute not only the costs of their own actions but also the combined cost of both agents, and work to maximise their joint utility (Torok et al, 2019). We examine whether infants likewise consider the joint utility of sequential actions of multiple agents and whether they form expectations about agents' subsequent interactions based on these computations. 16-month-olds observe dyadic interactions between computer-generated agents engaging in sequential foraging actions. In each interaction, two rewards are available and one of the agents is enabled to move and collect a reward first, followed by the second agent collecting the remaining reward. The two rewards are arranged so that they are equidistant from the agent that moves first, but placed 1 near and 1 far with respect to the second agent. We examine whether infants discriminate between agents who minimise the cost of their partner by collecting the reward that is more distant to the second agent (and thereby also maximising their joint utility) and agents who do the opposite. We investigate this by testing infants' expectations about whether the second agent will reciprocate the cost minimising/maximising actions in a subsequent interaction with the same agent. Eyetracking and looking time data collection with 16-month-old infants is ongoing.

PA-030 Links between agents and order in 12-month-old infants

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For adults and children the presence of an ordered array is diagnostic of the presence of intentional design. Past research has shown that infants have a similar approach: they expect that hands create order (Newman et al., 2010) but not mechanical objects (Ma and Xu, 2013). In case of unfamiliar agents, however, infants seem to have no specific expectations regarding the ordering propensity of the character (Newman et al., 2010). In our experiments using a violation of expectation paradigm we explored the role of two agency-defining factors in forming these expectations: the efficiency of the agent and the presence of eyes. We crossed these factors in a between-subject design by testing four groups of 12-month-old infants. For our participants the actions of an unfamiliar agent that had eyes

and efficiently navigated through a maze to achieve a goal was compatible with the creation of order. Infants looked longer when they experienced the opposite. The subsequent experiments revealed that i.) the presence of eyes was the main cue that triggered ordering expectations, while ii) in the absence of the efficiency cues infants did not interpret the agent's subsequent actions as relevant for ordering. These results reveal the richness of infants' expectations about order and the role of multiple agency cues in this process.

PA-031 What are you looking at? Examining means and outcome focus in an eye-tracking task

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Goals are often defined as cognitive representations of means-outcome-associations and seen as guides of our behavior throughout life. The distinction of means and outcomes has a long tradition in developmental research. During adulthood, the relative salience of means and outcomes (i.e., goal focus) changes with age. But already infants and toddlers are sensitive to different means that can bring about an outcome. To date, it is unclear how goal focus develops across the entire lifespan, including childhood, and whether the shift in goal focus in adulthood also applies to simple actions. To provide a first answer to these questions, we conducted a lab-based study with participants between 3 and 83 years. Here, we focus on an eye-tracking task, to test whether the participants look preferentially at images depicting the means or outcome of simple actions depending on their age (N = 254). The participants saw three images depicting the means of a simple action (e.g., the crafting of a paper plane) and three depicting the outcome (e.g. the finished paper plane from different perspectives), for 20 seconds per trial. Overall looking times indicate no relation between age and goal focus (b = -.05, SE = 0.06, p = .47). Here, we explore whether there are age-related differences in the trajectories of looking at the means vs. outcome within the 20 second trials. To this end, we will visualize these trajectories for different age groups and apply growth curve analysis to examine potential age-related effects.

PA-032 Do young children ascribe false belief or ignorance in an interactive change-of-location task?

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The standard false belief task (FBT), which children master at the age of four, has been the litmus test of theory of mind competence (Wellman, Cross, & Watson, 2001). Recently, several studies

questioned this traditional picture showing that infants understand another person's belief-based behavior through their spontaneous responses (Baillargeon & Scott, 2010). However, issues of replicability and validity of these tasks remain (Powell et al., 2018). In the present study, we tested 33- to 39-month-olds aiming at disentangling conflicting theoretical approaches that can explain young children's success in spontaneous-response FBTs: belief vs. ignorance ascription accounts. In our task, participants had to anticipate the agent's behavior in order to help her reach an object and had to consider whether she held a true belief (TB) about the final location of her object, a false belief (FB), or was ignorant (IG) about its location. Each child participated in all three conditions. We measured their interactive anticipatory behavior, the certainty of their actions (latencies and frequencies of changes), and their anticipatory looking. Children's interactive performance was at chance level in FB condition and differed from TB and IG conditions in which they predominantly chose the full box. We found no differences in latency durations, but children changed their choice more often in IG than in TB condition. Anticipatory looking revealed no differences between conditions. Results suggest that children use different strategies for solving FB, TB and IG scenarios but more research will settle whether this differentiated understanding is best characterized as belief understanding.

PA-033 The influence of group membership on false-belief attribution in preschool children

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Social relationships are manifold and complex. To find their way within social networks, children form social categories almost automatically (Kalish, 2012) and consider people to belong to certain social groups based on gender (Miller, Trautner, & Ruble, 2006), race (Kowalski & Lo, 2001), age (French, 1987), and language (Kinzler, Shutts, & Correll, 2010). The ability to infer beliefs and thoughts in interaction partners is essential in social life. However, reasoning about what other people believe might depend on their characteristics or our relationship with them. Recent studies indicated that children's false-belief attribution was influenced by a protagonist's age and competence (Seehagen, Dreier, & Zmyj, 2018; Zmyj & Seehagen, 2018). In the current experiments we investigated whether social group membership influences the way children reason about another person's beliefs. Children's positive evaluation of ingroup members may let them overestimate the ingroup member's knowledgeability. Therefore we hypothesized that 4-year-olds would be less likely to attribute false beliefs to a member of their own group (ingroup protagonist) than to a member of a different group (outgroup protagonist). In the first experiment, accent was used to define group membership. In the second experiment, we considered group membership in terms of gender. The results revealed that group membership, indicated by a protagonist's accent or gender did not influence false-belief attribution in preschool children. Future research should further clarify why some characteristics of a protagonist influence children's false-belief attribution while others do not.

PA-034 Newborn infants discriminate speech registers

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Infant directed speech (IDS) may help infants to learn to talk and can probably facilitate communication between children and adults, especially in pedagogic situations. Furthermore, the function of IDS also seems to change during the first year of life providing phonetic, syntactic and ostensive cues to the infant. For very young infants to utilize IDS in acquiring language it should be discriminable from adult directed speech (ADS). We recorded EEG from 98 newborn infants in response to Hungarian words naturally spoken in the IDS and the ADS register to test whether the ability to discriminate these two speech registers is functional already at birth. Words presented in the ADS and IDS register elicited event related responses differing in both latency and morphology. The results support the hypothesis that newborn infants process speech register in natural speech.

PA-035 Infants interpret requests for objects in terms of kinds rather than tokens

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We investigated whether infants interpret ambiguous object requests as being about kinds of objects (e.g., a doll) rather than particular tokens (e.g., a specific doll). We adapted the paradigm of Tomasello and Haberl (2003), who found that infants resolved ambiguous requests by considering what was novel to the speaker. Thirteen-month-old and two-year-old infants (n = 48 per age group) participated in an object requesting game. The infant and an experimenter (the Requester) played together with a toy, and when the Requester left the room, a second toy was introduced by another experimenter. This toy was either of the same kind or of a different kind (between subjects). Upon returning, the Requester expressed excitement at the sight of the toys: “Wow, that’s so neat! Can you give it to me?”. We measured the proportion of trials in which the new object was given to her. We found that 13-month-olds tended to give the novel object only when they had to choose from different kinds of objects. While 2-year-olds performed better, they still did not seem to interpret the ambiguous request to be about a particular token when the objects belonged to the same kind. In addition, infants in both age groups tended to offer both objects to the Requester in the same-kind condition. Overall, our results suggest that referential requests are interpreted in terms of object kinds in the first two years of life.

PA-036 More than a form: The role of morphology in preschooler's categorization and word learning

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Developmental studies have shown that word-forms affect the formation of categories they encode by blurring the boundaries between exemplars (Waxman & Markow, 1995; Johanson & Papafragou, 2016). These studies focused on entire word labels. However, few investigations focused on the impact of other formal levels on forming novel categories in preschool age. Here we explore sub-lexical forms and ask (1) whether Semitic-like morphological patterns affect the learning of novel superordinate categories they encode and the exemplars (the words) they underlie; and (2) whether this effect stems from perceptual and attentional factors related to phonological similarities. Seventy-two native Hebrew-speaking preschoolers participated in two experiments. In each experiment, novel pseudo-words (names of moving-cartoon-characters) were based on Semitic intedigited morphological structure. In experiment 1, words that share syllabic patterns encoding superordinate meanings (manners-of-motion) were presented in a Morphological condition. Words that share only the superordinate meanings were presented in a Conceptual condition. In experiment 2, words that are phonologically similar (i.e., sharing syllabic patterns that do not encode any meaning) were presented in a Phonological condition. Words that differed in both form and meaning were presented in a No-Similarity condition. Word-learning was tested and compared between the two conditions of each experiment. Results revealed that while sub-lexical forms that encode meaning impeded word-learning, syllabic patterns that lack meaning facilitated it. We suggest that the associations between morphological forms and their meanings influence their effect on word-learning in children, and that the mechanisms underlying this effect are beyond phonological similarities created by syllabic patterns.

PA-037 Fifteen-month-olds can productively combine two newly learned functions of a tool

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The rich representational and computational capacity characterizing human cognition is rooted in our ability to flexibly combine concepts and computations. However, the developmental origins of combinatorial operations remain poorly understood. In two looking-time experiments, we investigated whether 15-month-olds are able to learn two distinct functions of a tool and then combine their outcomes. To this aim, we used a tool that transformed objects. The tool had two functions (i.e., it changed the kind of the object that went inside, or duplicated it) that were linked to two manipulanda and distinct actions activating them. In Experiment 1, we familiarized infants (n = 16) with the two functions, one

at a time, and tested whether they would be surprised by the action-outcome swap. Indeed, infants looked longer when the outcome of the manipulation did not match the performed action than when it did, suggesting that they learned both functions they were familiarized with. In Experiment 2, following a familiarization with individual manipulations and their outcomes (as in Experiment 1), at test both manipulations were performed simultaneously. Infants looked longer when the outcome was consistent with a single operation (e.g., duplication) than when it represented an addition of both (e.g., duplication and kind change), suggesting that they mentally combined the outcomes of observed operations. Together our results indicate not only that 15-month-olds represent multifunctional tools and readily learn up to two functions at a time, but also they productively combine their outcomes.

PA-038 Meta-representation and complex syntax in children with ASD and TD

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Recent evidence supports the emergence, at around 4-5 years of age, of meta-representational cognitive capacities involved in reasoning both about false-beliefs (FB) and about the same objects under different descriptions ("intensionality"). Further evidence from children both with typical development (TD) and with autism spectrum conditions (ASC) supports a strong relation between the development of FB reasoning and embedded clause understanding. This suggests a potential common cognitive substrate between intensionality, FB, and embedded clauses. The present study sought to explore this through a sentence-picture matching task in an ASC group (mean age 9;4) matched to a TD group (mean age 9;1) on both chronological and verbal mental age (VMA). Participants were assessed on FB, intensionality and embedded clause performance (including relative clauses and two complement clause tasks, 'Sees that', and 'Sees/seems that', the latter manipulating appearance-reality distinctions.) Results showed that the ASC groups performed significantly lower than matched TDs in the FB task and in the complement clause tasks ($p \geq .008$, one-tailed). Within-group analyses showed that among children with ASC, there were no significant differences between performance on FB, intensionality or complement clauses, unlike in the TD group for whom significant differences were partially identified. Correlational analysis suggested that intensionality, complement clauses (in particular sees/seems) and FB all correlated with each other as well as with VMA, in the ASC group only. These findings suggest a relation between certain meta-representational cognitive capacities and the maturation of the syntax of complementation among children with ASC.

PA-039 The speech expression of fear in early childhood

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We have investigated means of expression of the emotional state of fear in typically developing Russian children, using the longitudinal children's speech recordings (14 children aged from 9 months to 3.5 years) provided by Children's Speech Data Foundation.

The fear is considered as an emotional situation schematically consisting of: «a cause» of a certain condition; a «the condition itself»; «a reaction» following this state.

The statements about individual emotions arise since 1.0-1.1 years. The most significant component was the «cause». Special emotional vocabulary was seen in 1.9-2.0 years, these are verbs (to fear), adjectives (horrible) and nouns (horror). The number of the components of the emotional situation in the utterances expressing speakers' own fear starts increasing (>2) at the age of 2.2-2.5. When children talk about themselves, the statement is structured so that the «cause» precedes the «condition» or «reaction». The description of state of the other person started from 2.3-2.5, focused on reactions and the number of components increased from 2.6-2.7 years. In the phrase structure «condition» usually precedes the «reaction».

Thus, we can conclude that verbalization of the emotion of fear develops accordingly to the formation of the "theory of mind". Expressing individual emotions, a child focuses on the subject of the emotional state. Describing the emotions of other's, the emphasis shifts to the situation in which this state can be experienced.

PA-040 The effects of relational language on children's spatial cognition

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Relational understanding is key to higher-order human cognition and is at the core of various cognitive processes (Gentner, 2003). Relational language (e.g., verbs and prepositions) that encodes relations between concepts and events expresses and supports relational representations (Gentner, 2016). Studies investigating this link have typically used the relational-matching-to-sample task (RMTS) as a measure of relational cognition. In this task, children are presented a standard card with two geometric shapes on it and have to indicate which of the two choice cards is similar to the standard one. Others use a spatial representation task such as children's mental transformation task (CMTT), in which children need to transform objects in mind to match the pieces to the whole object. This study asks whether RMTS (a general relational understanding) or relational language is a better predictor for preschool age children's mental transformation abilities.

Fifty-eight children (Mage=52.67 months) were administered RMTS and CMTT tasks. To test relational language, we used a playhouse and asked children to describe the location of the toy baby (production part), and to put the toy baby to the target locations indicated by the experimenter (comprehension part). We used hierarchical regression analyses to test two models, controlling for age, general language ability, and inhibition ability. In these models, both RMTS performance and preposition production (R^2 =.44, F(5,52)=8.25, p<.001) and RMTS performance and preposition comprehension predicted CMTT performance (R^2 =.45, F(5,52)=8.35, p<.001). These results suggest that both relational understanding and relational language abilities predict children's spatial task abilities.

PA-041 Kindergarteners Actively Use Implicitly Acquired Category Knowledge

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Dual models argue for separate systems behind category learning: an implicit and a verbal learning process. Because of the late maturation of the frontal lobe, the implicit system dominates at kindergartener's age, so they should acquire information-integration tasks easily. In our previous study using an information-integration task 19 children age of 4-5 participated in a four-session training in four consecutive weeks where they got familiar with 8-8 far-from-prototype exemplars (32 in total) of 2 categories according to a complex family resemblance structure. In test phase they had to create an exemplar of each category with features given to them. Our goal was to confirm the previous findings indicating children's ability to both make abstractions and remember specific exemplars, the later effect being the stronger. We used the same method with the only difference being in the specific features that build the categories to avoid possible biases caused by children's preferences for feature correlations or accidental resemblance to real-life cartoon characters or toy figurines. Our new findings confirm the previous results. The put-together exemplars' type-distribution is similar to the distribution from the previous study which is significantly different from random distribution. The two experiments' results show strong evidence for presence of both exemplar memory and abstraction in kindergarten age children. Some features (eyes and front limbs) are more salient than others but their salience does not influence abstraction.

PA-042 Conceptual understanding of quadrangles in four- to six-year-olds

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In the field of early mathematical education, there are only a few empirical findings on the conceptual understanding of two-dimensional figures, especially on the quadrangle, e.g. that the orientation

of the individually presented quadrangles plays an important role in the identification of the form in four- to six-year-old children. However in previous studies, the variation of the quadrangles is not sufficiently systematic and comprehensive and the different representatives and non-representatives are rarely all presented together. There is also a lack of knowledge about the children's reasons for their decisions. Therefore, the aim of this explorative study is to identify the properties to which children age four- to six-years-old (N=60) refer to when they identify quadrangles by systematically varying the quadrangles. In three conditions, the children are presented with various representatives and non-representatives of the quadrangle in individual interviews and asked for their identification as a quadrangle (yes/no answer). The geometric figures will be presented both individually and grouped with other representatives and non-representatives of the quadrangle. The children's reasoning for their decisions is then recorded. The assumption is, that it is easier for children to make correct identification decisions if they can simultaneously see other figures as reference values. The aim of the study is to replicate and extend previous findings. For early childhood educational research, the results could mean that it will be possible to adapt didactic methods in such a way that children are better supported in their development so that misconceptions can be prevented.

PA-043 Measuring sensitivity to social and non-social information across the visual field

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Human infants are highly sensitive to social information in their environment at very early stages of development. Thus far, the neuroscience underlying information processing has been primarily studied using simplified images presented centrally on computer displays. Although we rely heavily on central vision for everyday tasks, a large amount of visual information is actually delivered to the peripheral field, extending to over 90° in eccentricity in adults. This is the first study to examine infants' sensitivities to low- and high-level visual information beyond parafoveal areas. It aims to investigate: (1) how far into the periphery can infants see and (2) whether low- and high-level visual content affects visual field sensitivities. In Experiment 1, 19 9-month-old infants (Exp. 1a) and 20 control adults (Exp. 1b) were presented with Gabor patches with spatial frequency 0.5cpd at different peripheral locations up to 60° in eccentricity. In Experiment 2, 9-month-olds were presented with a similar paradigm using faces, that were band-passed filtered at 0.5cpd (same as the Gabor patches). We measured head/gaze orientation to peripheral targets in infants and key press responses in adults. Although adults (Exp.1b) could accurately locate the targets across all eccentricities, infants' detection rate (Exp.1a) differed significantly across eccentricities, dropping below chance level for targets presented beyond 50° [$F(5,55)=4.419$, $p=.003$]. Data collection for Exp.2 is currently ongoing with preliminary data suggesting a similar drop in infant performance across eccentricities. This information is key to setting the scene for further infant studies at the interface of perceptual and social domains.

PA-044 Infant gross motor rhythmic synchronisation and relationships with language

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In infant directed speech, the amplitude envelope of speech is altered to foreground amplitude modulations at ~2 Hz, approximately corresponding to a stressed syllable "beat rate". Temporal sampling theory proposes atypical oscillatory entrainment to slow amplitude modulations in speech in child language disorders, with speech processed as both a sound and an action (Goswami, 2011). Children with dyslexia and DLD are less accurate at tapping to a metronome (e.g. Overy et al., 2003; Thomson and Goswami, 2008; Flaugnacco et al., 2014). Individual differences in tapping predict language and literacy outcomes (Corriveau & Goswami, 2007). Accordingly, rhythmic synchronisation in the motor domain in infancy could be an early marker of language outcome. Here we measure rhythmic gross motor synchronisation to drumbeats, speech sounds, and nursery rhymes, recorded using motion capture technology, in a cohort of typically developing infants (N = 110). Participants visited the laboratory eight times between two and eleven months of age in a longitudinal design. Language outcome measures are currently being collected on the same sample from one to two-and-a-half years of age. We report a subsection of our longitudinal data, showing the first evidence of infant gross motor synchronisation predicting vocabulary comprehension ($F(3,15) = 5.63$, $p = .0239$, $R2 = .627$). Motion capture results will be further discussed in the context of rich neural and linguistic data collected for the same infants.

PA-045 Keeping the beat – Rhythmic synchronization and its relation to language and reading acquisition

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The rhythmic abilities of 39 typically developing Hungarian native-speaking children were assessed at the beginning of their first school year in two domains: rhythm reproduction and tapping to a regular musical beat in three tempos (80, 120, and 150 bpm). In contrast to most tapping tests, we used complex musical stimuli instead of metronome clicks which seemed more adequate for this age group. The synchronization test also included a spontaneous motor tempo task in which no external

reference was given during tapping. At the end of the year, children completed tests of phonological awareness and reading abilities. Reading fluency, accuracy and comprehension scores showed moderate but significant correlation with several indicators of synchronization performance and spontaneous motor tempo, measured at the beginning of the year. Synchronization accuracy and tapping variability accounted for 52.9% of the variance in phonological awareness scores. Surprisingly, rhythm reproduction and synchronization in the 150 bpm tempo task seemed independent of language and reading scores. Although small sample size has to be taken into consideration when interpreting the present findings, we assume that a link between rhythmic synchronization ability, language and reading acquisition exists among Hungarian native-speaking children, as it has been shown earlier in other languages. The use of complex musical stimuli has proven effective in testing the children's synchronization abilities while was also useful for sustaining their motivation. We hope that through further research we can create a standardized test that can be a helpful instrument in the prognosis of atypical development.

PA-046 The Magical Book: Pretend Play and Language Competence Relation Through a New Pretense Task

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The relation between language and pretense has been supported by examining language (e.g., vocabulary size, syntax) with standardized language tests and different types of pretense abilities including object substitution and play sequences (Lillard et al., 2013). In a recent study, we found links between linguistic complexity, as a measure of language competence, and two different pretense measures. This study attempts to replicate these findings with a new pretend play task (i.e., the magical book task - MBT). In this task, children can engage in different pretense activities: recontextualizing the play environment, personifying dolls, and creating imaginary objects. We ask whether 5-year-old children's pretense abilities predict their language competence (i.e., linguistic complexity) beyond their vocabulary knowledge. Forty-three Turkish-reared children (Mage=62.28months,SD=9.29) completed the MBT and telephone task for pretense assessments, a cartoon retell task to assess linguistic complexity, and a vocabulary measure. Controlling for age, the MBT and telephone scores correlated, $r(40)=.48, p=.001$. The first hierarchical linear regression model, including age and vocabulary knowledge first and the MBT score in the second step to predict linguistic complexity, was marginally significant, $(R2=.18), F(3,34)=2.54, p=.07$. The MBT score was the only significant predictor $\beta=.06, p=.03$. The second model, including the telephone score in the second step, was significant, $(R2=.23), F(3,34)=3.47, p=.03$. The telephone score was the only significant predictor $\beta=.08, p=.008$. Five-year-old children's pretense abilities predicted linguistic complexity over and above vocabulary knowledge and age. The link between pretense and linguistic competence can also be manifested in a complex pretense task, in which children need to engage in various pretense activities.

PA-047 Do Young Children React Selectively to the Emotional Distress of Others?

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Empathy, the sharing and understanding of others' emotional states, is a core feature of our social lives, however we know very little on how its affective and cognitive building blocks emerge in early in life. In the present study, we used the emerging method of infra-red thermography combined with behavioural experiments to investigate how young children (1-3 years) experience and respond to the distress of others. We tested whether children's empathic responses are more targeted towards socially close and relevant individuals. We measured the emotional reactions - including behavioural responses and changes in facial skin temperature- of 37 typically-developing young children from UK nurseries when watching short video-vignettes of familiar and unfamiliar caregivers displaying emotional distress. Findings indicate that older children tend to show stronger emotional reactions (including facial expressions) and avoidance behaviours towards the distress of the familiar vs unfamiliar individuals, in line with the "empathy gradient" which predicts strongest responses to socially-close individuals. Evidence indicating reduced empathic discrimination in younger children suggests that orientation towards the emotional states of socially relevant others increases with age, along with more complex cognitive abilities that allow more tailored responses. Furthermore, we present complementary findings of the physiological reactions of the children using innovative thermal-imaging technology. By combining evidence of physiological and behavioural responses to others' distress within the same paradigm, this study contributes to new theoretical and methodological advances into how internal emotions map onto external measures, thus shedding new light on the development of empathy and its underlying implicit processes.

PA-048 The social N400 effect: when semantic processing enters social cognition

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Several studies have demonstrated a so-called social N400 effect: infants and adults closely track the comprehension of social partners using the own language system. The typical N400 neural re-

sponse can be evoked by semantic incongruities and reflects retrieval effort from semantic memory. The social N400 shows up when a communicative partner experiences a semantic incongruity, not the participant. In three experiments we sought to replicate previous findings with adults in a novel paradigm of a false belief situation. Previous adult studies used information asymmetry to evoke the effect by providing extra information for participants that repaired sentences that were otherwise incongruent for social partners. We recorded adults' electroencephalogram while we presented them toys in a puppet theatre, which we named in the presence of an Observer. Toy labels were either congruent for both parties, incongruent for both, or congruent for the participant but incongruent for the Observer, because of an unseen object change. Adults did not produce a social N400 effect when we used either a video or a live presentation without instructions. When we provided instructions to follow the comprehension of the Observer, similarly to previous adult experiments, we did find a social N400 effect, although reduced in magnitude. Additionally, in all three studies we observed a late parietal positive and frontal negative response. While we are still investigating the latter two, communicational pragmatics, perhaps mentalization-related responses, the distinct social N400 response patterns of infants and adults hint at an intriguing developmental trajectory from implicit to explicit Theory-of-Mind computations.

PA-049 Effects of 'We'-framing on Children's Commitment, Sharing, and Helping

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Previous research suggests a 'normative turn' in child development. This emerges around three years of age within the context of collaborative activities. Thus far, no research has investigated how task framing (i.e., linguistic description) interacts with children's emerging moral psychology. This is interesting, as linguistic framing is associated with diverse effects on adult individuals' social behavior. To remedy this, this study investigates the effects of collaborative 'we-framing' and individualistic 'you-framing' on preschool children's commitment, sharing, and helping. In a sample of 96 children (2;6-4;6), a dyadic coloring game was first framed by an experimenter to the participant child using either we-framing or you-framing. The child-experimenter dyad then colored alongside one another for several minutes. Measures were taken during the task. Results show that we-framing influenced younger children (2;6-3;6) to 'take leave' from the task more often than they did in the you-framing condition. This suggests that we-framing causes children of this age to feel an increased sense of commitment towards their collaborative partner. Measures of resource sharing show an effect of gender, with females in the we-framing condition sharing more with their partner than females receiving you-framing. No similar effect appeared for males. Measures of instrumental helping show no clear effects of framing on younger or older (3;6-4;6) children's behavior. These results suggest a novel, unexplored type of context sensitivity in children's developing morality.

PA-050 Should I stay or should I go? Three-year-olds' sensitivity to appropriate motives to break a commitment

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Commitments create obligations, but the precise scope of commitments can never fully be made explicit. For instance, we expect someone to be released from her commitment anytime this conflicts with a weightier moral consideration (Shpall, 2014). Previous research shows that three-year-olds understand the obligations entailed by joint commitments (Gräfenhain et al., 2009), and they distinguish between instances in which a partner fails to make a contribution intentionally or for other reasons (Kachel et al., 2017). But can they assess the legitimacy of motives leading agents to intentionally break commitments? To probe this, we manipulate the motives that lead a partner to break a commitment. Three-year-olds play a game together with a puppet who suddenly interrupts this joint activity either because (a) she is lured away to play another tempting game; or (b) she assists another agent in distress. We measure whether children release the partner by scoring their verbal reactions on a Release Scale of -1, 1; where -1 means denying release, and 1 means giving release. Data collection (N = 60) is in progress. Pilot data (N = 15) show that children release the partner more often when the partner is faced with a conflicting moral duty (M = 0.5), while manifesting signs of protest (i.e. denying the release) when the partner is lured away by another temping game (M = -0.67). This suggests that three-year-old children make appropriate normative evaluations of the scope of commitments.

PA-051 Infants represent tolerated taking as a cue of communal sharing relations

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Recent evidence suggests that infants represent interactions based on giving and tolerated taking as instantiations of different relational models: equality matching (EM) and communal sharing (CS), respectively based on the principle of even balance and social equivalence. Supporting this proposal, earlier we found that one-year-olds selectively encoded the direction of resource transfer, information critical to the tracking of welfare imbalances, in the representation of giving, but not taking, interactions. Here we expand on this work to investigate whether the observation of giving and taking may induce different assumptions of social structure in infants. We tested whether 12-month-olds represented an open triadic structure (two agents related to a common patient) as a pure clique (three agents related to each other). Infants (N = 16 per study) were first familiarized to two agents either giving or taking a resource from a common patient, and later shown one of the two agents giving to/taking from the patient (old interaction) or the other agent (new interac-

tion). Paralleling the adults' tendency to infer unobserved CS-like ties in network recall tasks, we predicted that if infants selectively interpreted taking as a cue to CS relations, they would find the new interaction as compatible with the represented structure as the old one. As predicted, infants looked significantly longer to the new interaction in the giving, but not the taking case. The selective tendency towards triadic closure for interactions based on tolerated taking corroborates the claim that these may cue CS relations.

PA-052 Metaphor comprehension and intention attribution

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We looked at Giora's Optimal Innovation Hypothesis and a number of other factors potentially affecting metaphor comprehension in 3-6 year old Hungarian-speaking children. We asked the questions a) whether there was a correlation between the familiarity and perceived creativity of metaphors and b) to what extent metaphor comprehension was predicted by executive functioning, receptive vocabulary and intention attribution ability. Perceived creativity was measured in a task where children were shown a picture while listening to three utterances, one of which contained a target metaphor. They were asked to choose the utterance they thought was the nicest description of the picture. To test comprehension, the children listened to stories with a metaphor and had to choose from among three pictures the one best matching the story. Parental judgements of the familiarity of the metaphors were also obtained. Intention attribution ability was tested in a task where the children watched silent animations ending in a character expressing an intention through eye gaze and pointing. The children had to choose from among four pictures the one depicting the intentions of the character. Vocabulary and non-verbal cognitive skills were tested using standard tests. Although measured familiarity did not correlate with perceived creativity, parental judgements of familiarity and perceived creativity did for 6 year-olds: the children preferred metaphorical expressions that were judged to be moderately familiar. Of the potential predictors of measured metaphor comprehension, intention attribution was the only factor with a significant contribution: better intention attribution ability was accompanied by better metaphor comprehension

PA-053 Intent-based morality in a non-WEIRD sample

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The vast majority of the literature about the role of outcomes and intentions in judgements of transgression severity, third-party punishment severity and enjoyment has been conducted on WEIRD populations. We tested instead a non-WEIRD sample of 5- to 11-year-old urban Colombian children from a low-middle socio-economic background (n=44).
We found that the outcome-to-intention shift in judgements of transgression severity was moral domain-dependent. Judgements of unfairness were of equal severity between accidental and failed intentional transgressions, while judgements of disloyalty were harsher for failed intentional than accidental transgressions. Furthermore, disloyalty was punished more severely than unfairness; punishment severity of unfairness (but not disloyalty) decreased with children's increasing age. This evidence is in line with cultural group selection (Richerson & Boyd, 2005) and Moral Foundations Theory's (Graham et al., 2013) argument that non-WEIRD cultures are particularly concerned about binding over individualising moral domains, and that such selective concerns become more pronounced with development. To strengthen our cross-cultural claims we are now investigating how same-aged Spanish children react to transgressions when tested on the same paradigm. On average, Colombian children did not enjoy punishing, thus replicating findings in British children (Arini et al., submitted). This suggests that retribution is an unlikely motive for children's third-party punishment. Irrespective of whether Colombian children were asked to focus on punishment outcomes or not, they anticipated punishment to feel worse than how it actually felt during and after punishment allocation, showing a forecasting error in the opposite direction to the one observed by Carlsmith et al. (2008).

PA-054 From equality to equity: The roles of ability and effort in distributive justice decisions of children

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Classic studies indicate that justice develops gradually in stage-like progressions from equality to equity. Recent studies have challenged this constructivist account, showing that several parameters like the needs, efforts, material status, and the moral character of the receiver in addition to the value of the to-be-distributed-good influence children's judgments of justice very early on. This study attempts to investigate whether disability status might be another parameter that children consider when making distributive justice decisions. In three experiments, a total of 101 children aged 51-81

months (M = 65.66, SD = 5.36; 51 girls) were presented with stories in which a physically impaired character (i.e., using a wheelchair) either contributed less despite having worked as much as the healthy character (Exp 1: Equal Effort; N = 32); was an equal contributor despite having worked more than the healthy character (Exp 2: Equal Outcome; N = 35); or worked less and contributed less than a healthy character (Exp 3: Free-rider; N = 34). Children were then asked to distribute cookies to these characters. The majority of the children distributed cookies equally both when the disabled character worked equally, though contributed less (75%); and when s/he worked more, yet contributed as much as the healthy character (74.3%). However, when the disabled character was a free-rider, the tendency to distribute equally decreased (52.9%), and the tendency to favor the healthy character increased (38.25%). Thus, both equality and equity seem to guide children's distributive justice decisions.

PA-055 Children's trust in individuals who speak in a familiar regional accent and those who speak in the standard accent used on TV

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Children are more likely to absorb knowledge from individuals who speak their language in a native accent rather than from those who speak it in a foreign accent (Kinzler et al., 2011). However, in a country, some children hear their language in a regional accent in daily face-to-face interactions, but are also regularly exposed to the language in a standard accent on TV. Do these children try to acquire knowledge from individuals who speak in the regional accent or from those who speak in the standard accent? To investigate this subject, we focused on children from Tokyo and Okayama. In Tokyo, the capital of Japan, people talk in standard Tokyo-accented Japanese which is also the accent used in the media. In Okayama, an average-sized regional city in western Japan, people speak Okayama-accented Japanese, although standard Tokyo-accented Japanese is heard on TV. We surveyed 3- to 5-year-old children in Tokyo (N = 60) and Okayama (N = 60) on whether they preferred being taught by an individual speaking in Tokyo-accented Japanese or one speaking in Okayama-accented Japanese. Irrespective of age, the children from Tokyo chose the former whereas the children from Okayama indicated no particular preference. As per previous research, children who almost always hear a language in a particular accent happen to trust people who speak in that accent. However, children who are regularly exposed to two variations of a language do not show preference for one over the other. Experiences with different dialects may influence young children's social reasoning skills.

PA-056 Children manage their reputation with regard to gossip

Asami Shinohara[1,2,3], Yasuhiro Kanakogi[4], Yuko Okumura[3], Tessei Kobayashi[1,3]

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Gossip plays an important role in human society; it conveys an individual's reputation among a social group. People use gossip to decide how to interact with other members without needing to rely on direct observations of another person's past interactions. At the same time, members of society must cultivate their reputation in front of those who are witnessing them as well as those who are not present. In other words, people need to adjust their behavior with regard to being gossiped about (Piazza & Bering, 2008). Children use gossip to selectively interact with others (Shinohara et al., under review), but it is unclear whether they care about being the subject of gossip. In this study, we investigated whether 4- and 8-year-old children (N=134) adjust their sharing behavior when there is a possibility that they could be gossiped about. We asked the children to share their own resources (seven pieces of candy) to an anonymous peer in front of an observer under three conditions: (1) Gossip-to-ingroup condition: the observer told the children that she would report their behavior to the children's friend, (2) Gossip-to-outgroup condition: the observer told the children that she would report their behavior to an unknown peer (i.e., from a different kindergarten or elementary school), and (3) Control condition: the observer would not gossip. Children from both ages shared more resources in the gossip-to-ingroup condition and the gossip-to-outgroup condition than in the control condition, indicating that even 4-year-old children become more altruistic in the face of gossip.

PA-057 Children's early understanding of moral consistency in using decision rules.

Hannah Hok, Alex Shaw

University of Chicago

Should you pay people according to merit or according to equality? Although people vary in whether they think the former or latter is the right rule (e.g., Damon, 1977), adults can often partially select the decision rule based on what benefits them. Intuitively, it seems that adults do not like people who express such moral inconsistency, endorsing a rule when it benefits the actor, but not endorsing the same rule when it disadvantages the actor. Here we explore when in development children begin to judge others negatively for such moral inconsistency. We asked 4 to 9-year-olds (N = 180) to evaluate how fair a distributor of resources was across two conditions, where the distributor allocates four rewards between herself and another person. What varied between conditions was whether the person used a morally consistent versus inconsistent rule. The morally consistent person always rewards based on merit, both when she does better and when she does worse. The morally inconstant person rewards based on merit when she does bet-

ter, but rewards based on equality when she does worse. We found that children think the morally inconsistent person is less fair than the consistent one. In a follow up study, we examine if children are more accepting of inconsistency that benefits others (a distributor who rewards equally when she does better, but according to merit was she does worse). These results suggest that children have strong and early intuitions about the wrongness of hypocritically applying moral rules.

PA-058 Children consider mental states for lying

Mareike Heinrich, Ulf Liszkowski
University of Hamburg, Hamburg, Germany

Research suggests that infants share information with others who lack information (e.g. about the location of an object they are searching for) (Liszkowski et al., 2006). However, they do not share information, if the other person already knows where the object is hidden (Knudsen & Liszkowski, 2012). In line with this, telling a lie seems to be more or less relevant depending on the other person's level of knowledge. Yet, few attempts have been made to determine the degree to which children consider another person's mental state and level of knowledge before they decide to tell a lie. This project therefore investigates whether children adapt their lying to another person's ignorance, false belief or true belief about an object's location. Four-year-old children (planned N=80, data collection ongoing) are engaged in an interactive puppet play with three between-subjects conditions. In the puppet play a competitor is looking for a toy in order to steal it from the child. The toy is hidden in one of two boxes and the competitor either does not know where the toy is (ignorance condition) or has a false belief (false belief condition) or a true belief (true belief condition) about its location. If children consider others mental states for lying, the proportion of trials with lying should differ between the three conditions. If children need an explicit Theory of Mind in order to consider mental states for lying, differences between the conditions should only occur in children passing an explicit false belief test.

PA-059 Infants represent 'like-kin' affiliation

Ashley J. Thomas[1,2], Rebecca Saxe[2], Elizabeth Spelke[1]
[1]Harvard University, US [2]MIT, US

Social affiliation is important across species. Usually occurring between kin, it predicts proximity, who will aid one another in fights, and who will groom one another. Some non-human primates, such as baboons, even represent kin relationships--expecting kin to support one another in conflicts. For humans, the network of affiliative relationships, especially with non-kin, vastly outstretch those of non-human species. We affiliate with many individuals and sometimes treat unrelated individuals as 'like-kin'. Preliminary results from two studies suggest that infants distinguish 'close' social affiliation (e.g. people you'd share an ice cream cone with) and distant social affiliation (e.g. people you

would work with or help). In one study, 9 and 10-month old infants anticipated that someone who had displayed a 'close' affiliative cue toward a puppet (took a bite of orange, fed the puppet, then took another bite) would comfort that puppet over a person who merely interacted with the puppet (by passing a ball back and forth). Moreover, 4 and 5-month-old infants seem to differentiate between these types of affiliation: they look longer at 'close' affiliative cues (where an experimenter puts her finger in her mouth, puts her finger in a puppet's mouth, and then puts her finger back in her mouth) over distant ones (where an experimenter touches her forehead, touches a puppet's forehead and then touches her own forehead). Together, this suggests that infants may be sensitive to cues that might be particularly important in understanding who is in their immediate social circle.

PA-060 Adolescent welfare tradeoff psychology: More valued friends and more despised enemies

Rhea M. Howard, Annie S. Spokes, Samuel A. Mehr, Max M. Krasnow
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Making social decisions often requires weighing one's own wants against the needs and preferences of others. Adults incorporate multiple contextual features when deciding how to trade off their welfare against another's. For example, they are more willing to forgo a resource to benefit friends over strangers (a feature of the individual) or when the opportunity cost of giving up the resource is low (a feature of the situation). In prior work presented at BCCCD, we found that 4-10 year olds (N=208) also systematically forgo resources to benefit others. Like adults, children (1) made repeated resource allocation decisions that were internally consistent with stable valuations of specific other people, and (2) were willing to forgo more resources to benefit friends over strangers over enemies. This pattern of valuation matches that of adults tested using the same stimuli (N=200), but children's valuations were compressed compared to adults: children were less willing to sacrifice for friends, but were more willing to sacrifice for enemies. Here we tested 10-17 year olds (N=200) to explore how interpersonal valuation changes throughout adolescence. We found that early adolescents were less willing to sacrifice for their friends than adults (just like children), but that they were also less willing to sacrifice for their enemies than children were (similar to adults). In addition, older adolescents were willing to sacrifice increasingly more for their friends, while continuing to value enemies lowly. This cross-sectional evidence suggests that welfare valuations track deepening social relationships, while simultaneously erring on the side of self-benefiting.

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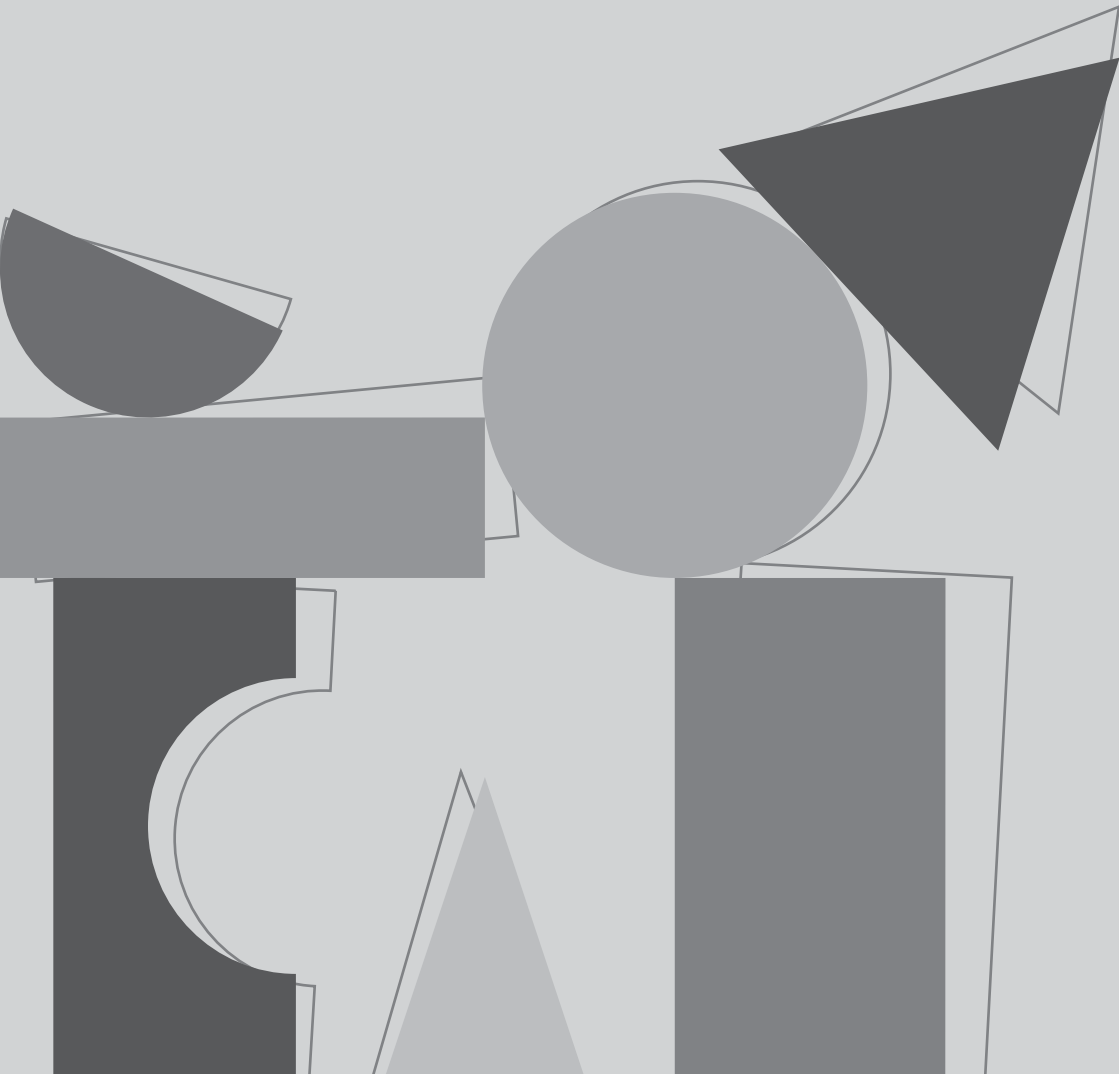

POSTER SESSION B: FRIDAY

PB-001 Longitudinal touchscreen use is associated with differences in saccadic attention control in infants and toddlers

Ana Maria Portugal[1], Rachael Bedford[2], Teodora Gliga[3], Tim J. Smith[1]

[1]Centre for Brain and Cognitive Development, Birkbeck, University of London, [2]Institute of Psychiatry, Psychology & Neuroscience, King's College London, [3]University of East Anglia, Norwich, UK

PB-002 Maternal Depressive Symptoms, Social Support and the Early Development of Maternal Confidence

Gizem Samdan, Franz Petermann, Tilman Reinelt

University of Bremen, Bremen, Germany

PB-003 Short term exposure to fast and slow mobile games influences attentional control in preschoolers

Veronika Konok[1], Krisztina Peres[1,2], Dorottya Júlia Ujfalussy[1], Zsolt Jurányi[1], György Kampis[1], Ádám Miklósi[1]

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PB-004 Revisiting pay disparity in monkeys: social disappointment could explain long-tailed macaque frustration behavior in an inequity aversion paradigm

Rowan Titchener[1], Constance Thiriau[2], Julia Fischer[1,3], Stefanie Keupp[4]

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PB-005 "Time is not what it used to be": age-dependent changes in time perception

Sandra Stojić[1,2,3], Vanja Topić[3,4], Zoltán Nádasdy[2,5,6]

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PB-006 The influence of script knowledge on false memories in children

Elena Vaporova, Norbert Zmyj

TU Dortmund University, Germany

PB-007 The relationship between control of action sequences and executive functions in preschoolers

Lisanne Schröer[1], Richard P. Cooper[2], Denis Mareschal[1]

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PB-008 Task co-representation in children and great apes

Sophie Milward[1,4], Malinda Carpenter[2], Josep Call[2], Michael Tomasello[3]

[1]University of Portsmouth, UK; [2]University of St Andrews, UK; [3]Duke University, USA; [4]Max Planck Institute for Evolutionary Anthropology, Germany

PB-009 Domain-generality of children's certainty reasoning

Carolyn Baer, Darko Odic

University of British Columbia

PB-010 Development of self-face representation in 12-month-old infants: A study with the preferential looking paradigm using the morphing technique

Hiroshi Nitta, Kazuhide Hashiya

Kyushu University, Fukuoka, Japan

PB-011 Young Children's Responses to Future Uncertain Events

Neha Khetrapal, Ernő Téglás

Cognitive Development Center, Central European University

PB-012 Crossmodal Statistical Learning in Children

Veronika M. G. Schlesinger-Zweckerl, Patrick Bruns, Brigitte Röder

Biological Psychology & Neuropsychology, University of Hamburg, Germany

PB-013 Kids only bother to probability match when they have a chance to verify their predictions

Levente Madarász, Ernő Téglás

Cognitive Development Center, Center European University

PB-014 Can pre-verbal infants use logical negation?

Milad Ekramnia, Ghislaine Dehaene

UNICOG, Neurospin, CEA, Gif sur-Yvette, France

PB-015 7-month-old infants detect symmetrical structures in abstract visual patterns

Irene de la Cruz-Pavía[1,2], Gesche Westphal-Fitch[3], W. Tecumseh Fitch[3], Judit Gervain[1,2]

[1]CNRS; [2]Université Paris Descartes; [3]University of Vienna

PB-016 Children's failure to consider false beliefs when ascribing intentions

Britta Schünemann, Marina Proft, Hannes Rakoczy

University of Göttingen, Göttingen, Germany

PB-017 Counterintuitive Cognitive Educational Strategies

Stephen Wee Hun Lim

National University of Singapore, Singapore

PB-018 Linking interoception and (implicit) theory of mind – a new theoretical perspective

Markus R. Tünte, Stefanie Höhl

Faculty of Psychology, University of Vienna, Austria

PB-019 The impact of maternal signals on emotion perception in infancy

Sarah Jessen

University of Lübeck, Germany

PB-020 Toddlers' communication comprehension: Equal processing demands for direct and indirect communication but differences in behavioral performance

Cornelia Schulze[1], David Buttelmann[2]

[1]University of Leipzig, Germany; [2]University of Bern, Switzerland

PB-021 Show me something new! – the role of manual-gestural items in children's understanding of labels

Edina Hajnal[1], Ágnes Kovács[2]

[1]University of Szeged, Szeged, Hungary; [2]Central European University, Budapest, Hungary

PB-022 What is the baby "saying"? Adults' interpretation of infants' pointing gestures

Ran Wei, Paul L. Harris, Meredith L. Rowe

Harvard University

PB-023 The development of simile comprehension: From comparison to scalar implicature

Madeleine Long, Vishakha Shukla, Paula Rubio-Fernández

University of Oslo, Norway

PB-024 "Umm…": When children do and do not infer knowledge based on disfluency

Benjamin C. Morris, Alex Shaw

University of Chicago

PB-025 Children's goal-driven information search

Andreas Domberg[1], Karla Koskuba[1,2], Azzurra Ruggeri[1,3]

[1]Max Planck Institute for Human Development, Berlin, Germany; [2]University College London, UK; [3]Technical University of Munich, Germany

PB-026 Cost-efficiency is not expected from communicative actions by 8-month-old infants

Nima Mussavifard, Gergely Csibra

Central European University, Budapest, Hungary

PB-027 Together is better. 14-month-olds' expectations about coordination

Arianna Curioni[1], Liza Vorobyova[1], Katarina Begus[2], Gunther Knoblich[1], Gyorgy Gergeley[1]

[1]Central European University, Budapest, Hungary; [2]Rutgers University, Newark, NJ

PB-028 Ten-month-olds' representations of utility in goal selection

Laura Schlingloff, Denis Tatone, Barbara Pomiechowska, Gergely Csibra

Department of Cognitive Science, Central European University, Budapest, Hungary

PB-029 Interpersonal causality during the observation of interactions at 10 months of age

Elisa Roberti[1,2], Lucia Maria Sacheli[1,2], Chiara Turati[1,2]

[1]University of Milano-Bicocca, Department of Psychology; [2]NeuroMI, Milan Center for Neuroscience

PB-030 Can observing adults' persistence enhance attention in infants?

Mikako Ishibashi[1,2], Yuta Shinya[2]

[1]Ochanomizu University, JPN; 2University of Tokyo, JPN

PB-031 Prosocial and psychological reasoning on protective interventions toward third parties at 17 months

Alessandra Geraci, Francesca Simion

Department of Developmental Psychology and Socialization, University of Padova, Padova, Italy

PB-032 Reading from the eyes - First results of a new mentalizing task for deaf children

Timea Budai, Szabolcs Kiss

Institute of Psychology, University of Pécs, Pécs, Hungary

PB-033 When do Children appreciate the Subjectivity of Desires?

Lydia Paulin Schidelko, Britta Schünemann, Marina Proft, Hannes Rakoczy

University of Göttingen, Göttingen, Germany

PB-034 How many observations is one generic worth?

Michael Henry Tessler[1], Sophie Bridgers[2], Joshua Tenenbaum[1]

[1]Massachusetts Institute of Technology, Cambridge, Massachusetts, USA; [2]Stanford University, Stanford, California, USA

PB-035 Diving deep - mechanisms of children's lexicon development in circumscribed domains

Gerlind Große[1], Berit Streubel[2], Frederike Svensson[2], Catherine Gunzenhauser[2], Noburo Saji[3], Cornelia Schulze[2], Henrik Saalbach[2]

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PB-036 Increased lexical competition effects in children with Autism Spectrum Disorders

Ekaterina Ostashchenko[1,2], Gaetane Deliens[2], Stephanie Durrleman[3], Mikhail Kissine[2]

[1]University of Cambridge, UK; [2]Université Libre de Bruxelles, Belgium; [3]University of Geneva, Switzerland

PB-037 Learning the number sequence: preschool children make sense of numbers

Francesco Sella[1], Daniela Lucangeli[2], Roi Cohen Kadosh[3], Marco Zorzi[2]

[1]University of Sheffield, UK; [2]University of Padova, Italy; [3]University of Oxford, UK

PB-038 Properties of early vocabulary development in Japanese-English bilingual children

Yuka Sakamoto[1], Yuko Okumura[2], Tessei Kobayashi[2], Yasuhiro Minami[1]

[1]The University of Electro-Communications, Japan; [2]NTT Communication Science Laboratories, Japan

PB-039 Spelling words at the end of first grade: Is it easier to spell after hearing the word than after seeing its image?

Cynthia Boggio[1,3], Maryse Bianco[2], Marie-Line Bosse[1]

[1]Université Grenoble Alpes, CNRS, LPNC, Grenoble, France; [2]Université Grenoble Alpes, LaRAC, Grenoble, France; [3]Editions Hatier, Paris, France

PB-040 Plant food avoidance in infancy

Camille Rioux[1,2], Annie, E. Wertz[1]

[1]Max Planck Institute for Human Development, Max Planck Research Group Naturalistic Social Cognition, Berlin, Germany; [2]Aix Marseille Université, PSYCLE EA3273, Aix en Provence, France

PB-041 How do children and adults represent temporal and numerical magnitudes in space?

Karoline Lohse, Elena Sixtus, Jan Lonnemann

University of Potsdam, Potsdam, Germany

PB-042 Scale Errors Are Induced by Associating Functions to Categories of Objects in 3-year-old Children

Katalin Oláh[1], Lilla Schmidt[2], Ildikó Király[1,3]

[1]MTA-ELTE Momentum Social Minds Research Group; [2]Institute of Psychology, Eötvös Loránd University; [3]Central European University

PB-043 Young children's active use of pedagogical cues when they teach object part names to others

Harumi Kobayashi[1], Tetsuya Yasuda[1], Yuka Ishizuka[2], Jun-ichi Yamamoto[3]

[1]Tokyo Denki University, Saitama, Japan; [2]University of Tsukuba, Tsukuba, Japan; [3]Keio University, Tokyo, Japan

PB-044 Is music an evolutionary adaptation? Effects of listening to music on social interactions in preschool children.

Carla Aimé, Dalila Bovet, Uyen Tran, Mathilde Le Covec, Rana Esseily

Université Paris Nanterre

PB-045 Telling a story improves counterfactual reasoning in 4-year-old children.

Lisa Starcke, Caroline Wronski
University of Applied Sciences Potsdam, Potsdam, Germany

PB-046 Own-age effect on emotional face detection

Virág Ihász, Cintia Bali, Júlia Basler, Rebecca Cseh, Diána Stecina, András Norbert Zsidó
University of Pécs, Hungary

PB-047 The influence of observation on children's emotions to seeing a needy peer receive help

Stella Gerdemann[1,2], Ronja Büchner[1,2], Robert Hepach[1,2]
[1]Department of Research Methods in Early Child Development, Faculty of Education, Leipzig University; [2]Leipzig Research Center for Early Child Development, Leipzig University

PB-048 The role of spontaneous versus purposeful joint attention in prosociality

Bahar Tunçgenç[1], Ellen M. Howard[1], Roger Newport[1,2], Danielle Ropar[1]
[1]School of Psychology, University of Nottingham, Nottingham, United Kingdom; [2]School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough, United Kingdom

PB-049 Children's sharing of real and symbolic resources

Martina Vogelsang, Mirjam Ebersbach
Department of Psychology, Developmental Psychology Group, University of Kassel, Germany

PB-050 Children's stances toward resources shape the development of fairness

David Buttelmann
University of Bern

PB-051 Children's Biased Preference for Category Information about Out-Groups

Meytal Nasie[1,2], Gil Diesendruck[3]
[1]The MOFET Institute, Tel Aviv, Israel; [2]Levinsky College of Education, Tel Aviv, Israel; [3]Bar-Ilan University, Ramat-Gan, Israel

PB-052 Children's perceptions of shared knowledge as a social cue

Gaye Soley, Begüm Köseler
Bogazici University, Istanbul, Turkey

PB-053 Cognitive prerequisites for cumulative culture are context-dependent: children's potential for ratcheting depends on cue longevity

Charlotte E. H. Wilks, Eva Rafetseder, Christine A. Caldwell

University of Stirling, UK

PB-054 Exploring imitation and innovation in neurotypical and autistic development.

Lauren Marsh, Emily Burdett

School of Psychology, University of Nottingham, Nottingham, UK

PB-055 Mutual Joy and Social Learning in Small-Scale Societies

Tanya Broesch, Jeremy Carpendale

Department of Psychology, Simon Fraser University

PB-056 Children's third party norm enforcement in eight diverse societies

Patricia Kanngiesser[1,2], Daniel Haun[2,3], Esther Herrmann[3], Marie Schäfer[3], Henriette Zeidler[3], Michael Tomasello[4]

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PB-057 What do others need to know? Children's information-sharing becomes more effective with age in cultural transmission chains

Gemma Mackintosh, Christine Caldwell

University of Stirling

PB-058 Social attention during real-life interactions in Williams syndrome and autism spectrum disorder

Yoko Hakuno[1,2], Nozomi Naoi[3], Ayaka Ikeda[4], Kosuke Asada[5], Yasuyo Minagawa[2], Takahiro Ikeda[1], Takanori Yamagata[1], Masahiro Hirai[1]

[1]Jichi Medical University, Tochigi, Japan; [2]Keio University, Tokyo, Japan; [3]International Christian University, Tokyo, Japan; [4]Senshu University, Kanagawa, Japan; [5]Hakuoh University, Tochigi, Japan

PB-059 Affective Social Learning from a developmental perspective

Daniel Dukes[1],2, Paul Harris[3], Fabrice Clément[4]

[1]Fribourg University, Switzerland; [2]Swiss Centre for Affective Sciences, Geneva, Switzerland; [3]Harvard University, USA; [4]Neuchâtel University, Switzerland

PB-060 Effect of Knowledge Access Training on Children's Strategic Lying

Xiao Pan Ding, Nabil Syukri Bin Sachiman

Department of Psychology, National University of Singapore

PB-001 Longitudinal touchscreen use is associated with differences in saccadic attention control in infants and toddlers

Ana Maria Portugal[1], Rachael Bedford[2], Teodora Gliga[3], Tim J. Smith[1]

[1]Centre for Brain and Cognitive Development, Birkbeck, University of London, [2]Institute of Psychiatry, Psychology & Neuroscience, King's College London, [3]University of East Anglia, Norwich, UK

The development of attention is partly subject to environmental influences, such as screen media use. Attentional impairments have previously been associated with traditional screen media like television, but the video gaming literature has shown increased performance on cognitive tests including enhanced visual attention. The now ubiquitous touchscreen technologies (i.e. tablets, smartphones) offer the potential for both video watching and interactive use, but empirical research questioning the impact on development is lacking. In this study we identified infants with different levels of touchscreen exposure (HTU: high use, LTU: low use) as part of the TABLET project, and followed them longitudinally (12-months, 18-months, and 3.5-years) using lab-based, gaze-contingent tasks including gap-overlap and infant anti-saccade. Performance in these was used to measure exogenous (baseline and pro-saccade saccadic reaction times, SRTs) and endogenous (disengagement effect and anti-saccade inhibition) attention control. Generalised estimating equations showed significantly slower disengagement and reduced anti-saccade behaviour in the HTUs. However, these effects were driven by significantly faster exogenous attention, i.e. faster baseline and pro-saccade SRTs in the HTUs. While this speeded bottom-up response did not benefit HTUs in the overlap/competition condition in the gap-overlap task, in the anti-saccade task it enabled HTUs to use a strategy for pro+anti-saccades which still showed target anticipation. High users' priority of bottom-up processing might be displacing increasing competency of top-down processes, which might lead to poorer performance in goal-directed behaviour and executive functioning. Future work is needed to clarify these potential off-screen consequences and to assess direct causal associations with touchscreen use.

PB-002 Maternal Depressive Symptoms, Social Support and the Early Development of Maternal Confidence

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University of Bremen, Bremen, Germany

Objective. Maternal confidence – a mother's perception of her parenting abilities – is an important predictor of parenting behavior and the mother-child relationship. Especially during the early infancy period with psychological stress due to new expectations, roles, and a new family structure, mothers might need external resources to cope with these challenges, adapt to their parenting role, and develop maternal confidence. Following the parenting model of Taraban and Shaw (2018), it was hypothesized that maternal depressive symptoms, so-

cial support and their interaction would predict maternal confidence during early infancy. Method. Socially and/or culturally disadvantaged families (N = 150) participating in the BRISE Project were visited during pregnancy and three months after birth. The Maternal Confidence Questionnaire, the Edinburgh Postnatal Depression Scale and the Social Support Questionnaire were conducted. Results. The preliminary analyses indicated a direct negative relationship between depressive symptoms and maternal confidence at both time points, and between depressive symptoms and social support during pregnancy. On the other hand, there was no direct relationship between social support and maternal confidence. When assessed longitudinally, higher levels of social support during pregnancy were associated with lower levels of depressive symptoms after birth; and higher levels of depressive symptoms during pregnancy were associated with lower levels of maternal confidence after birth. Discussion. These results show that maternal depressive symptoms might hinder mothers to gain confidence about their parenting. As social support seems to potentially buffer the negative effects of depressive symptoms, programs aiming to promote early child development should improve the mother's social networks.

PB-003 Short term exposure to fast and slow mobile games influences attentional control in preschoolers

Veronika Konok[1], Krisztina Peres[1,2], Dorottya Júlia Ujfalussy[1], Zsolt Jurányi[1], György Kampis[1], Ádám Miklósi[1]

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It becomes more frequent in preschool children to use touchscreen devices for digital games, when environmental stimuli still strongly influence neurocognitive development. Studies suggest that young children's electronic media use can lead to executive and attentional problems. However, the effect of touchscreen games and specifically, the pace of the game on preschoolers' executive functions is poorly investigated. In our experiment, 4-6-year-old children played with either a fast or a slow digital game (balloon game) on a tablet, or with a non-digital game (whack-a-mole) for 3x2 minutes. Their executive control (attentional and inhibitory control, cognitive flexibility) was measured afterwards with the Navon test, including a Go/No-Go subtest. While children in the slow digital and non-digital condition showed an advantage of selective attention over divided attention, children in the fast digital condition did not. Children playing with digital games (slow or fast) showed local precedence, while children playing with the non-digital game showed global precedence in the divided attention task. The treatment had no effect on inhibitory control and cognitive flexibility. When playing with a fast digital game, children have to attend to multiple stimuli simultaneously which may train their divided attention but not their selective attention. In general, MTSD screens show only a part of the 'whole' (the content often 'continues' over the borders: users can scroll up or down, images can arrive from outside the screen). This may strengthen bottom-up attention (focusing on details) and weaken top-down attention (gestalt perception), in line with digital gamers' local precedence in divided attention.

PB-004 Revisiting pay disparity in monkeys: social disappointment could explain long-tailed macaque frustration behavior in an inequity aversion paradigm

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Inequity aversion (IA) is the objection to an inequitable distribution of reward or effort. Humans protest in the face of both disadvantageous inequity (underpayment) and advantageous inequity (overpayment). When rewarded disproportionately to a conspecific, a number of animals (e.g. capuchins, dogs and crows) become frustrated and reluctant to work. Such behavior has been taken as evidence that disadvantageous IA exists in animals however this interpretation has met with skepticism. An alternative explanation is social disappointment – this explanation shifts the cause of frustration away from the conspecific and onto the human experimenter who could reward subject and partner equitably but elects not to. In line with this explanation, a recent study found that chimpanzees refused to exchange tokens more often when a human rather than a machine distributed the reward. Conspecific presence had an effect only in the human distributor condition, with partner presence leading to a lower refusal rate. In the current study, we tested long-tailed macaques in a similar design to assess if the results generalize to another species and whether they hold in light of an equality control condition. In line with predictions of the social disappointment explanation, the monkeys refused rewards more often from the human than the machine. Interestingly, in both distributor conditions, refusal rates were lower when the partner was present. While this is the reverse of what inequity aversion would predict, it is also not a straightforward prediction of the social disappointment explanation and warrants further exploration.

PB-005 "Time is not what it used to be": age-dependent changes in time perception

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Time is one of the cardinal dimensions of our episodic memory. A concept that is uniquely human yet ubiquitous in every culture and developing over the years. Because time does not have a direct sensory representation like distance, our hypothesis was that subjects at different ages apply different heuristics to obtain an indirect estimate of time; preschool children using a representational

heuristics, or „how much they can talk about something“ rule, and adults following the sampling heuristics, i.e. “how many times they were able to sample the flow of absolute time” rule. We asked groups of preschool children (N=46; M=4,70; sd=,59), school-age children (N=46; M=9,61; sd=,49) and University students (N=46; M=22,22; sd=5,2) to solve the binary comparison by identifying which of the presented cartoons, either “action-packed and exciting” or “monotonous and flat”, subjectively appeared as longer. In addition, participants were asked to intuitively express durations of both cartoons with simple hand gestures. Statistical analysis has shown clear-cut preferences in binary estimation ($\chi 2$ (2, N = 138) = 18.22, $p < .001$), where the preschools estimated the action-packed cartoons as longer, while the school-age children and adults claimed the monotonous cartoons as such. The tendency to map the temporal durations horizontally was a predominant orientation among all three groups ($\chi 2$ (2, N = 138) = 19.42, $p < .001$), with the increasing rate across the age. The results of this study support the heuristic hypothesis and demonstrate the effects of the Cartesian arrangement and spatial context on the perception of time.

PB-006 The influence of script knowledge on false memories in children

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Memories are no exact copies of reality. Many people form false memories when asked suggestive questions, especially children are highly suggestible. Previous research shows that script knowledge about an event increases the probability for forming false memories. However, the influence of script knowledge on false memories was usually investigated by implanting biographical events instead of using suggestive interviews and script knowledge was rarely experimentally controlled. In our study, we taught 6-year olds (N = 32) script knowledge about four arbitrary actions. Afterwards the children watched a televised adult performing the four familiar actions and violating one aspect of each script. Children also watched the adult performing four unfamiliar actions. After a 4 minutes pause, suggestive and non-suggestive questions about all actions were asked. In the suggestive condition for script knowledge actions, questions suggested that the adult performed accordingly to the script. In the suggestive condition for unfamiliar actions, questions suggested that the adult performed differently than witnessed. In the non-suggestive conditions for both actions neutral questions were asked. Finally, test questions were asked to measure memory performance. The chance for forming false memories in the suggestive condition was higher than in the non-suggestive condition. There was no effect of script knowledge and no interaction between script knowledge and suggestion. The results indicate no impact of script knowledge on false memories about details. These findings are inconsistent with previous false memory research on script knowledge. This study calls for further investigating the effect of scripts with different elaboration on false memories.

PB-007 The relationship between control of action sequences and executive functions in preschoolers

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There is evidence that the control of action sequences develops over preschool years. Five-year-olds execute actions based on all levels of the goal hierarchy in an action sequence, while 3- and 4-years-olds experience problems in following the highest goal in an action sequence (Freier et al., 2017; Yanaoka & Saito 2017; 2019). This study investigates whether improvements in executive functioning could underlie these improvements in control of action sequences based on goal hierarchy over early childhood. Twenty 3-, 20 4- and 20 5-year-olds built a Duplo shelter with several subgoals and a main goal as their hand movements were recorded using optical motion capture. Behavioural data of whether children were able to follow the main goal and the subgoals was coded afterwards. Three games measuring inhibition, working memory/updating, and switching were used to assess individual differences in executive functioning. Preliminary analyses on 23 participants using a binary logistic regression with main goal score as dependent variable (0 = not following main goal, 1 = building a shelter with two walls and a roof) and outcome measurements of inhibition, working memory and switching tasks, and age in months showed that main goal score could best be predicted by the predictor switching effect (i.e. error-rate post-switching block – error-rate pre-switching block) ($\chi 2(1) = 5.376$, $p = .020$). This model explained 29.7% (Nagelkerke R2) of the variance, and correctly classified 72.7% of the participants. Improvements in switching skills may be related to improvement in control of action sequences in preschool years.

PB-008 Task co-representation in children and great apes

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Human adults and 4-year-olds automatically co-represent a co-actor's task when acting jointly (Milward et al., 2014; Sebanz et al., 2003). This mechanism is argued to aid prediction of a partner, but also interferes with one's own performance (increasing response times and error rates). Similar effects have recently been found in the common marmoset (Miss & Burkart, 2018), which could suggest an evolutionarily ancient mechanism. However, these researchers argued for a convergent evolutionary explanation, whereby the marmoset evolved this social cognitive mechanism due to its cooperative breeding behaviours. To distinguish between these two explanations, we designed two novel joint object selection tasks to compare this in great apes and 4-5 year-old children. Great

apes are closer to humans in evolutionary history, but are not cooperative breeders, allowing us to distinguish between these two explanations. Great apes showed a non-significant trend ($F(1,12) = 4.42$, $p = .057$, $\eta p2 = .27$), for an interaction between the task type (Same colour or Different colour from one's partner) and the Location of the correct cup (Same or Different side of the apparatus), providing some preliminary evidence that this mechanism may be shared with our closest living relatives. We are currently following up this study with a modified methodology to increase dependence between actors and testing this with a larger sample of apes and children.

PB-009 Domain-generality of children's certainty reasoning

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Children can reason about certainty – the strength of their beliefs, knowledge, and abilities. What cognitive information do children use to make these judgments? Some proposals for this ability rely on domain-general reasoning, like error detection or probability calculations, while others rely on domain-specific reasoning, like analysis of perceptual noise or stimulus-specific cues. Here, we test between these groups of accounts by asking whether children's certainty reasoning is domain-general. Specifically, we compare whether children's ability to compare their certainty between domains (e.g., in a number judgment versus an emotion judgment) is as effective as their ability to compare certainty within a single domain (e.g., two number judgments). Forty-eight 6 and 7-year-olds were presented with Number, Area, and Emotion perceptual discriminations. Questions were presented in pairs – either Within-Dimension (e.g., number/number) or Between-Dimensions (e.g., area/emotion). After making the discrimination decision for each of the two trials, children reported their relative certainty in the questions ('which answer are you more sure you got right?'). Children were equivalently good at comparing within-domain and between-domain when both tasks were perceptual, signalling that there was no cost for between-domain judgments, consistent with a domain-general account. In current work, we are extending this paradigm to test whether domain-generality also extends to memory judgments in a wider range of ages.

PB-010 Development of self-face representation in 12-month-old infants: A study with the preferential looking paradigm using the morphing technique

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Visual experiences contribute to the development of face processing in infancy. The present study investigated facial representations of the self-face in 12-month-old infants using the morphing technique and the preferential looking paradigm. In the main experiment (N = 30), we used the participant's own face, an unfamiliar infant's face (age- and gender-matched), and a morphed face comprising 50%

each of the self and the unfamiliar faces as stimuli. Two of these stimuli were presented side-by-side on a monitor in each trial, and infants' fixation duration was measured. Shorter fixation durations were found for the morphed face compared with the self-face and unfamiliar face, respectively. We also conducted a control experiment (N = 38) with an identical procedure except that the self-face was replaced with another unfamiliar face to eliminate the possibility that infants' preferences would be due to our use of morphed stimuli. However, we found no significant differences in fixation duration for any comparisons. The results suggest that infants of this age can detect subtle differences in physical characteristics among their self-face, a morphed face containing the self-face, and an unfamiliar infant's face, and demonstrate that the lower preference for the morphed face was not due to its synthetic nature. Overall, representations of the self-face seem to be formed to a certain extent by the end of the first year of life through daily visual experience.

PB-011 Young Children's Responses to Future Uncertain Events

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Prior looking-time based paradigm shows that infants around 12 months of age anticipate the most likely outcomes when dealing with uncertain events even in the absence of prior experience. Although impressive, these findings are in contrast with young preschoolers' failure of probability understanding. Even in these later stages of development, very little is known about the nature of children's probability intuitions. Can children take into account all the possible outcomes of an event? Can they combine a subset of the possible outcomes for estimating probability? With these aims, we planned experiments where preschool children were given an opportunity to catch an item dropped into an inverted Y-tube with two bottom exits by placing a moveable basket under them on a touchscreen. Ideally, all exits should be covered in order to increase the performance to the maximum. Children's performance improved across age groups; with the oldest group (5 year olds) covering both openings while the younger age groups covered only one of the exits (3 year olds). Another group of children was presented with a modified tube. This tube had additional branches such that the different arms were associated with outcomes of differential probabilities. Children's performance dropped to chance level in comparison to the previous experiment. The results imply that while young children's ability to combine a subset of possibilities is fragile, they have less difficulty accounting for all possibilities for the purpose of planning future actions.

PB-012 Crossmodal Statistical Learning in Children

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It is still unknown which learning mechanisms are predominantly used in which phases of development to extract statistical regularities from a constant stream of multisensory information. Rohlf et

al. (2017) showed that 6-months-old infants engaged in implicit learning mechanisms of crossmodal stimulus-combinations, whereas adults needed an explicit task to learn the statistical properties of audio-visual stimulus-pairs. By means of ERPs, we now addressed how children learn audio-visual regularities. Audiovisual stimulus pairs of varying probabilities were presented to 5- to 6-year-old healthy children: 'highly frequent standards' (A1V1 and A2V2, p = 0.3 each), 'rare recombinations' (A1V2 and A2V1, p = 0.1 each), 'rare deviants' (A3V3, p = 0.1), and 'visual-only' stimuli (V4, p = 0.1). We addressed possible differences by implementing two learning conditions in a between-group design: one in which the underlying crossmodal statistics were irrelevant for the task, and one in which they were made task-relevant. In both learning conditions, we found differences in ERPs between 'highly frequent standards' and 'rare deviants', indicating that the children learned the overall frequency of the sensory elements. However, differences in ERPs between 'highly frequent standard' combinations and the 'rare recombinations', indicative for successful learning of the crossmodal statistical regularity, were observed in the relevant learning condition only. Our results thus suggest that at 5 to 6 years of age, children have lost the superiority in implicitly extracting crossmodal regularities from the sensory input. Instead, they seem to use a more adult-like statistical learning that to a greater extend depends on explicit mechanisms.

PB-013 Kids only bother to probability match when they have a chance to verify their predictions

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Numerous foraging situations require taking into account distributions. Reliance on distributional cues however may manifest in a suboptimal behavior. In situations where kids have to formulate a prediction on the basis of observed possible outcomes (e.g., picking a ball from a bag of 10 green and 5 yellow balls), instead of always formulating a preference for the group making up the majority of the observations (expected utility maximization), the ratio of their guesses will match to the ratio of the possible outcomes (probability matching). In the current study, we present data that shows how this is not always the case. Specifically, we propose that preschool age children express a higher propensity to commit to a probability matching strategy if they have a chance to verify their guess. In a similar task, 5-year olds were introduced to a set of items consisting of tokens of two types with different cardinalities (e.g., 10 houses and 5 flowers). Following a hiding event, kids had to reach into the bag of items and without looking, guess what is inside their hand. In two experiments we found that kids matched to the composition of the items only on those trials where we notified them in advance that they will have a chance to check their prediction. This raises the possibility that children at this age only perform probabilistic reasoning when they have a chance to verify and thus attune their predictions.

PB-014 Can pre-verbal infants use logical negation?

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Assessing the capability of representing logical operators in early infancy can help us understanding the framework of a potentially innate language of thought and the type of operations that it may support. So far there has been little direct evidence on the existence of abstract operators in young infants however it has been established that rule learning and statistical inference are operational in the first year of life and more recently it has been shown that infants can demonstrate disjunctive-like inferences by 12 months of age.

We focused on Negation as a principal operator in formal logic and asked whether 5 month old infants can comprehend that an arbitrary word can adhere to this function. To this aim we home-trained infants on 4 arbitrary associations between pseudo-words and objects and in an ERP-EEG design trained them on a novel word with the role of a Negation concept in the following context: Label1 --> Obj 1, Label2 --> Obj 2, Label1 'Neg' --> Obj 2. Our cluster-based analyses suggest that infants after a few number of training trials can discriminate between the correct and incorrect usage of this word and moreover they show surprise if this word is being omitted in the incongruent mappings of known labels to a novel object. We further discuss the potential markers of performance in the gamma band across the training trials. Whether this word relates to a central Negation operator or to a context dependent rule shall further be examined and discussed.

PB-015 7-month-old infants detect symmetrical structures in abstract visual patterns

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Adults and children readily detect rules underlying abstract visual patterns. [Westphal-Fitch et al. 2012, Phil. Trans. R. Soc. B 367, 2007–22]. Here, we investigate whether young infants exhibit similar pattern-processing abilities. We generated square abstract tiles of varying forms and colors, and split them into two categories depending on whether they contained a circle (A) or not (B). We arranged tiles into mosaic-like sequences that followed a simple rule of strict alternation, resulting in a symmetric structure with two lengths: 3 tiles (ABA) and 5 tiles (ABABA). Two groups of 7-month-old infants saw either 8 ABA (n = 23) or ABABA (n = 24) sequences interspersed with 8 asymmetric sequences (AAB/ABB or BAABA/AABAB/ABBAB/ABAAB). Each sequence consisted of a single A and B token: AaB1Aa or AaB1AaB1Aa. Another two groups of 7mo infants (n = 24 each) saw similar sequences, but that now contained different tokens of the same category: AaB1Ab or AaB1AbB2Ac. Sequences were thus either symmetric at the token (and category) level (AaB1AaB1Aa), or at the

category level (e.g. AaB1AbB2Ac). We measured infants' spontaneous attention to whole sequences (the tiles in a 3/5 sequence were presented simultaneously). Infants looked significantly longer to asymmetrical sequences, regardless of sequence length and type of grammar (token vs category), although only when analyzing the first 8 trials. These results show that young infants readily detect symmetrical structures in abstract visual patterns. Importantly, their abilities appear to go beyond detecting identical tokens, suggesting that infants parsed the sequences' underlying structure and visual categories.

PB-016 Children's failure to consider false beliefs when ascribing intentions

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Intentions are the subjective reasons for why people act (Astington, 2001). Hence, making sense of others' actions relies fundamentally on a fully-fledged concept of intentions. One facet of intentions that needs to be appreciated is that they are aspectual; i.e. that actions are unintentional under descriptions the agent is ignorant of (Searle, 1983). For instance, as Oedipus holds the false belief that Yocasta is not his mother the action of marrying Yocasta is not intentional under the description "mother". This project examines when children's concept of intentions recognizes this aspectuality of intentions. To this aim, Study 1 and 2 compared children's (N=117) performance on structurally similar belief and intention test questions regarding analogous scenarios in which the protagonist acts on false beliefs. We found that even 7-year-old children but not adults fail to consider an agent's belief when ascribing intentions. An interesting correlation pattern suggests that although a fully developed understanding of beliefs is necessary for the appreciation of the aspectuality of intentions, it is not sufficient. However, these difficulties might not reflect a genuine incompetence but originate from linguistic pragmatics. Due to the measurement via explicit questions in Study 1 and 2, we cannot be certain that children really failed to take the agent's perspective (hence, applied a de dicto reading) or simply referred to intentions-in-actions (de re reading). Thus in Study 3, we ensured a de dicto reading by measuring children's evaluation of an aversive action that was unintentional due to the agent's epistemic state.

PB-017 Counterintuitive Cognitive Educational Strategies

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Today, there is an ever rising need to improve education. Expensive technological applications have been recommended for improving education notwithstanding the lack of empirical support for their effectiveness, whereas the potential of one inexpensive avenue has, unfortunately, been undermined. Cognitive educational psychologists have discovered strategies that significantly

boost teaching and learning, and yet these approaches are not usually announced in education nor implemented in schools. In fact, teachers often subscribe to educational practices which psychologists have established to be wrong (e.g., massing rather than interleaving examples in explaining a concept). In this talk, I will illuminate, based on recent data arising from my lab, how applying such cognitive psychological principles as interleaving (Wong, Low, Kang, & Lim, JRME, to appear), global-local processing (Tan, Lim, & Manalo, QJEP, 2017), and retrieval practice (Wong, Ng, Tempel, & Lim, J. Exp. Edu., 2019; Koh, Lee, & Lim, Applied Cog. Psych., 2018) to classroom instruction is a helpful and inexpensive strategy in achieving a variety of educational goals. Implications for the real world will be discussed.

PB-018 Linking interoception and (implicit) theory of mind – a new theoretical perspective

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How do we acquire a theory of other people's minds? Although this question has been debated for decades, theoretical approaches have only recently started to discuss the role of interoception for theory of mind (ToM) abilities (Ondobanka, Kilner, & Friston, 2017). Building upon predictive coding frameworks, these approaches argue that in order to take another person's perspective, a distinction between self and other has to be made. This distinction partly depends on interoceptive awareness (IA), the ability to perceive one's own bodily states such as the heartbeat. However, empirical links strengthening these theoretical views are sparse and focus mainly on explicit emotional ToM. Critically, a developmental perspective and considerations of implicit ToM are currently lacking in this debate. Recent empirical findings indicate that implicit and explicit ToM paradigms might measure partly different constructs that also build upon maturation of partly different brain structures (Grosse-Wiesmann, Friederici, Singer, & Steinbeis, 2016). Here, we discuss theoretical approaches and empirical results relating ToM to interoception, focusing on distinctions between explicit, implicit, and (non)emotional components. Building on this, we argue that the impact of IA on ToM differs depending on emotional components and explicitness. For explicit ToM we predict high IA to allow making a distinction between self and other more readily. However, for implicit ToM, we expect low IA to be beneficial, as less effort is needed to distinguish between self and other. Further, due to the importance of IA for emotional experience, its impact should be enhanced for tasks with greater emotional demands.

PB-019 The impact of maternal signals on emotion perception in infancy

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Within the first year of life, infants start to discriminate different emotional expressions in others. Importantly, this process does not occur in isolation but is impacted by a number of internal and external factors. I will focus on one particularly salient environmental factor, namely the presence of the infant's mother. In particular, I will present two event-related potential (ERP) studies investigating the influence different maternal signals have on emotion processing in 7-month-old infants. In study 1, infants were presented with emotional facial expressions while being exposed to their mother's odor. We recorded the EEG signal and focused our analysis on the Nc response, an attention-related ERP component that is typically enhanced in response to fearful expressions in this age group. While two control groups, who were not exposed to their mothers' odor, showed the expected enhanced Nc response to fearful expressions, this enhancement was absent if the infants could smell their mothers. In study 2, we investigated whether this effect is specific to maternal odor or also occurs for other modalities. To that end, infants again saw emotional expressions, this time while hearing or not hearing their mother's voice in the background. Preliminary results suggest that the mother's voice can elicit a similar effect as the mother's odor, namely a reduced Nc response to fearful expressions. Taken together, our findings demonstrate that signals indicating maternal presence have a strong impact on infants' responses to emotional faces, suggesting a decreased sensitivity to threat when their mother is present.

PB-020 Toddlers' communication comprehension: Equal processing demands for direct and indirect communication but differences in behavioral performance

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Making sense of others' utterances is a crucial part of human interactions and a milestone in children's social-cognitive development. However, it seems that indirect communication is more difficult to understand than direct communication.

We tested 3- and 5-year-old children (n=108) with an object-choice task, with mode of communication (direct vs. indirect) as a between-subjects factor. The children watched videos that showed puppets during their every-day activities (e.g., eating breakfast). For every activity, the puppets were asked which of two objects (e.g., cereal or toast) they would rather have. The puppets responded either directly ("I want the toast") or indirectly ("I have got jam"). Children's task was to decide which object the puppets wanted. Additionally, the children's pupil dilation was measured before the utterance (baseline), post-utterance, and post-choice.

Results show that children chose the object intended by the puppets more often in the direct- than in the indirect-communication condition ($F(1)=23.740$, $p < .001$, $\eta 2 = .190$), and 5-year-olds chose correctly more than did 3-year-olds ($F(1)=7.517$, $p = .007$, $\eta 2 = .069$). However, even though we found that children's pupil size increased between the three time points (suggesting cognitive effort when children needed to infer how the utterance related to the objects in question) ($F(1.871)=132.857$, $p < .001$, $\eta 2 = .613$, Greenhouse-Geisser-corrected), we found no effect for the mode of communication ($p = .394$). Thus, although children's object-choice performance suggests that indirect communication is harder to understand than direct communication, the cognitive demands during processing both modes of communication seem similar.

PB-021 Show me something new! – the role of manual-gestural items in children's understanding of labels

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One crucial ability in early language development is mapping a label to its referent. Studies suggest that at the onset of language acquisition, infants can link different kinds of labels – words, sounds, pictograms, gestures – to objects (Namy&Waxman,1998; Woodward&Hoyne, 1999). However, as experience with spoken language increases, hearing toddlers and preschoolers prefer conventional linguistic forms over gestural items, and reject arbitrary gestures as labels (Suanda&Namy,2013; Marentette&Nicoladis, 2011). Here, we asked whether in contexts in which manual-gestural labels are part of a linguistic system – Sign Language (SL) – preschoolers would treat these as object names. In the exposure group, children (N=17,Mage=5.1) watched a short conversation involving SL and a spoken language, while in the nonexposure group (N=17,Mage=5.2) only spoken language and nonlinguistic gestures were used. Afterwards, both groups performed a task consisting of a teaching phase and a mutual exclusivity (ME) phase, while the experimenter used only gestures. In six teaching trials, children were shown four unknown objects, and two (ObjectA, ObjectB) were labelled with a gesture. Then the experimenter requested either ObjectA or ObjectB. In the test, the experimenter introduced two objects: one new, and the other from the previously labelled objects. Afterwards, the experimenter asked for the new object (using a new gesture-ME trial) or the labelled one (using the just-learned gesture). Preliminary results suggest that both groups performed above chance on the ME trials ($p<0.001$), successfully mapping the new gesture to the new object. Follow-up studies target the role of exposure in more difficult tasks.

PB-022 What is the baby "saying"? Adults' interpretation of infants' pointing gestures

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Harvard University

Infants' pointing gestures emerge early in life, typically between 10 to 12 months. Although psychological studies have suggested that infants may use pointing gestures to express various communicative intents, such as declarative, informative, requestive, and interrogative intents (Bates et al.,1975; Harris, 2019; Tomasello et al., 2007), it remains unclear whether adults interpret infants' pointing gestures as requests, declaratives, or questions. Moreover, studies have shown considerable individual differences among adults in their responsiveness to infants' points (Ger et al., 2018), but little is known about the factors that might explain such variability, such as variability in adults' interpretations of pointing gestures. The current study explored how adults interpreted infants' pointing gestures and whether adults' responses to those gestures align with their interpretations. In the pilot study, adapting the Human Simulation Paradigm (Cartmill et al., 2013), we showed 28 short video clips ("vignettes") of adult-infant interactions to 58 adult participants and asked participants to interpret the pointing gestures featured in the vignettes. From the pilot study, we selected five prototypical vignettes of pointing gestures, each representing a communicative intent identified in the psychological literature. In the main study, 76 adults watched the five vignettes, interpreted the pointing gestures, and indicated how they would have responded to those gestures. The findings indicated that on average, adults could reliably interpret infants' intents expressed through pointing gestures. Moreover, adults' self-reported responses to pointing gestures aligned with their interpretations, thus providing preliminary evidence that adults' interpretations of infants' pointing gestures drove their responses.

PB-023 The development of simile comprehension: From comparison to scalar implicature

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Preschool children have difficulty deriving scalar implicatures. For example, they may fail to appreciate that 'Fred ate some of the cookies' means that he ate some, but not all of the cookies. Here we tested preschoolers on a new type of scalar implicature: if someone says 'Betty is like a nurse', they would often imply that she is not a nurse – otherwise they would use the stronger, categorization statement 'Betty is a nurse'. Experiment 1 investigated whether preschoolers derive this kind of scalar implicature using the game 'I spy with my little eye' with children 3, 4, 5, 6 and 13 years (N=99), who were given metaphors ('Lucy is a parrot') or similes ('Lucy is like a parrot') as clues and had to select one of three drawings (a parrot, a girl or a parrot-looking

girl). Experiment 2 (ages 3, 4, 5 and adults; N=201) focused on the simile condition using photographs instead of drawings. Results revealed a developmental trend in the derivation of scalar implicatures, starting as early as 3 years in the photograph condition. Young children might derive higher rates of scalar implicatures with similes than with other scalar expressions because categorization and comparison statements (e.g., 'A whale is a mammal' or 'A clementine is like an orange') are likely to be highly frequent in child-directed speech. The results therefore support the view that children's difficulties with scalar implicatures need not stem from their limited pragmatic abilities, but from the protracted acquisition of alternative expressions and their scalarity.

PB-024 "Umm…": When children do and do not infer knowledge based on disfluency

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As children begin to track other agents' knowledge, they must learn to rapidly infer who knows what and how much. Language provides a rich data source to judge knowledgeability (e.g., Koenig & Harris, 2005). However, it is not simply what one says that conveys information, but also how one says it. Adult listeners use speech disfluencies (e.g., "uh") to infer speaker knowledge (Brennan & Williams, 1995). In pilot data (n=44), we demonstrate that children ages 4-9 use disfluencies to infer knowledge. In the knowledge disfluency condition, children are presented one speaker who fluently labels a familiar animal ("This one is a cat") and one who produces a filler before the animal label ("This one is a… uh… dog"). Asked which speaker knows more about animals, 81% of children (18/22) reported that the fluent speaker knows more. Is this because children think "uh…" always signals a lack of knowledge? To test this possibility, in the ignorance disfluency condition, children are presented one speaker who fluently claims ignorance ("I don't know"), and one who produces a filler prior to answering ("Uh… I don't know"). In this context, disfluency may signal greater knowledge. Indeed, only 41% of children (9/22) now chose the fluent speaker as more knowledgeable about animals-- demonstrating that children recognize that disfluencies do not always signal incompetence. We are currently examining age differences in a preregistered replication (planned n=120). This work demonstrates that children use the way a speaker talks and the utterance context to infer knowledgeability.

PB-025 Children's goal-driven information search

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What properties are important when deciding what player to team up with or bet on – their speed, strength or cleverness – depends on the game. Indeed, to find the best player, one must tailor the

information search to a specific goal. This paper investigates how this adaptiveness develops across childhood. We presented 106 children (3;0–7;0) with several trials, introducing a game (i.e., throwing a ball into a bucket; jumping a hurdle) and two monsters, with arms and legs hidden. Children had to predict which monster would succeed at the given game. To do that, they had to decide whether to reveal the monsters' arms or legs, knowing that monsters needed long arms to hit the bucket, and long legs to jump the hurdle. Our results show that children's adaptiveness, i.e., their ability to select the most relevant piece of information and to tailor their search to the given goal, steadily increases with age (Pr(correct choice) from .58 [3;0–4;0] to .87 [6;0–7;0]), becoming better than chance at age 5;8. The accuracy of children's choices improved across trials of the same type (arms or legs), but this learning did not generalize to the other game. In an ongoing follow-up, we investigate whether children stop searching when all the information relevant to the goal has been collected.

PB-026 Cost-efficiency is not expected from communicative actions by 8-month-old infants

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Communicative actions, like all actions, incur some cost upon the agent. However, unlike instrumental goal-directed actions, which are usually performed cost-efficiently, the meaning of communicative actions is typically not related to the cost of performing their conventional form. Observers should, therefore, be able to relax their efficiency assumption when confronted with communicative actions. We tested this hypothesis in infants by adopting the looking-time paradigm of Brandone and Wellman (2009). In the instrumental condition, we familiarized 8-month-olds to videos of an actor efficiently reaching for and grasping an object in an arcing manner above a barrier. In the communicative condition, after addressing the infant, the actor performed an identical action, but the barrier was placed behind the object such that the arcing reach appeared instrumentally redundant. In the test phase, infants in both conditions observed the actor reaching either directly or in an arcing manner toward the object while the barrier was removed. Our prediction was that whereas infants in the instrumental condition would look longer at the inefficient arcing reach (confirming earlier findings), infants in the communicative condition would exhibit the opposite looking-time difference. This pattern of results would indicate that, in communicative contexts, infants are more open to encoding seemingly inefficient actions as potentially meaningful gestures. Data collection is ongoing.

PB-027 Together is better. 14-month-olds' expectations about coordination

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Interpreting others' actions and inferring preferences from their choices is indispensable for social learning. Infants expect agents to maximize their utility, that is to minimize their costs when pursu-

ing a goal. Based on the observable costs that agents are incurring when performing an action, infants can infer their preference for a given goal. But not all choices adults make in action planning can be fully accounted for by utility maximization. For example, adults' choices seem to be biased towards performing joint actions, rather than individual actions, even when there is no observable advantage to those. This suggests some additional (unobservable) reward assigned to coordination. Here we investigate whether infants likewise assume joint actions more rewarding. 14-month-old infants watched animations showing a simple scenario where an agent can pursue the same goal in two different ways, either by choosing to engage in a joint action with a partner, or to perform the task alone. We hypothesized that if infants, like adults, expect additional rewards in joint compared to single action, they should be surprised if the agent chooses to act alone. Looking-time results from 24 infants (within-subject) showed that infants looked significantly longer at individual vs. joint trials (average looking time in joint action trials = 5.024 sec, SE= 370; in individual trials = 8.315 sec, SE=533). These results suggest that as early as at 14-months of age, infants expect that doing things together with a partner is more rewarding than achieving the same goal alone.

PB-028 Ten-month-olds' representations of utility in goal selection

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The naïve utility calculus theory argues that humans view agents as utility-maximizers, who act in a way that minimizes action costs and maximizes rewards. While a wealth of research shows that infants expect agents to realize outcomes in the most cost-efficient way possible, not much work has examined whether they expect agents to select the highest-utility outcome among those available. In three studies, we tested whether 10-month-olds expect an agent to maximize her utility by (a) bringing about the outcome which would yield higher rewards (operationalized as larger number of goal objects) than another, given identical action costs (Study 1: n = 24), and (b) bringing about the outcome which would require less effort than another, given identical rewards (Study 2a: n = 24; Study 2b: ongoing replication). In Study 1, after being familiarized with an agent approaching object A over B, infants looked longer at test when the agent approached three tokens of object A over one, compared to when she approached a single token (as in familiarization). In Study 2a, after being familiarized with an agent approaching an object by jumping a wall of variable height, infants did not look longer at test when the agent, facing a choice between two identical goal objects respectively located behind a high or low wall, selected the former. These results suggest that infants may fail to use common assumptions about reward computation ("more is better" or "identical objects are of identical value") in the domain of action understanding.

PB-029 Interpersonal causality during the observation of interactions at 10 months of age

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From very early in life, infants acquire social and instrumental skills by observing people engaged in motor and interactive tasks. The understanding of cause-effect relationships that give origins to interactive scripts (e.g., give-and-take interactions) is essential for successfully navigating the social world. The literature on the perception of causality has shown that 10-month-olds encode the systematic association between actions performed on an object and auditory outcomes (Perone et al., 2011). No study addressed whether causality encoding is also present in social interactive situations. Therefore, we investigated whether 10-month-olds can link human gestures to specific outcomes during the observation of 2-sec videos of interactive exchanges. We used a double-habituation paradigm: infants were first habituated at one specific association between a neutral action and a vocal reaction of a second person (e.g., touching the nose of the partner with the finger + "eehh" reaction), and then at a second one (e.g., touching the cheek of the partner with the palm + "aahh" reaction). In the test phase, infants watched one of the two habituated videos (familiar), a video with a reversed action-reaction association (violation) and a novel video, the latter two in counter-balanced order between infants. Preliminary data indicate that 10-month-old infants are habituated by the double procedure and can link specific actions performed in an interactive context to specific outcomes. This suggests that action effects play an important role not only in the case of actions involving physical objects, but also in the case of social actions performed by human agents.

PB-030 Can observing adults' persistence enhance attention in infants?

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How could children learn the "value of persistence" has received considerable attention in recent years. A study showed that infants' persistence behaviour were affected by observing the adults' persistence behavours (Leonard, Lee, & Schulz, 2017). In the present study, we examined whether infants' attention is affected by observing the adults' persistence (effortful) behaviours. In a between-subject design, 50 12-to13-month-old children (M=12.38, SD = 0.57) were randomly assigned either effort (n = 23: an adult model achieved the goal after 30 seconds later) or no-effort condition (n = 27: the model achieved the goal after 10 seconds later). Using the eye-tracker, children were presented the effort or no-effort stimuli, followed by looking version of a cognitive control task. In the cognitive control task, we measured an anticipated looking to a target box where the animal was occluded or to a non-target box where no-animal was occluded. The results showed that infants in the effort condition were likely to be the anticipated looking at the

target box than those who in the no-effort condition. However, no difference in the anticipated looking at non-target box between condition was found. Our results may provide the new evidence that infants attention may be affected by observing the adults' persistence behaviours.

PB-031 Prosocial and psychological reasoning on protective interventions toward third parties at 17 months

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This study investigates whether 17-month-olds evaluate other's actions by attending to their interventions aimed at protecting a victim by an aggressor. Using a violation of expectation paradigm, we examined whether infants would selectively expect a bystander to help a protective agent or non-protective agent. During the familiarization phase, infants look at events in which negative interactions or contacts involving third parties were presented, while a bystander watched these interactions. In the first experiment, an aggressor pushed up a victim (negative social interaction); in the second, two inanimate spheres collide performing inanimate motions (inanimate collision); in the third, a victim was stung by the contact with a spiny plant (negative physical contact). In the two test trials, the protective and non-protective agent needed assistance to enter into a box, and the bystander helped either agents. Infants' looking times toward the two displays were recorded. Results showed that infants detected a violation when the bystander helped the non- protective agent only in the first experiment. Following visual test trials, we used a manual choice task to investigate infants' personal preferences. The results revealed that infants attend to the outcomes of protective interventions to evaluate agents' actions, reason about bystanders' dispositions and prefer the protective agent. The findings support a developmental continuity and provide further evidence of an early and rich interplay of both prosocial and psychological reasoning.

PB-032 Reading from the eyes - First results of a new mentalizing task for deaf children

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In our everyday life we constantly attribute mental states to ourselves and to others. Neurotypically developed children are able to attribute mental states from the age of four, and from that age, they can pass the false belief task as well. In case of deaf children of hearing parents, there is a delay in the development of mindreading compared to hearing children of the same age. In this study we applied a modified version of the Eyes test: the test contains six short stories paired with the six basic emotions. The children's task is to tell how the protagonist was feeling (mentalization task), and then to choose his or her eyes' picture (emotion task).

Compared to hearing children, deaf children of hearing parents performed significantly worse on the verbal part of the test (naming the emotion), while there was no significant difference between the two groups in case of choosing the right eyes for a certain emotion. Our result suggests that deaf children of hearing parents can read emotions from the eyes of other people just as good hearing children, but they seem to struggle with the labeling. This might result from their disadvantage in verbal tasks, the stories might have been too difficult for them, so in further studies we have to modify the stories, too, to make them easier to understand.

PB-033 When do Children appreciate the Subjectivity of Desires?

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Recent empirical (Smith & Warneken, 2014; Yuill et al., 1995; Priewasser et al., 2013) and theoretical work (Perner & Roessler, 2010; Perner et al., 2018) cast substantial doubt on the view, that children understand desires ontogenetically earlier than beliefs (asymmetric view). Assuming a teleological reasoning strategy, they argue that the evidence supporting an asymmetric development can be explained by a goal-directed objective reasoning strategy. The ability to really appreciate desires as subjective conative states requires overcoming the notion of objective desirability which develops in tandem (symmetric) with the subjective notion of belief. The present project compared children's understanding of wicked desires, which due to their conflict with objective desirability requires subjective reasoning, to neutral desires, which can be ascribed employing an objective reasoning strategy. Avoiding indirect measurements of earlier studies, we assessed children's understanding via memory-for-complements-tasks. These confront children with protagonists expressing propositional attitudes (here: wicked and neutral desires) that later turn out to be false/unfulfilled (DeVilliers & Pyers, 2002). Children fail repeating propositions for states they do not yet have a concept for (Perner et al., 2003). The results show that children between two and four years (N=60) were proficient in ascribing wicked desires even though they failed the false belief task and thus point to an asymmetric development. However, the interpretation of the earlier understanding for desires is constrained because children were not able to ascribe neutral desires earlier than beliefs. Future research will again investigate this pattern with an increased relevance of neutral desires.

PB-034 How many observations is one generic worth?

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Generic language (e.g., "Birds fly") conveys generalizations about categories and is a simple and ubiquitous way of learning beyond direct experience. The meaning, and hence the belief-updating

capacity, of generic language is hard to specify however (e.g., penguins don't fly), owing to extreme forms of content and context-sensitivity. Tessler & Goodman (2019) proposed that generics are a kind of vague quantifier (a la "some", "most") which operate over richly structured prior knowledge. Their computational model is mathematically equivalent to simple Bayesian belief-updating based on a single positive example. This rather surprising mathematical connection between learning from generic language and learning from observations suggests a developmental mechanism for meaning acquisition, namely: semantics can co-opt more basic mechanisms of belief-updating from observations. Relatedly, Csibra & Shamsudheen (2015) argue that generics are an inherently non-verbal but pedagogical phenomenon, which can be understood by prelinguistic infants via intentional reference to a member of a kind. In a quantitative study with adults, using a diverse set of stimuli covering a range of prior beliefs, we compare the belief-updating capacity of generic language to that of single observations, both presented pedagogically and incidentally. We find that generics convey stronger generalizations than single observations even when presented pedagogically (which we operationalize in two distinct ways), raising new questions about the contextual parameters that would support learning generic-like generalizations from pedagogical demonstrations in infancy and early childhood.

PB-035 Diving deep - mechanisms of children's lexicon development in circumscribed domains

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The meaning of a word and the boundaries of that meaning are determined by the meaning of the words belonging to the same semantic domain. Children need to learn a cluster of words in the same semantic domain and delineate the boundaries among them. This is particularly critical for concepts that do not have natural partitions (as compared to object names) like for example emotion labels or color names. In this project, we describe the acquisition of the lexicon in circumscribed conceptual domains across childhood development and investigate the linguistic, individual and social factors which influence this development. In a cross-sectional design, we assess the production of emotion words and of color words. Analyses are conducted by multidimensional scaling and regression analysis with covariates: age, gender, general vocabulary, SES, word specific input frequency and word specific difficulty. For emotion words, we tested German monolingual children from age four to eleven (N = 120) and adults (N = 30, M=37 y). For color words, we tested children from age three to nine (N = 86), and adults (N = 26 , M = 23 y).

Using multi-dimensional scaling analysis, we calculated the distances between the domain specific words and compared categorization patterns between age groups. We find very different patterns of development for emotion and color words. Color words are learned earlier and more quickly than emotion words. Regression analysis show effects of word difficulty as well as individual factors like SES.

PB-036 Increased lexical competition effects in children with Autism Spectrum Disorders

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There is ample evidence that children with Autism Spectrum Disorder (ASD) and children with Developmental Language Disorder (DLD) have reduced lexical knowledge, and there is evidence that children in both groups have atypical phonological processing. However, it has not yet been examined how children with ASD and children with DLD matched on their receptive vocabulary process novel words that sound similar to familiar nouns. Seventy-four children (aged 5-8) participated in the study: 24 in the ASD group, 34 in the DLD group and 20 in the typically developing group. Children heard a novel word while viewing a screen containing pictures of a novel and a familiar object. The noun of a familiar object was a phonological competitor to the novel word. Participants selected the referent while eye-movements to each picture were monitored as a measure of lexical activation. We examined whether children perceive phonological alterations of familiar words and whether they spontaneously interpret such perceptible phonological variants as novel words or as mispronunciations. We found that children in two clinical groups selected a familiar object instead of a novel object more often than their TD peers. Moreover, children in the ASD group had difficulty in suppressing phonological competitors as revealed by the analysis of eye-movements towards the competitor. Surprisingly, word-to-referent mappings in both clinical groups proved faster than in children in the TD group, which suggests that children with ASD and children with DLD encode new word-referent pairs less efficiently than their TD peers.

PB-037 Learning the number sequence: preschool children make sense of numbers

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Learning how symbolic numbers represent exact quantities is a cornerstone in the development of early numeracy skills. We explored how the mastering of different numerical concepts relate to symbolic magnitude knowledge, as assessed in number comparison tasks. We used a give-a-number task to classify preschool children in subset-knowers and cardinal-principle (CP) knowers. We implemented a direction task to assess children's understanding of the directional property of the counting list: that is, adding one item to a set leads to the next number word in the counting list (i.e., successor knowledge) whereas removing one item leads to the preceding (i.e., predecessor knowledge). We used a numerosity estimation task to evaluate children's understanding that later number words in the counting list are associated with larger numerical quantities (i.e. later-greater principle). We also used

different tasks to assess children's knowledge of the (spatial) ordinal arrangement of numbers (e.g., 1-2-3-4-5-...). Across multiple studies, our findings highlight that CP-knowers master the successor, but not predecessor knowledge. Some CP-knowers may adopt a "blind" counting forward strategy when solving the give-a-number and direction tasks without fully understanding the directional property of the counting list. Children's mastering of the predecessor knowledge and the ability to order numbers spatially relate to number comparison skills whereas the later-greater principle has a marginal role. In this vein, the directional property of the counting list and the spatial arrangement of numbers scaffold the understanding the magnitude relation between numbers.

PB-038 Properties of early vocabulary development in Japanese-English bilingual children

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Previous studies have shown that the vocabularies of bilingual children are lower than those of monolingual children when assessments are done in just one language (Hoff et al., 2012). In this study, we conducted a detailed item-based analysis for both languages that focused on how Japanese-English bilingual children acquire both vocabularies. We used the Japanese monolingual vocabulary data of 2,417 children aged 9-45 months, the American English data obtained from Wordbank, and our bilingual data obtained from 18 children aged 14-52 months whose parents are Japanese or English. Although the English vocabularies of the bilingual children are very small, the differences of the Japanese vocabularies between bilingual and monolingual children shrinks as the vocabularies increase. The total (English+Japanese) vocabularies of bilingual children are almost the same as monolingual children. We divided the words in the vocabularies of the bilingual children into three types: words only in the Japanese vocabularies (WJ), words only in the English vocabularies (WE), and words in both (WB). Then we calculated the proportions of these words for each child. The WJ proportions were the highest, and the WB proportions were no more than 10%: fewer than 100 words. However, the WB proportions increased as the vocabularies increased. This indicates that the vocabularies in Japanese and English do not overlap at the initial stage, and the vocabulary in the more environmental predominant language (the one that provides more input to the children) is acquired earlier.

PB-039 Spelling words at the end of first grade: Is it easier to spell after hearing the word than after seeing its image?

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Learning to spell is a very difficult but essential task for children learning to read, who spend a lot of time writing words at school. As some studies showed that spelling performance of adults is

modulated by the type of task (e.g., Bonin & Méot, 2019), it is important to know whether the type of task also influences the children performance. This study focuses on the performance of French students in first grade on two spelling tasks: written naming and spelling to dictation. We hypothesize that it is easier for them to activate an orthographic representation from a phonological one than from a semantic one. Then, we expect that the dictation task leads first graders to make fewer errors and have a shorter response time compared to the written naming task. 77 students in first grade successively had to write words on a tablet with a keyboard, from their corresponding pictures (written naming) and from their spoken presentation (spelling to dictation). The order of presentation of the conditions and items was counterbalanced. The presentation times of the pictures matched with the listening time of the words dictated. The number of correctly spelled items and response time were measured. The results are currently being analysed. We will discuss the results on both a theoretical and a practical perspective. A difference of performance between the two tasks could have consequences on the spelling acquisition models. Moreover, it could have strong implications on first grade pedagogical practices.

PB-040 Plant food avoidance in infancy

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Food neophobia is an important component of the development of food learning. Food neophobia is particularly strong for plant foods such as fruits and vegetables and peaks in early childhood, making it an impediment to establishing healthy eating habits. Here we investigate a potential precursor to food neophobia in infancy and explore, for the first time, the effects of cues of processing on infants' avoidance of plants and plant foods. To do this, we presented 7- to 15-month-olds (N=56) with whole plants, processed plant foods, and non-plant food controls (starchy foods, novel artifacts, and naturally-occurring objects). Consistent with the proposal of a precursor to food neophobia in infancy, our results showed that infants avoid touching both plants and processed plant foods, relative to their matched non-plant food controls. However, infants still take longer to touch whole plants than processed plant foods, suggesting that cues of processing may act as signals that plant foods are safe to eat because another person has actively prepared the plant product for consumption. In a context of growing concern over the lack of children's dietary diversity, this provides a basis for constructing interventions targeted at increasing the consumption of fruits and vegetables during this critical developmental stage.

PB-041 How do children and adults represent temporal and numerical magnitudes in space?

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According to A Theory Of Magnitude, mental representations of at least time, space, and number interact because they are processed in a similar fashion by a generalized magnitude system. Following previous findings, smaller numbers, shorter durations, and words describing earlier points in time should be associated with left, lower, and rear space while larger numbers, longer durations and later points in time should be associated with right, upper, and front space. However, these findings regarding the spatial representation of temporal and numerical magnitudes are not entirely consistent. This might be due i.a. to differences in the age group tested, the aspect of the operationalized concept, and the allowed response-format. Furthermore, multiple spatial dimensions have rarely been compared intra-individually. We measure spatial representations of temporal and numerical concepts A) on coordinate-axes (horizontal and vertical) and B) on body-axes (lateral and sagittal) in closely matched tasks. In addition, we vary conceptual aspects within time and number, i.e. linguistic exact stimuli (“tomorrow”, “seven”), linguistic vague stimuli (“later”, “many”), and non-linguistic stimuli (sounds, differing in numerical and temporal magnitude). Moreover, we compare these spontaneous spatial representations in pre-schoolers, school-aged children, and adults. The main questions concern the development of spatial representations of abstract concepts in humans and the consistency of representation formats within and across concepts. Preliminary results show a general tendency of school-aged children and adults for horizontal representations. Intra-individual patterns and implications of our preliminary data for the idea of a shared representation within a generalized magnitude system will be discussed.

PB-042 Scale Errors Are Induced by Associating Functions to Categories of Objects in 3-year-old Children

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It has been suggested that children’s proneness to commit scale errors originates from their propensity to reason about artifacts as existing to fulfill a specific function. In this view, children overlook size information because they focus on the function with which the given tool category is associated. However, it has not been directly tested whether categorization indeed plays a part in the phenomenon. In this study, 3-year-old children (n=51) were presented with object sets consisting of a target and a potential tool to bring about a certain goal. First, a model demonstrated the object

functions. After this, children were handed the object sets, however, the sets contained an important alteration. In the experimental condition, the original tool was replaced by one that differed in two characteristics from the original one: it was differently colored and was oversized. In the control condition, the oversized tool was the same color. Children were also provided with a novel, affordant tool. Participants committed scale errors both when the oversized tool was otherwise identical to the original one (41%) and when it was a different color (48%). These percentages differed significantly from a baseline (24%) where the goal was merely pointed out to children but there was no function demonstration. The results show that scale errors can be attributed to children's tendency to generalize object functions from a single demonstration.

PB-043 Young children's active use of pedagogical cues when they teach object part names to others

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Young children are sensitive to ostensive cues and receptively use these in learning. However, how children actively use such pedagogical cues themselves to teach others is rarely investigated. We examined typically developing 18 3-and 17 5-year-olds' ability to recognize and control ostensive cues using the "teaching part names paradigm" that we originally developed. We also analyzed 3 preschoolers with ASD as preliminary data using a similar paradigm. Two types of the experimenter's eye gaze directions, Object Part and Child's Face, were used to examine the effect of adult eye gaze direction. The experimenter asked the child to learn a "foreign" word for an object part and to teach the word to another adult. Then the experimenter showed the child an object set (a bear that holds a patrol car) and taught a foreign word about the object part (the tire of the patrol-car) using appropriate pointing gesture with tapping the part. Then the child was asked to teach the word to an adult who didn't know the word. The child's teaching behavior and the direction of the puppet's front when the child taught were analyzed. The study showed that the TD children could teach object part names to others using appropriate pointing gesture only when the original information was given to the child with appropriate adult eye gaze to the object part. The ASD children were generally good at showing the right direction of the puppet, however, they rarely used appropriate pointing gesture in both eye gaze conditions.

PB-044 Is music an evolutionary adaptation? Effects of listening to music on social interactions in preschool children.

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Music exists in all human cultures, and evolutionary biologists have suggested that musical capabilities may have spread in humans because music promotes group cohesion (Roederer, 1984; Dunbar, 2017). Consistently, developmental psychologists have found joint music production to increase children's empathy (Rabinowitch et al. 2012), helping behaviors and cooperation (Kirschner & Tomasello, 2010). However, to date, the effects of listening to music on prosociality are still unknown, and the specific properties of music involved in this relation are unidentified. In 2017, we have conducted a comparative experiment with children and cockatiels (a species of social birds capable of vocal learning) in order to explore the relationship between music and prosociality, and to better understand the origins and biological functions of musical capabilities. In children, we observed significantly more social interactions during a cooperation task between participants who heard consonant music as compared to participants who heard dissonant music or a control noise. In cockatiels, we observed a significant decrease of agonistic behavior in presence of music (consonant or dissonant), and an increase in spatial proximity between individuals in presence of consonant music. Listening to music thus promoted positive social interactions in both species. However, it remains unclear whether a shared musical experience promotes prosocial behaviors only between individuals of the same group who share this experience, or whether it also includes other people. Thus, we have recently conducted another experiment in which dyads of children (age 3 to 6) were exposed either together or separately to either music or a control noise. Then, all dyads were tested for prosocial behavior using three tasks : a sharing task, a cooperation task and a helping task. Again, children who listened to music were more prosocial than children who listened to a control noise. On going analyses are conducted to test whether children who listened to music together were more prosocial than children who listened to music separately. This would support the idea that musical capabilities may have evolved in humans (and some other species) as music promotes group cohesion and communication between individuals within a social group.

PB-045 Telling a story improves counterfactual reasoning in 4-year-old children.

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Imagination and fiction could be regarded as tools for practicing counterfactual reasoning (e.g., Byrne, 2016; Walker & Gopnik, 2013). In this study, we examined whether a short training involving the creation of a story can improve counterfactual reasoning in 4-year-olds. N=36 children participated

in an experimental study with two conditions (storytelling condition and game condition; between-subjects). In the training phase, children in the storytelling condition were presented with pictures displaying phantastic scenes. The experimenter encouraged the child to tell a story about the scenes (e.g., "imagine what could have happened here" / "how do you think this will continue"?). Children in the game condition played a sorting game with the experimenter and received prompts and questions regarding the game (e.g. "what can we do with this?" / "let's try the blue ones"). The time spent on the task (5.5 minutes) and overall amount of interaction was kept equal in both conditions. In the test phase, both groups received tasks for conditional counterfactual reasoning and syllogistic reasoning from false premises. First results indicate that children in the storytelling condition performed significantly better in answering counterfactual questions based on conditionals and syllogisms than children in the game condition. This suggests that the imaginary activity involved in creating a fictional story may help children to think counterfactually, even after just a brief training episode.

PB-046 Own-age effect on emotional face detection

Virág Ihász, Cintia Bali, Júlia Basler, Rebecca Cseh, Diána Stecina, András Norbert Zsidó
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A large body of research studies the reflection and reactions to emotional faces in children. The majority argue that threatening stimuli, namely angry faces evoke the fastest reactions – similarly to studies with adults. Their argumentation is based on that it is inevitable to notice threatening stimuli, mostly due to evolutionary considerations. Regardless of using a specific or non-specific modular approach, the results were corresponding. However, more recent studies showed that we give faster reactions to happy faces than threatening stimuli. A similarity of these studies is that independently of the subject's age they used adult faces. Thus, our goal was to observe whether angry or happy faces are found faster if we match the age of the models seen to the age of the respondent. We used emotional faces of adults and children to see if there is a difference between seeing same or different age faces. An odd-one-out visual searching task was used for the research. The participants had to find a distinguished emotional face in a neutral crowd. The emotions used were happiness, fear, and anger. In order to increase the reliability of results, we used a touch screen monitor to measure reaction times. We found a happiness superiority in detection for both age groups. When adults saw children and same-age faces, they found happy faces the fastest, but there was no significant difference between angry and fearful faces. As for the children, finding of the fearful was the slowest, but further accumulation of data is in progress.

PB-047 The influence of observation on children's emotions to seeing a needy peer receive help

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Young children show positive emotions, for instance indicated through an elevated body posture, when helping others (Hepach, Vaish, & Tomasello, 2017). Here, we asked (a) whether children show similarly positive emotions when seeing a needy peer receive help, and (b) whether children's emotions depend on the presence of observers and are thus strategically motivated. To this end, 5-year-old children (N=49 out of planned N=64 dyads; data collection ongoing) played a game with a same-aged peer, by the end of which one child (the needy child) possessed less game tokens than the other (the non-needy child). In a 2x2-design, we then manipulated which child received a final game token from a naïve adult, the needy child (congruent helping) or the non-needy child (incongruent helping), while the other received a useless rag. Subsequently, we measured children's body posture using a Kinect camera and manipulated—only for the non-needy child—whether she could be observed. Analyses focused on the non-needy children's posture. Preliminary results indicate that children's postural elevation increased while walking towards the Kinect only in the Observed Congruent condition. Our findings suggest that young children integrate both self- and other-regarding motives when seeing a needy peer receive help. In addition, consistent with prior work from our lab (Gerdemann et al., in preparation), and the view that emotions provide proximal motivations to solve problems of adaptive importance (e.g., Nesse, 1990), the expression of elevation appears to be strategically motivated. By the date of the conference data collection and analyses will be completed.

PB-048 The role of spontaneous versus purposeful joint attention in pro-sociality

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AIMS & HYPOTHESES

Joint attention has been linked with a myriad of positive social outcomes throughout childhood. We investigated whether spontaneously (Experiment-1) and purposefully (Experiment-2) joining attention with a social, rather than a non-social, partner during a finger-tapping task would yield increased pro-sociality as measured by (a)desire to be physically closer to the partner, and (b)mimicry of the partner's behaviours. While both proximity and mimicry are implicit pro-sociality measures, the proximity measure requires self-report, therefore bringing the pro-social intent to the respondents' consciousness.

METHODS

Fifty-four children aged 4.5-14 years (Mage=8.79, 27F, nExperiment-1=29, nExperiment-2=25) par-

ticipated. The finger-tapping task and the pro-sociality tasks were administered thrice (baseline, social, non-social). In the social (non-social) condition, children played the finger-tapping task with another adult (a bouncing ball). For the proximity measure, children placed the adult as close to themselves as they wished in hypothetical scenarios (e.g., waiting room at a train station). For the mimicry task, children played a picture guessing game, during which they could mimic the adult's behaviours (e.g., rubbing forehead).

RESULTS & DISCUSSION

Experiment-1: Spontaneously joining attention with the social, compared to the non-social partner, led to increased mimicry ($p=.0001$) but not to increased proximity.

Experiment-2: Purposefully joining attention with the social, compared to the non-social, partner led to increased pro-sociality in both proximity and mimicry measures ($ps<.05$).

These findings suggest distinct cognitive pathways for aspects of pro-sociality: While merely joining attention is sufficient to yield increased behavioural mimicry, purposeful joint attention may be needed for increased pro-sociality in self-report measures.

PB-049 Children's sharing of real and symbolic resources

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Children are more willing to share low value resources than high value resources (such as different stickers or food items; e.g., Blake et al. 2015; Blake & Rand, 2010). While all these items represent real resources although of different value, it remains an open question how children would react when sharing "symbolic" vs. real resources. The present study investigated whether children share differently depending on whether the resources possess a real or a symbolic value, and can only later be exchanged for real resources. In a within-subjects design, we let 83 4- to 6-year-olds share real (stickers) and symbolic (dots made from paper) resources with an anonymous counterpart. In line with our expectations, children shared more symbolic than real resources, $F(1,81) = 57.4$, $p < .001$, $\eta p2 = .42$. More specifically, children shared about half of their paper dots, but only one third of their stickers with the anonymous counterpart. These proportions correspond to those observed when sharing low and high value resources (Blake & Rand, 2010). Hence, children stuck to the equality rule when sharing the paper dots, while they acted more selfishly when sharing the stickers. Children's age was not related to their sharing behavior. Explanations for the difference between real and symbolic representations of resources are discussed.

PB-050 Children's stances toward resources shape the development of fairness

David Buttelmann

University of Bern

It has been proposed that the increase in fairness with children's age is shaped by the development of other-regarding preferences. Here we investigate the hypothesis that it is the development of stable stances toward resources that shape the increase of fairness. As they mature, children develop stable stances toward resources that help them estimate the costs involved in sharing. Once children can estimate these costs, they can identify low-value resources (that involve low costs when sharing) and start to increase their fair allocations with these. In this study, 4-8-year-olds (N=129) ranked resources before and after they allocated them between themselves and a hypothetical same-aged child. When allocating (12 trials), they could make either egoistic (2,0) or fair choices (1,1) by putting the resources into the appropriate containers. Results show that the stability of children's stances toward resources increased with age. This stability of stances had a significant effect on children's sharing behavior: While younger children were relatively unstable in their preferences and allocated resources indifferentially (fair allocations in about 50% of trials), older children held more stable stances and made more fair allocations. However, they only did so with medium- and low-value resources. No increase in fairness occurred for high-value resources. These results demonstrate that the increase in fairness from kindergarten to elementary school age depends on the stability of children's stances toward the to-be-allocated resources. The more stable children's stances are and the less children value a resource, the more likely occurs an increase in fairness with children's age.

PB-051 Children's Biased Preference for Category Information about Out-Groups

Meytal Nasie[1,2], Gil Diesendruck[3]

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The tendency to evaluate those similar to oneself – the in-group – more favorably than those different from oneself – the out-group, is a prevalent social phenomenon that may have destructive effects on intergroup relations. Developmental work shows that such a bias is present already in young children, and perhaps even infants. Crucial questions, therefore, are where do these biases come from, and how can they be remedied. We investigated a potential conceptual foundation for such a bias, namely, the tendency to construe out-groups as homogeneous sets. In particular, we assessed whether Jewish-Israeli children manifest biased preferences regarding the scope of information (individual vs. category) they prefer to receive about in-group ("Jews") and out-group members ("Arabs" as "conflict" out-group, and "Scots" as "neutral" out-group). In Studies 1a and 1b

(N = 96), we presented 5- and 8-year-olds a picture facing down of a target individual, described its group membership, and invited children – four times – to ask the experimenter for either individual or category information about the target. Study 2 assessed how providing 5-year-olds (N = 48) these different scopes of information affects their intergroup attitudes. The main findings were: a) children prefer receiving category information about out-groups more than in-groups, and vice-versa regarding individual information; b) providing individual information about out-groups reduces attitudinal biases, and providing categorical information exacerbates them. These findings highlight children's differential construal of in- and out-groups – namely, qua individuals vs qua category exemplars, respectively – and suggests ways for remedying biases towards out-groups.

PB-052 Children's perceptions of shared knowledge as a social cue

Gaye Soley, Begüm Köseler
Bogazici University, Istanbul, Turkey

While knowledge that is shared among individuals can be indicative of a shared social history, not all knowledge is socially meaningful. For instance, shared knowledge of cultural practices might signal shared cultural group membership, whereas shared knowledge of self-evident facts may not do so. The present research explored whether children make social inferences about others based on what they know, and if so, whether they are sensitive to the distinctions in the diagnostic potential of different kinds of knowledge.
Five-to 9-year-old monolingual Turkish-speaking children (N = 80, Mean age = 7,22 years) were presented with target children who were knowledgeable about familiar things that are either culture-specific (e.g., a traditional dance) or universal (e.g., a generic fact). Children were asked whether the knowledgeable target would speak Turkish (native) or French (foreign) and whether the target would live close by or far away. Children are also asked whether they are a little sure or very sure of their answer. These answers are converted to scores, with higher scores indicating stronger expectations that the target is a Turkish speaker or lives close by. Older children's scores (7-8 years) tended to be higher when the target shared cultural knowledge as opposed to general knowledge with them, but younger children (5-6 years) did not use shared knowledge as a social cue. These findings suggest that children's explicit inferences about others' social attributes based on their cultural knowledge become evident around the age of 7 years.

PB-053 Cognitive prerequisites for cumulative culture are context-dependent: children's potential for ratcheting depends on cue longevity

Charlotte E. H. Wilks, Eva Rafetseder, Christine A. Caldwell
University of Stirling, UK

Human cumulative culture has been suggested to depend on particular human-unique cognitive mechanisms, explaining its apparent absence in other species. We show that the potential for ex-

hibiting cumulative culture depends on the cognitive abilities of the agents in combination with the demands associated with using information generated by others' activity. Children aged 3-6 completed a searching game ("Find the Treasure"), taking their turn after a puppet demonstrator. The puppet's attempt revealed information about the contents of the locations searched, which could be exploited to target rewarded locations, and avoid unrewarded ones. Two alternative versions of the game were presented, intended to capture realistic variation in the transience of the cues generated by another individual's activity. In one condition, the puppet's demonstration provided ephemeral information only – boxes were opened, seen to be rewarded or not, and then closed. In the other condition the puppet's chosen boxes remained partially open, thus providing an enduring visible cue as to whether or not that location was rewarded. Children took part in three trials of varying demonstration success, and we used their patterns of performance to infer the potential for improvement over multiple generations of transmission. In the enduring cues condition, children's performance demonstrated the potential for cumulative culture whereas in the transient condition performance was not compatible with the possibility of improvements over generations of social transmission. We conclude that under certain conditions cumulative culture could occur in many species, but that it is manifested in a broader range of contexts in humans.

PB-054 Exploring imitation and innovation in neurotypical and autistic development.

Lauren Marsh, Emily Burdett

School of Psychology, University of Nottingham, Nottingham, UK

The human ability to innovate is crucial to our success as a species. It is a key driver of cultural evolution and technological progress, yet little is known about how innovation develops. Research suggests that neurotypical children find it difficult to create new tools to solve novel problems. However, when they are shown one way to solve a problem, they tend to imitate this method instead of exploring other options. Perhaps an over-reliance on copying others' behaviour blocks exploration and innovation. On the contrary, autistic children are less biased to copy others' behaviour and this may give them a unique advantage in innovating novel solutions. We assessed imitation and innovation abilities of typically developing and autistic children. Children completed an overimitation task and an innovation task. In the overimitation task, children witnessed a demonstrator opening a box using necessary and unnecessary actions. Children's imitation of the demonstration was assessed. To measure innovation, children completed a 'hook task' where they were presented with a tall, narrow container with a capsule at the bottom. They were asked to retrieve the capsule using the tools available (a straight pipecleaner and a piece of string). Successful innovation was coded if children made a hook to retrieve the capsule. Preliminary analyses indicated no difference in the imitation abilities of autistic and neurotypical children in the overimitation task. However, counter to our hypotheses, autistic children were poorer at the innovation task than their neurotypical counterparts. The developmental link between imitation and innovation will be discussed.

PB-055 Mutual Joy and Social Learning in Small-Scale Societies

Tanya Broesch, Jeremy Carpendale

Department of Psychology, Simon Fraser University

Ninety-five percent of research in developmental science is conducted with a minority of the human population (Nielsen et al., 2017) with the implicit assumption of generalizability (Henrich et al., 2010). Evidence examining infancy across diverse societies indicates both cultural specificity as well as commonalities in early experiences. Here we present evidence suggesting that the experience of "mutual joy" offers an explanation for the commonalities as well as the variation across cultures. Cross-cultural evidence indicates that caregivers provide similar kinds of responsiveness, affect mirroring (Broesch et al. 2016), infant directed speech (Broesch & Bryant, 2014; 2017), infant directed song (Broesch & Bryant, in prep) yet we also see cultural specific developmental patterns for the frequency and timing of contingent responding and emotional attunement (Kärtner et al., 2010) We also find that infants are similarly tuned into others subtle behavioral cues early in life (Hernik & Broesch, 2018). Here we argue that mutual joy with another, early in life, sets the foundation for social learning, including the transmission of culture-specific emotion information. By mutual joy we mean: the positive emotional experience of a caregiver or social partner that is contingent on the positive emotional experience of the infant or young child. This mutual joy supports many aspects of emotional development including the attachment bond with a caregiver and, in turn relationships with peers and other caregivers from which children learn culturally specific information. We argue that the drive for mutual joy underlies all other components of emotion development and social learning.

PB-056 Children's third party norm enforcement in eight diverse societies

Patricia Kanngiesser[1,2], Daniel Haun[2,3], Esther Herrmann[3], Marie Schäfer[3], Henriette Zeidler[3], Michael Tomasello[4]

[1]Freie Universität Berlin, Berlin, Germany; [2]Leipzig University, Leipzig, Germany; [3]Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany; [4]Duke University, Durham (NC), USA

Third party interventions against norm transgressions play an important role in sustaining social norms and in stabilizing cooperation. Western, middle-class children already show third party norm enforcement during the preschool years (e.g., Rakoczy et al., 2008). Yet, cross-cultural evidence from adults has revealed substantial variation in norm enforcement, both in frequency and in cultural enforcement styles (e.g., Heinrich et al., 2006; Wiessner, 2005). We investigated the third party norm enforcement in five- to eight-year-olds from eight diverse populations worldwide (N = 382 children; 3 urban and 5 rural populations). Children participated in the study in peer dyads and were taught a novel sorting game: one group learnt to sort by colour, another group by shape. Next, children observed (1) another child who had learnt the same rule (control condition) and (2) a different child who had learnt an incompatible rule (test condition). We developed a comprehensive coding scheme for children's verbal and non-verbal behaviours. We found across all eight populations that observ-

ers intervened more frequently in the test condition than in the control condition – this was true for both non-verbal and verbal behaviours. However, there were societal differences in children's norm enforcement styles. These findings show that a functionally similar behavioural outcome, norm enforcement, can be achieved through culturally variable means.

PB-057 What do others need to know? Children's information-sharing becomes more effective with age in cultural transmission chains

Gemma Mackintosh, Christine Caldwell

University of Stirling

In previous work, adult participants arranged into transmission chains provided clues to a following participant to help them complete the experimental task. Adults made highly effective choices about the information they passed on, resulting in improvements in task performance in these chains. Improvements were not observed in control chains where clues were selected at random. This could be attributed to theory of mind reasoning (ToM), which allows an information sender to tailor signals to the needs of a learner, and allows a learner to infer more from a limited subset of information. While there are numerous accounts of the emergence of ToM in children, it is not clear at what point this begins to influence the ability to select appropriate information tailored to the needs of the learner. The current study used a transmission chain design to investigate the point in development where intentional information sending begins an accumulation of beneficial information, relative to transmission via inadvertent information.

A subset of the information provider's search was transmitted to an information receiver, either selected by the information provider (Intentional), or randomly sampled from their search history (Inadvertent). A condition (Full) where all search attempts were transmitted was also included. We tested 5-to-10-year-old children in 5 chains per condition in each of the 3 age categories. The pattern of performance in older age groups corresponded closely to adult results, suggesting that children's ability to effectively inform others develops with age. These findings provide insights into the cognitive abilities required to support cumulative cultural transmission.

PB-058 Social attention during real-life interactions in Williams syndrome and autism spectrum disorder

Yoko Hakuno[1],2, Nozomi Naoi[3], Ayaka Ikeda[4], Kosuke Asada[5], Yasuyo Minagawa[2], Takahiro Ikeda[1], Takanori Yamagata[1], Masahiro Hirai[1]

[1]Jichi Medical University, Tochigi, Japan; [2]Keio University, Tokyo, Japan; [3]International Christian University, Tokyo, Japan; [4]Senshu University, Kanagawa, Japan; [5]Hakuoh University, Tochigi, Japan

Children with Williams syndrome (WS) and autism spectrum disorder (ASD) are found to be characterized by atypical social attention, in particular, in an ambiguous social context (Riby and Hancock

2008; Riby et al. 2013). While individuals with WS are known to spend more time viewing faces in static pictures compared to typically developing (TD) individuals, the opposite is apparent for those with ASD. However, their attentional characteristics during real-life social interactions with others remain poorly examined. We investigated how 5- to 13-year-old children with WS (N = 23), ASD (N = 14), and TD children (N = 33) would view social partners and objects in the context of joint attention interactions using eye-tracking techniques. During the responding to joint attention (RJA) condition, the social partner moved her eyes in the direction of the target toy and kept looking at the toy for approximately 4 seconds. In the initiating joint attention (IJA) condition, a puppet appeared for approximately 8 seconds, during which the social partner remained still with no communicative cues to promote the children to initiate joint attention. While we found no significant difference in fixation duration for face and object across groups during the RJA condition, WS children tended to look at the face of the social partner shorter than TD or ASD children during the IJA condition. The inconsistent results from previous studies with regard to social attention of WS and ASD children may highlight the importance of more ecologically valid settings to study their social competence.

PB-059 Affective Social Learning from a developmental perspective

Daniel Dukes[1,2], Paul Harris[3], Fabrice Clément[4]

[1]Fribourg University, Switzerland; [2]Swiss Centre for Affective Sciences, Geneva, Switzerland; [3]Harvard University, USA; [4]Neuchâtel University, Switzerland

Since Piaget, the image of the child as the curious scientist has loomed large in the Western collective imagination. But even during Piaget's lifetime, this view was challenged, as people like Vygotsky pointed out the importance of learning from others. Later, Bandura recognized the power of observing others' when learning how to achieve our goals. More recently, this idea was extended by pointing out, not only the importance of others for scaffolding one's behaviour, but also how important others can be for shaping our cognitive landscape – whom to trust, our history, the workings of the brain and even the choice of the gods to whom we pray (Harris, 2012; Clément, Koenig and Harris, 2004). The idea behind Affective Social Learning (Dukes & Clément, 2019) is to extend this project even further, to account for the social learning of values. In this paper, we outline the main processes of Affective Social Learning and chart their impact on how we learn from others, focusing on infancy. Furthermore, we argue that each process – emotion contagion, affective observation, social referencing and natural pedagogy – has, in itself, a developmental trajectory which determines what we learn and from whom, about what matters most, and what doesn't matter at all, in the culture where children have to belong. PLEASE NOTE: This abstract is currently being considered as part of the Symposium " Multi-dimensional approaches to socio-emotional development"

PB-060 Effect of Knowledge Access Training on Children's Strategic Lying

Xiao Pan Ding, Nabil Syukri Bin Sachiman

Department of Psychology, National University of Singapore

Knowledge Access (KA), an early component of theory of mind, refers to children's ability to infer whether others have knowledge based on the person's recent experience (Pillow, 1989). Though previous studies found that children's false belief understanding is essential for children's lying (Talwar & Lee, 2008; Lee, 2013), there is emerging evidence that KA plays a role in the development of children's strategic lying behavior (Leduc, Williams, Gomez-Garibello, & Talwar, 2016; Ma, Evans, Liu, Luo, & Xu, 2015; Sai, Ding, Gao, & Fu, 2018). However, there is no direct evidence confirming the causal link between KA and children's lying. The present study addressed this gap by investigating whether training children's KA understanding can improve their strategic lying behavior. Sixty-one three-year-old children were randomly assigned into two training conditions. Children in the experimental condition were coached on their knowledge access understanding, while those in the control condition were taught to reason about physical concepts. Consistent with our hypothesis, children in the experimental condition demonstrated significant improvement in their strategic lying relative to those in the control condition. The findings present empirical evidence supporting the causal role of knowledge access understanding in the emergence of lying and, more broadly, of theory of mind in the development of social competence among young children.

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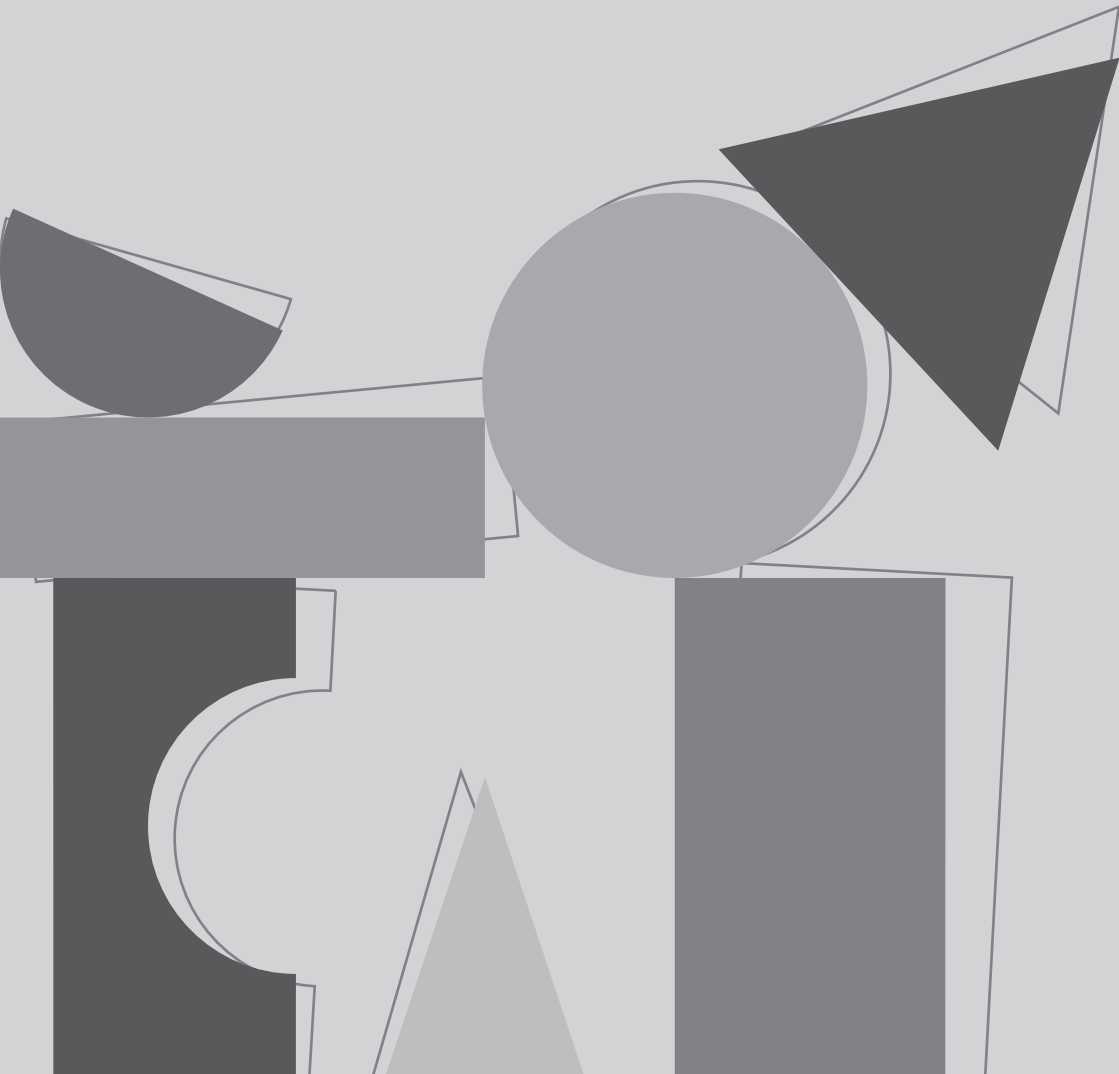

POSTER SESSION C: SATURDAY

PC-001 Top-down attentional and sociocognitive processes are impaired in mobile user preschoolers

Veronika Konok[1], Nóra Bunford[1,2], Bence Ferdinandy[3], Zsófia Ágnes Réti[1], Ádám Miklósi[1,3]

[1]Eötvös Loránd University, Ethology Department, Budapest, Hungary; [2]Hungarian Academy of Sciences, Research Centre for Natural Sciences, Institute of Cognitive Neuroscience and Psychology, Budapest, Hungary; [3]MTA-ELTE Comparative Ethology Research Group, Budapest, Hungary

PC-002 Prosocial Behavior Itself Increases Happiness in Preschoolers: A Facial-Expressions-Coding Study

Risa Mizobata[1], Shoji Itakura[2]

[1]Kyoto University, Japan; [2]Center for Baby Science, Doshisha University, Japan

PC-003 Second-Order Deception in Middle Childhood. The Role of Second-Order False-Belief Understanding and Working Memory

Joanna Jakubowska, Marta-Białecka-Pikul

Jagiellonian University, Kraków, Poland

PC-004 Thinking inside the box: Mental manipulation of working memory contents in 3- to 7-year-old children

Eva Reindl, Divya Parkash, Amanda Madeleine Seed

University of St Andrews, St Andrews, UK

PC-005 Assessing Young Children's Executive Functions: The Impact of Individual Differences

Darlene DeMarie[1,2], Jennifer Bugos[1], Daisy Solis[1], Cassidy David[1], Sydney Andersen[1]

[1]University of South Florida, Tampa. Florida, United States; [2]Eotvos Lorand University, Budapest, Hungary

PC-006 Attentional Control in Bilingual Infants: Evidence from the Cognitive Control and Gap/Overlap Tasks

Tori Kok[1], Isabel Quiroz[2], Luke Mason[2], Atsushi Senju[2], Roberto Filippi[3], Peter Bright[4], Evelyne Mercure[6,5,2]

[1]Ear Institute, UCL, London, UK; [2]Centre for Brain and Cognitive Development, Birkbeck, London, UK; [3]Department of Psychology & Human Development, UCL, London, UK; [4]Department of Psychology, Anglia Ruskin University, Cambridge, UK; [5]Institute of Cognitive Neuroscience, UCL, London, UK; [6]Goldsmiths, University of London, London, UK

PC-007 A novel task of self-concept: Infants can map their parent's face onto their own

Charlotte Grosse Wiesmann[1,2*], Dora Kampis[1*], Sarah Koop[3], Victoria Southgate[1]

[1]Department of Psychology, University of Copenhagen [2]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig [3]Humboldt University, Berlin *These authors contributed equally.

PC-008 Socio-emotional development in our closest relatives, the bonobos: A Longitudinal analysis

Zanna Clay[1], Frans BM de Waal[2]

[1]Department of Psychology, Durham University, UK; [2]Psychology Department/ Yerkes National Primate Research Center, Emory University, USA

PC-009 Young Children's Representations of Possibility and Logical Inferences: They Differentiate Possibility vs. Impossibility

Esra Nur Kucuk, Fatima Tuba Yaylaci

Istanbul Sehir University, Istanbul, Turkey

PC-010 Investigating visual properties preschool children and adults use when distinguishing naturalistic images

Karola Schlegelmilch, Annie E. Wertz

Max Planck Institute for Human Development, Berlin, Germany

PC-011 Behavioral markers and neural representations of logical inferences in 12-month-old infants

Ana Martín[1], Luca L. Bonatti[1,2,3], Judit Gervain[4]

[1]Center for Brain and Cognition, Universitat Pompeu Fabra, Barcelona, ES; [2]ICREA, Barcelona, ES; [3]Università Ca' Foscari, Venezia, IT; [4]Integrative Neuroscience and Cognition Center, UMR 8002, CNRS & Université Paris Descartes, Paris, FR

PC-012 Visual sequence learning in children: piloting an adaptive artificial grammar learning task

Daniela K. Schönberger, Patrick Bruns, Brigitte Röder

Biological Psychology and Neuropsychology University of Hamburg Hamburg Germany

PC-013 In the eyes of analogical reasoning: comparing children and adults solving strategies

Jean-Pierre Thibaut, Robert M. French

University of Bourgogne Franche-Comté, LEAD, CNRS UMR 5022, Dijon, France

PC-014 Gross Motor Abilities, Visual Perception, and Language Development in Preterm and Term Infants

Mert Kobaş[1], Erim Kızıldere[1], Aslı Aktan Erciyes[2], Işıl Doğan[1], Tilbe Göksun[1]

[1]Koç University; [2]Kadir Has University

PC-015 Pragmatic effects in adults' false belief evaluation

Rachel Dudley, Salvador Mascarenhas

Ecole Normale Superieure, Paris, France

PC-016 Implicit False Belief Understanding in Infancy Predicts Counting Skills at Age Four

Beate Sodian, Christopher Osterhaus, Daniela Kloo

Department of Psychology Ludwig Maximilian University, Munich

PC-017 Children's advanced theory of mind: A longitudinal study from age 5 to 10

Christopher Osterhaus[1], Susanne Koerber[2]

[1]Ludwig-Maximilians-Universität München; [2]Freiburg University of Education

PC-018 The Development of Episodic Memory

Marie Alkan[1], Alexander Easton[1], Deborah Riby[1], Tom V. Smulders[2]

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PC-019 Individuating objects based on communicators

Gabor Brody, Gergely Csibra

Cognitive Development Center, Central European University, Budapest, Hungary

PC-020 Parents facilitate children's conceptual pact formation in referential communication

Ashley Leung[1], Daniel Yurovsky[2]

[1]University of Chicago, Chicago, USA; [2]Carnegie Mellon University, Pittsburgh, USA

PC-021 The role of variability in enhancing attention during infant-directed actions

Marlene Meyer[1,2], Johanna E. van Schaik[3], Sabine Hunnius[1]

[1]Donders Institute for Brain, Cognition, and Behaviour, Radboud University Nijmegen, the Netherlands; [2]Department of Psychology, University of Chicago, USA; [3]Faculty of Behavioural and Movement Sciences, Vrije Universiteit Amsterdam, the Netherlands

PC-022 Which robot knows more? Children evaluate how robots learn to guide their selective learning

Xiaoqian Li, W. Quin Yow

Singapore University of Technology and Design, Singapore

PC-023 The early ontogeny of expectations about speakers' informativeness

Marie Aguirre, Mélanie Brun, Anne Reboul, Olivier Mascaro

Institut des Sciences Cognitives Marc Jeannerod, Lyon, France

PC-024 Intergroup bias and information seeking in early childhood

Lisa Chalik[1], Harriet Over[2], Yarrow Dunham[3]

[1]Yeshiva University, Stern College for Women, New York, NY, USA; [2]University of York, York, UK; [3]Yale University, New Haven, CT, USA

PC-025 Now I know who was right before! When learning from others, preschoolers consider subsequent cues of informant reliability

Friederike Schütte[1], Nivedita Mani[1,2], Tanya Behne[1],2

[1]University of Göttingen; [2]Leibniz ScienceCampus Primate Cognition

PC-026 Can you give me the one that I like? Testing toddlers' preference understanding and helping behavior

Charlotte Herzmann[1], Sabina Pauen[2], Duygu Narin[1,3], Claudia Zierul[1]

[1]Universität Bremen, Bremen, Germany; [2]Universität Heidelberg, Heidelberg, Germany; [3]Üsküdar University, Istanbul, Turkey

PC-027 The production of body movement impacted infants' learning about others' body movements

Eriko Yamamoto, Kazuo Hiraki

The University of Tokyo, Tokyo, Japan

PC-028 Eleven-month-olds expect agents to act efficiently but also to repeat the movements of their group members

Nazlı Altınok[1], Iulia Savoş[1], Mikołaj Hernik[2], Ildikó Király[1,3], György Gergely[1]

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PC-029 Relation of Motor Competence and Neural motor activity during perception of means-end actions in Infancy

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PC-030 Children selectively favor leaders and prosocial agents in an economic exchange

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PC-031 False belief understanding in deaf children with cochlear implants

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PC-032 Understanding privileged access and second-order theory of mind

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PC-033 Implicit theory of mind in preschool aged children: evidence from simultaneous gaze-recording and fNIRS study

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PC-034 Effects of second language acquisition on children's character referencing in elicited narratives

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PC-035 Atypical lateralization of language-lelated tracts in non- or minimally verbal children with autism

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PC-036 Neural indicators of articulator-specific sensorimotor influences on infant speech perception

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PC-037 The development of time word comprehension & mental time travel in early childhood

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PC-038 The facilitative effect of phonetic context variability on early word learning: A habituation study with 14-month-old children

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PC-039 Mapping linguistic cues to causal events: A cross-linguistic study

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PC-040 How language changes thought: Learning number words supports match-to-sample

Roman Feiman[1], David Barner[2]
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PC-041 Within - category object recognition may be associated with expressive vocabulary at 18 months

Agnes Kata Szerafin[1,2], Tamas Kaldi[2,3], Andrea Balazs[2,3], Anna Babarczy[2,3], Ildiko Toth[1,4], Bence Kas[3,5]
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PC-042 Spatial Organization and Numeracy in American and Israeli Preschoolers

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PC-043 Gaze-following in 5 months old infants in the context of infant-directed and adult-directed speech

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PC-044 Change of Limb Movements in Response to Auditory Feedback with Virtual Drum-Kit Device in Three-Months-Old Infants

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PC-045 Why can't I buy chocolate in the shop with my Monopoly money? - Understanding contextual boundaries in pretense play

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PC-046 Three-year-olds' imitative learning from peer and adult models

Gregor Kachel[1], Robert Hepach[1], Richard Moore[2], Michael Tomasello[3]

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PC-047 Infants' sensitivity to the signaling value of strange behaviors explains the pull of irrational leadership.

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PC-048 Inequity aversion in preschooler children

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PC-049 Social and physiological determinants of peer cooperation and competition in preschool children

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PC-050 Girls, not boys, are strong reciprocators in a one-shot, sequential, and costly interaction

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PC-051 Children hold leaders more accountable than subordinates in joint deeds

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PC-052 Fourteen-month-olds' imitation is influenced more strongly by a model's competence than by a model's certainty

Norbert Zmyj[1], David Buttelmann[2]

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PC-053 Racial out-group target heightens 3-4-year-olds' perspective-taking abilities

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PC-054 Young children use meta-talk to convince their partners to make rational collaborative decisions

Kirstie Hartwell[1], Silke Brandt[2], Laura Boundy[1], Grace Barton[1], Bahar Köymen[1]

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PC-055 The developmental trajectory of altercentrism in human ontogeny

Dora Kampis[1], Charlotte Grosse Wiesmann[1,2], Victoria Southgate[1]

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PC-056 Early attachment as a predictor of children's friendship: A longitudinal study

Nika Čermak, Ljubica Marjanovič Umek

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PC-057 Joint object play in 10-month-olds predicts their developmental outcomes at the age of 3 years - study in siblings of children with ASD

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PC-058 Children's selectivity in informing others: Exploring the roles of knowledge type and group affiliation

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PC-059 Tap with them or tap with it: Exploring social facilitation and intentionality effects on children's visuomotor synchrony ability

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PC-060 Is early location memory about remembering what the agent did?

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PC-001 Top-down attentional and sociocognitive processes are impaired in mobile user preschoolers

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Mobile touch screen devices (MTSDs: smartphones and tablets) are used by an increasingly greater number of children and at an increasingly younger age. As using these devices withdraws time from other (including social) activities yet offer a different type of sensorimotor stimulation than traditional games, neurocognitive development might be influenced. In a cross-sectional study, tests of selective and divided attention, global-local focus, theory of mind and emotion recognition were administered to 4-6-year-old children, 20 of whom were frequent MTSD users and 20 of whom did not use such devices (control). Both groups showed the typical global advantage in selective attention tasks, but in the divided attention task MTSD users showed an atypical, local-to-global precedence, in contrast to non-users. Users also exhibited worse performance on theory of mind tasks, but their emotion recognition performance was similar to that of non-users. The processing of stimuli in a top-down fashion (gestalt perception) is not automatic for MTSD users. On MTSD screens usually only a part of the 'whole' can be seen at once (e.g. scrolling; images arriving from outside) which may train MTSD users to focus on details rather than the whole. Users also have difficulties with higher-order, but not with more automatic socio-cognitive skills (theory of mind vs. emotion recognition). Therefore, using MTSDs may deteriorate executive functions, however, overstimulation, displacement of social interactions and/ or pre-existing individual differences are also alternative explanations to these findings. Further experimental studies are required to reveal causality and the specific mechanisms.

PC-002 Prosocial Behavior Itself Increases Happiness in Preschoolers: A Facial-Expressions-Coding Study

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In recent years, it has been shown that spending money or engaging in volunteer activities for others increases happiness in adults. In addition, one study has reported that infants also feel happy when they are giving their own resources to others. However, it is not clear which factors in prosocial behavior cause positive emotions in infants and young children. In this study, we examined how costs for oneself and benefits for the other affect happiness during resource sharing behavior in young children . Twenty-seven 4- and 5-year-old children conducted a sharing task, distributing seals to others, and their facial expressions were recorded during the task. Participants were assigned to a high-cost group or low-cost group in which the stickers to be distributed were high value or low

value respectively. In each group, there was a high-benefit group in which the recipient wanted the seal very much, and a low-benefit group in which the recipient did not want the seal very much. The results showed that although there was no difference in happiness according to the amount of cost for oneself and the amount of benefit for others, in any condition, children showed more happy faces when distributing seals to others than when distributing seals to themselves. The results suggest that the prosocial behavior itself causes a positive feeling in young children, and because of this positive feeling during prosocial behavior, humans may continue to help others.

PC-003 Second-Order Deception in Middle Childhood. The Role of Second-Order False-Belief Understanding and Working Memory

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Second-order deception, i.e. providing a truthful statement to deceive is a kind of reflective deception observed in children older than 6 year of age (Jakubowska & Białecka-Pikul, 2019). We examined the effectiveness of deception and the ability to use second-order deception during a competitive multi-trial game in a longitudinal study. Our aim was to describe developmental changes in deception and to find weather general cognitive skills, i.e. working memory and/or second-order false-belief understanding predict the ability to deceive. Potential gender differences were explored. We tested 152 children (73 girls) twice: at age 6 and at age 7 with Smith and LaFreniere (2013) deception task, two standard second-order false belief tasks and Memory for Digit Span Task. As children got older the mean number of successful deceptions increased, $t(151) = -3.86$, $p < .001$. The better children were able to use second-order deception the more effective their deceptions are ($rs = .35$, $p < .001$ at age 6, $rs = .24$, $p = .003$ at age 7). At age 6, in boys, second-order deception was predicted by second-order false-belief understanding ($\beta = .26$, $p = .026$) but in girls working memory was the only significant predictor ($\beta = .30$, $p = .015$). In accordance with our expectations reflective deception is associated with false-belief understanding, but only in boys. Moreover, in girls, the ability to remember previous answers of the competitor during the game predicted their ability to use second-order deception. Gender-specific strategies of complex deception are discussed.

PC-004 Thinking inside the box: Mental manipulation of working memory contents in 3- to 7-year-old children

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Working memory (WM) is core to any cognitive processing and predictive of academic success. While our understanding of the development of WM in childhood has increased over the last decades, there is still a lack of adequate tasks for assessing a crucial emergent component of WM in children:

the manipulation of mental representations. We present a novel, non-verbal task (Rotating Grid Task) assessing retrieval, updating, and manipulation of WM content. 80 3- to 7-year-olds were presented with a 4x4 grid containing 4 boxes in the middle compartments and 4 boxes in the edges. In the Outer condition, the reward was hidden in one the outer boxes; in the Inner condition it was hidden in one of the inner boxes. In phase 1 (retrieval), children watched a sticker being hidden in one of the boxes and could look for it after a short retrieval phase. In phase 2 (updating), the sticker was hidden and the grid rotated (0, 90, 180 or 270°) before children could retrieve the reward. In phase 3 (manipulation), the grid was occluded during the rotation, requiring children to mentally manipulate the reward location. Results showed that 3- and 4-year-olds performed below chance level in the manipulation trials of the Inner condition (but not the Outer one, where performance was aided by visual tracking), demonstrating that the mental manipulation capacities of young pre-schoolers are not yet full-fledged. The scalability and non-verbal nature of our task makes it suitable for future research with other age groups and non-humans.

PC-005 Assessing Young Children's Executive Functions: The Impact of Individual Differences

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Are differences in young children's executive functions assessible and consistent individual differences (i.e., an ability), or are they observed differences due to task demands or to individuals' experiences in the world? We collected data assessing both inhibition and working memory and learned the importance of using assessments that captured individual differences in all children's performance. 204 four-to-six-year-old children from families with lower or middle/higher socioeconomic status (SES) in four different contexts participated. Children were tested individually on 8 different measures from the computerized EF Touch battery. Using item response theory, we found only two EF Touch tasks: Farmer and Houses (both working memory tasks), captured individual differences of the sample's children from middle/upper SES families. Inhibition also was assessed using a newly developed version of the Day/Night Stroop Task. First, we assessed children's baseline performance with a "Regular trial" (i.e., saying "day" for the picture of the sun and "night" for the moon) when shown 10 pictures. Then children said a different list the "Silly Way" (i.e., opposite responses: "day" for moon, and "night" for sun). Another "Silly" trial followed. Finally, children returned to the "Regular way." The results revealed family SES was a significant predictor of performance, and age was not, when controlling for SES. Some children had difficulty returning to the "Regular Way;" a new finding. The results highlight the challenges faced by researchers assessing whether children's executive functions changed due to programs. Appropriate measures of assessment are necessary for determining potential changes over time.

PC-006 Attentional Control in Bilingual Infants: Evidence from the Cognitive Control and Gap/Overlap Tasks

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Research is converging on the idea that bilingualism influences cognitive processes outside of the linguistic domain. Recently, infants who are exposed to two spoken languages from birth have been observed to show increased cognitive control prior to the production of their first words (Comishen et al., 2019; Kovács & Mehler, 2009). Infants growing up with more than one language from birth grow up in an environment in which language input is more varied and less predictable. This could have a positive impact on the development of their attentional control abilities. To test this hypothesis, the present study administered two eye-tracking tasks tapping into attentional control to 7- to 10-month-old monolingual and bilingual infants. In Experiment 1, infants participated in the cognitive control task, which assessed infants' visual expectation behaviour and their ability to anticipate the location of a target following a cue, before and after this location switched sides. The results showed absolute performance was similar for the groups, but bilingual infants were faster than monolingual infants in making correct anticipatory saccades to the target. In Experiment 2, infants participated in the gap/overlap task, which assessed the ability to allocate and disengage visual attention from a centrally presented stimulus. The results indicated no effect of bilingualism on performance. Thus, exposure to a bilingual language environment only increased the efficiency of directing anticipatory saccades. These findings demonstrate the need to clarify the mechanisms underlying the cognitive control task and the potential impact of bilingualism on attentional control.

PC-007 A novel task of self-concept: Infants can map their parent's face onto their own

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Children typically start recognizing themselves in the mirror between 18 and 24 months of age. While this behavior is often taken as a hallmark of a self-concept, it is unclear to what extent the requirement to understand the geometrical properties of the mirror might prevent younger children from displaying a self-concept.

Here, we present a novel task where we test whether infants map a state observed on their parent's

face to themselves. Infants aged 16 to 26 months were presented with a sticker on their parent's cheek or forehead (depending on condition) without seeing how the sticker had been placed there. Infants were then offered a sticker, and we observed whether they spontaneously placed the sticker in the same location on their own face. Preliminary results in 50 out of 72 preregistered infants show that they differentially place the sticker in the matching location on their own face (Fisher's exact $p < .001$). Moreover, infants who recognized themselves in the mirror tended to place the sticker in the matching location on their face more often than infants who did not (Fisher's exact $p = .086$). Our results show that infants in their second year of life are able to map another person's facial features to their own face without visual access to it and actively intervene to emulate a state of their parent by mapping it to themselves. Importantly, this behavior goes beyond imitation as children did not see the parent's action.

PC-008 Socio-emotional development in our closest relatives, the bonobos: A Longitudinal analysis

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Empathy – the sharing and understanding others' emotions and thoughts – is a defining feature of what it means to be human and forms a core part of healthy socio-emotional functioning. Although comparative research suggests that empathy has deep evolutionary roots, we lack knowledge about how empathy and other aspects of socio-emotional functioning develop in animals. Here, I present longitudinal research spanning 8 years that investigate the development of socio-emotional competence in our closest living relatives, the bonobos, focussing on empathic responding and forms of emotion regulation. From periods of infancy to adulthood, we compared the socio-emotional and cognitive skills of sanctuary-living bonobos with different rearing backgrounds: most being orphans from the pet and bushmeat trades, who had experienced early trauma, compared to individuals born and mother-reared at the sanctuary. These differential early experiences provide an ideal opportunity to investigate the impacts of early disturbances on socio-emotional development. At early time points, during infancy and juvenility, we found striking effects of rearing; orphans showing inhibited socio-emotional skills and more disordered social functioning compared to mother-reared. Rother-reared infants showed highest levels of empathic responding towards distressed victims compared to other age classes, which contrasts with patterns shown in in humans. Longitudinal analysis of the same individuals into adolescence and now adulthood, indicate evidence of considerable inter-individual variation and amelioration under certain conditions, potentially linked to differences in attachment styles. Overall, results highlight the importance of studying great apes for understanding the evolution of human socio-emotional development and the potential for plasticity across time.

PC-009 Young Children's Representations of Possibility and Logical Inferences: They Differentiate Possibility vs. Impossibility

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Modal concepts—possibility, necessity, impossibility—structure adult language and reasoning. Scientific reasoning, for example, cannot do without them. Redshaw and Suddendorf (2016) demonstrated a dramatic failure in great apes and young children to represent two equally likely possibilities (when it is unknown which will become actual) and prepare for both in goal-directed action. Their study failed to assess whether children differentiate possibility from impossibility. Here we show that even when 3 and 4-year-old children respond as adults in Redshaw and Suddendorf's tube task, (i.e., cover both possible places a marble might exit an inverted y-branching tube), when a third option where it is physically impossible that the marble might exit from it, many of them cover two options, but fail to distinguish the possible ones from the impossible one. We present data from an intervention designed to make sure children understand the physical mechanism, which has a larger effect on 4-year-olds' behavior than on 3-year-olds behavior, and test the hypothesis that children's active participation during the intervention (8 pre-test, 8 post-test trials) will affect their performance. In a sample of 3 and 4-year old (n=34) children from Turkey, we found that young children develop an understanding of possibility and impossibility at the age of 3. We found both a significant effect of age ($p < .05$) and active participation ($p < .01$). These findings suggest that young children are able to show a representation of possibility and impossibility when they actively participate in the task and understand the physical mechanism.

PC-010 Investigating visual properties preschool children and adults use when distinguishing naturalistic images

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Visual processing of a natural environment occurs quickly and effortlessly. Yet, little is known about how young children are able to visually categorize naturalistic structures, since their perceptual abilities and their sensitivity for regularities of naturalistic visual properties are still developing. We addressed this open question by asking children (N = 76; age: 4-5 years) and adults (N = 72; age: 18-50 years) to first sort cards with greyscale images depicting vegetation, manmade artifacts, and non-living natural elements (e.g., stones) into groups according to visual similarity. In a second task, they were asked to identify the images' superordinate categories. We then analyzed the relevance of different visual properties to the decisions of the participant groups. In both tasks children and adults differed in the visual properties they included in their categorization decisions. For example, to distinguish the superordinate categories in the identification task, children

additionally relied on pictorial depth cues and on similarity to a spatial frequency distribution common in natural scenes. However, when sorting according to visual similarity, differences between the participant groups in the attended visual properties only explained little variance. Moreover, it became obvious that children and adults did not differ in the amount to which they included the images' assumed superordinate categories in their similarity decisions. This finding suggests that already for young children the assumed identity of an unfamiliar structure is tightly linked to its perception. Taken together, these findings add to the sparse literature on developing perceptual abilities for naturalistic visual input.

PC-011 Behavioral markers and neural representations of logical inferences in 12-month-old infants

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Two decades of research have attested infants' sophisticated abilities at interpreting situations and generating expectations. However, it is unclear whether preverbal infants also posses logical reasoning abilities. Recently, Cesana-Arlotti et al. 2018 showed that 12-month-olds may spontaneously draw elementary logical inferences witnessing simple visual scenes. Gaze inspection patterns and pupil dilation dynamics marked infants' behavior when the scenes required a logical inference to be understood. Building on this work, here we explore the stability of such markers and extend our investigation to infants' representations before the inference is triggered. We focused on two crucial moments of a nonverbal disjunctive syllogism: when participants have to represent an object without knowing its identity (only knowing that it could be either object A or B), and when the scene licenses disjunctive syllogism (it cannot be A, so it has to be B). Both when something unknown had to be represented and when the identity of a non-visible object could be determined by inference we found higher pupil dilation with respect to control conditions in which the identity of the object was known, signaling processing of logical aspects of the scenes. Our design also allows us to investigate the neural basis of elementary nonverbal logical reasoning. Thus, we also report preliminary results based on functional NearInfrared Spectroscopy (fNIRS), collected in the same conditions and with the same stimuli tested behaviorally. Our work opens new ways to better understand the development of logical abilities at early stages.

PC-012 Visual sequence learning in children: piloting an adaptive artificial grammar learning task

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Sequence learning paradigms like artificial grammar learning (AGL) are used to investigate the development of skills related to language acquisition. We tested an adaptive AGL task to identify grammars and stimulus materials which children between the age of 5 and 7 years are equally well able to learn. Healthy children aged 61 to 85 months (mean = 73 months) each completed the AGL task with two (out of three) randomly selected stimulus materials (animals, colors, or fruits) following the same grammar. Two different grammars were tested between-participants (n = 14 vs. n = 13). Learning phases displayed grammatical sequences (3-7 items). Participants were instructed to pay close attention to the stimuli. In the test phases, they had to choose the grammatical sequence out of two sequences in each trial. The difficulty of the test trials was adaptively adjusted by varying the length of the tested sequences. At group level children performed above chance. Performance was indistinguishable for all stimulus types and the two grammars. When taking sequence length into account, intra-individual performance for the two different stimulus materials (with the same grammar) was significantly correlated (r = .42), indicating a moderately large within-session reliability comparable to previous findings. AGL task performance did neither correlate with working memory nor with general grammar skills. Taken together, our results suggest that the stimulus materials and grammars tested in the present study are suitable as parallel versions for use in AGL experiments.

PC-013 In the eyes of analogical reasoning: comparing children and adults solving strategies

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How do children solve analogies? Do they use the same strategies as adults and which strategies? Do they adapt the search for a solution to the analogy format? These questions are critical for any developmental model of analogical reasoning. We present eye-tracking data from 5-8-13-year olds, and adults in a A:B::C:D paradigm and confront them to predictions of computational models. We will describe significant differences between groups in the exploration of the space of possible answers to analogy problems. Looking times showed that adults followed a strategy transfering the relation between A and B to C and the solution set. Children, by contrast, organized the C item, a strategy that was interpreted in terms of a difficulty to inhibit the main goal. Also, children monitored their search less efficiently with fewer backward saccades from the solution set to the A-B pair. Errors and correct trials differed from the start of the trial, suggesting that they followed different search strategies. Results from other analogy paradigms suggest that children adapted their strategies to

the specifics of the analogy tasks. Machine learning algorithms (SVM and LOOCV) predicted whether a child or an adult did the task, whether the trial was an error or a correct trial. Overall results were more consistent with the notion of projection than with alignment and were discussed in terms of the interaction between the development of executive functions and the control and integration of the available information.

PC-014 Gross Motor Abilities, Visual Perception, and Language Development in Preterm and Term Infants

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Embodied cognition theory argues that cognition emerges as a result of perception and action interactions (Smith & Gasser, 2005). In line with this theory, research shows a relation between motor abilities and language development (Walle & Campos, 2014). This relation can be stronger for atypically developing children such as children born before 37 weeks (preterm infants) (Hellendoorn, 2015). In this study, we investigated (1)the mediating role of visual perception on the relation between gross motor abilities and word comprehension and gesture use at 14 months of age, and (2)whether these mediation models showed different relations for preterm and term infants. We tested 68 infants (Mage=13.59, 33 preterm). The Mullen Scales of Early Learning was used to measure motor abilities, visual reception. Language development was measured by MacArthur Bates CDI. Controlling for age, gender, preterm/term condition (group), and maternal education, the mediation analyses showed that visual reception mediated both the link between gross motor abilities and word comprehension (β=3.20; SE=1.39; 95% CI=.34, 5.81) and the link between gross motor and gesture use (β=.51; SE=.23; 95% CI=.04, .94). Further analyses showed that the relation between gross motor abilities and visual reception was stronger for preterm infants (β=.18, t =-3,32, p=.002), but other relations were not moderated by group. These results suggest that gross motor abilities are supported by visual reception, guiding infants to interact in environment and can contribute to children's language learning. The connections among these variables could be even stronger for children who have atypical developmental trajectories.

PC-015 Pragmatic effects in adults' false belief evaluation

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We examine traditional false belief (FB) tasks within the Theory of Mind (ToM) literature and ask whether pragmatic processes contribute to children's typical errors in these tasks. Building off conflicting findings in the ToM literature, pragmatic accounts challenge the notion that children and adults have qualitatively different mental state concepts, instead suggesting that various prag-

matic factors influence children's performance in a quantitatively different way from adults: (i) relevance of beliefs within linguistic stimuli, (ii) relevance of beliefs to experimental context, and (iii) participant biases about what's relevant. The idea is: if the task is perceived to be about reality, participants will be more likely to respond on the basis of reality and make reality-based errors. We test adults (a population which is known to have a full ToM) in a FB task and ask if pragmatic factors impact their rate of reality-based performance errors. Using a modified elicited-response FB task, we investigate three factors: (i) relevance of beliefs within linguistic stimuli, (ii) relevance of beliefs to the experimental context, and (iii) participant biases about what is relevant. We find evidence that linguistic stimuli and participant biases both lead adults to make reality-based errors in these tasks, which is inconsistent with these reality-based errors having conceptual sources. As a result, it is most parsimonious to conclude that early FB successes in infancy reflect true ToM competence and later failures in childhood are experimental artifacts.

PC-016 Implicit False Belief Understanding in Infancy Predicts Counting Skills at Age Four

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There is some recent evidence for conceptual relations between Theory of Mind and number skills around the age of 4 years (Perner, 2019; Osterhaus et al., submitted). Explicit false belief understanding at 4 to 5 years is predicted longitudinally by implicit false belief understanding at 18 months (Thoermer et al., 2012; Kloo et al., in press). To investigate the domain-specificity of this predictive relation in the same longitudinal study, we used a broad assessment of intelligence across domains (Bornstein & Putnick, 2019) at 48 months. There was one significant association of infant TOM and a non-social domain: Number. Implicit false belief understanding at 18 months predicted performance in a counting game that assessed the one-to-one principle, the cardinality principle, and the coordination of direction and counting, r=.43, p=.017, N=31. The correlation remained significant when verbal and nonverbal IQ were partialled out. Further, goal encoding (Woodward, 1998) at 7 months and Knowledge Access (Wellman & Liu, 2004) at 36 months were also significantly correlated with the Counting Game. These findings suggest that the conceptual link between TOM and number originates in infancy. While the links between explicit false belief understanding and number understanding (equinumerosity and cardinality) have been discussed in terms of perspective understanding, the present findings indicate that simpler skills at perspective tracking may provide a basis for relations between social and non-social perspective understanding.

PC-017 Children's advanced theory of mind: A longitudinal study from age 5 to 10

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What is the structure of and the continuity in advanced theory of mind (AToM)? Replicating a three-factor model of AToM (Osterhaus, Koerber, & Sodian, 2016, Child Development), the present study investigates whether children's AToM in late elementary school is predicted by their higher-order false belief reasoning at the ages 5 and 6.

Altogether, 159 children participated in this longitudinal study. Children in cohort 1 (spring 2014) were assessed at ages 6 (M=73.4 months, SD=4.3; n=84), 9, and 10. Children in cohort 2 (fall 2014) were assessed at ages 5 (M=66.5 months, SD=4.2; n=75), 6, and 9. At ages 5 and 6, we assessed a third-order false belief task and the double bluff from the Strange Stories; at ages 9 and 10, a comprehensive AToM battery was used (higher-order false belief; Strange Stories; Eyes Test; faux pas; and ambiguity task). Children's language skills were measured at age 6. An exploratory factor analysis of the data obtained at age 9 (cohorts 1 and 2) replicated the three-factor model. Substantial longitudinal stability between ages 9 and 10 emerged for all three AToM factors (r's between .32 and .42). The AToM factor social reasoning was significantly associated with children's language skills. Children's understanding of a double bluff at age 6 but not their understanding of third-order false belief independently predicted children's AToM competencies at age 9. Our findings replicate earlier results, showing that AToM comprises three distinct abilities. Individual differences are stable across time, suggesting a considerable continuity in the development of AToM.

PC-018 The Development of Episodic Memory

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Background: Episodic memory (EM) is memory for past events in specific spatial-temporal contexts ('what-where-when' memory) (Tulving, 1972). EM emerges around 4-5 years of age (Tulving, 2003, 2005). However, there is a lack of evidence regarding how EM develops and the mechanisms involved or how they are impacted by developmental disorders. In part this is due to an emphasis on conscious recollection as an integral feature of EM but which is difficult to assess in the absence of language. Here, we use a behavioural measure of EM to determine whether integration and binding of the EM develops after the memory for other combinations (What-Where or What-Which). We compare these tasks across age-groups in typically-developing and Autistic children.

Method: We developed a hide-and-seek task combining elements of the What-Where-When memory test by Holland and Smulders (2011) and What-Where-Which by Eacott & Norman (2004). Children aged 3-6 years completed two sessions to hide six coloured pens (what) at specific locations (where) in two different contexts (which). At retrieval, children retrieved 6 pens

across two sessions yielding 2 trials each of What-where, What-Which and What-Where-Which. Results: TD data suggests that children's accuracy on each task is above chance and does not differ by age. Comparison data for autistic children will be presented.
Conclusion: Initial findings suggest that contrary to traditional research, but in line with other behavioural measures of EM, children demonstrate equivalent performance on the episodic task even when tested at 3 years of age. Data for autistic children will be discussed.

PC-019 Individuating objects based on communicators

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Several studies have shown that if infants are cognizant of the relevant conceptual distinction between object kinds, they can use it in object individuation tasks. Sometimes this success is dependent on ostensive-referential communication referring to the objects to be individuated. In our novel paradigm we explored the functional relevance of the communicative setting in the process of individuating objects. We presented 12-month-old infants (N=48) with video displays of either one or two protagonists engaging in ostensive communication towards the viewer. In the one-location condition, they pointed behind a single occluder and verbally indicated the presence of an object, without providing any information about what that object was. In the two-locations condition either a protagonist pointed behind two occluders, or each of the two protagonists pointed behind a distinct occluder in a similar manner. After these communicative acts, the occluder dropped revealing either one or two objects, and infants' looking times were measured to this outcome. In this 2(communicators) x 2(locations) x 2(outcomes) design we found a 3-way interaction with a large effect size on log-looking times, indicating that both the number of communicators and the number of locations influenced infants' expectations about the number of objects in the scene. To further clarify the nature of this interaction, we conducted an additional baseline condition (N=24). We discuss possible interpretations of the obtained pattern of data in relation to the individuation literature, and possible interpretive constraints on pointing acts.

PC-020 Parents facilitate children's conceptual pact formation in referential communication

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A fundamental problem for successful referential communication is coordination on a shared label. While adults readily form temporary agreements on referent names (conceptual pacts) with each other, young children struggle to do so with their peers (Clark & Wilkes-Gibbs, 1986; Glucksberg & Krauss, 1966). Children eventually develop the ability to form conceptual pacts with peers (e.g. Koymen et al., 2014), but little is known about how these communicative skills emerge. Could parents

play a facilitatory role, scaffolding referential communication to help their children successfully form conceptual pacts? We invited parents and their children (ages 4, 6, and 8) to play a game in which they took turns communicating about novel tangram referents. Across all age groups, dyads (n = 60) used shorter referring expressions as the game progressed, indicating convergence on more efficient reference over time. Parents of younger children (but not younger children themselves) produced longer referring expressions overall, indicating that parents were adapting language to their children's abilities. Our results show that parents can scaffold effective referential communication with their children, and ongoing qualitative analyses will shed light on how patterns and content of referential communication change as children develop. Overall, our study shows that parents and their children can converge on efficient reference for novel objects—a skill that children struggle with in peer interactions—suggesting that parental calibration may play an important role in children's communicative development.

PC-021 The role of variability in enhancing attention during infant-directed actions

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When demonstrating new actions to their infants, parents tend to exaggerate their movements (van Schaik et al., 2019). Importantly, such infant-directed actions enhance infants' attention to the action (Brand & Shallcross, 2008) and facilitate infants' action learning (Brand et al., 2002). How do modulations in parents' actions capture infants' attention? In this EEG study, we examined the hypothesis that variability in movement amplitude rather than larger movements alone attracts infants' attention during infant-directed actions. We measured 14-month-old infants' brain activity (N=23 in final sample) while they observed demonstrations of three new actions. Within subjects we manipulated whether an action was presented either with movements of normal, high or varied amplitude. Movement amplitude was for instance reflected in how high a ball was lifted to subsequently put it in a bucket. Across participants, we counterbalanced the distribution of actions in the three conditions. Theta band activity in frontal brain regions has previously been linked to attention and memory (Clayton et al., 2015) and is thought to reflect infants' learning of new information (Begus et al., 2015). To investigate how the different conditions affected infants' attentional processing, we compared infants' theta power (4-5Hz) in fronto-central midline channels (Fz, FCz, Cz) between conditions. We found that frontal theta was significantly higher, indicating stronger attentional engagement, in the varied amplitude condition compared to both the normal and high amplitude conditions. This suggests that variability in movement amplitude rather than larger movements alone engages infants' attention during infant-directed actions.

PC-022 Which robot knows more? Children evaluate how robots learn to guide their selective learning

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Socially interactive technologies such as robots are becoming a part of children's lives, yet an important question is left unanswered: do children apply the same learning strategy when interacting with robots as they would when learning from other humans? Prior work suggests that children consider how adults acquire knowledge to decide from whom to learn; for example, children preferentially seek help on a problem from an adult learner who has earlier solved a different problem by herself over someone who has solved it through passive observation (Bridgers et al., 2018). Do children also consider how robots learn when determining from which robot to learn? The current study explores this question by examining to what extent children would select robots as information sources based on the robots' ability to generalize some newly acquired knowledge. Fifty-two children (Mage=5.35 years, range=4.01-6.13) observed how two robots learn words: a competent robot that successfully extended newly learned labels to new members of the same category (i.e., generalization) vs. an incompetent robot that did not do so. Subsequently, children were examined on their willingness to learn novel words from these two robots. Results showed that children preferred to learn new words from the competent robot over the incompetent one, doing so 57.21% of the time (p=.003, binomial). This study provides evidence that preschool-age children's selective learning based on others' learning processes extends to their interaction with robots; children care about how robots acquire knowledge and use this information to guide their subsequent learning from the robots.

PC-023 The early ontogeny of expectations about speakers' informativeness

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By preschool age, children interpret what is communicated to them relying on the assumption that speakers are appropriately informative (Frank & Goodman, 2014). Here, we investigate the nature and early development of this expectation. We tested preschoolers (n = 73) and toddlers (n = 40) in a word learning paradigm. After a familiarization phase, a speaker produced a novel label while pointing ambiguously towards a set of unfamiliar objects: one unique exemplar of a first type of object and many identical exemplars of another type of object. Thus, participants could infer that the speaker was referring to the unique exemplar by assuming that she was informative enough to allow her audience to identify what she referred to. Preliminary results reveal that expectations about speakers' informativeness develop during the first years of life. Whereas preschoolers assumed that the novel label referred to the unique exemplar (thereby demonstrating that they expected the speaker to be informative), toddlers assumed that the novel label referred to the type present in multiple exemplars (a strategy that is consistent with simple associative or statistical learning strategies). In an additional

condition, we also demonstrate that toddlers and preschoolers rely on the distribution of potential referents from the speaker's viewpoint, rather than from their own egocentric viewpoint. Altogether, the results suggest that expectations about speakers' informativeness change greatly during early childhood, and are based on social, not perceptual, salience from the outset.

PC-024 Intergroup bias and information seeking in early childhood

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Children choose to learn from reliable informants over unreliable ones, but also seek information that is biased in favor of their ingroup. The present studies investigate how children seek and respond to information when informant reliability and bias conflict. In two pre-registered studies, children (ages 4-6, N = 88) were assigned to minimal groups and given a choice to learn from one of two adults: one who was reliable, but biased in favor of the outgroup, and one who was unreliable, but biased in favor of the ingroup. Children chose evenly between the two informants ($p = .594$), suggesting that they were concerned with both reliability and ingroup bias: Outside the story-choice context, children turned to the reliable author when seeking an answer to a question in which groups were irrelevant ($p < .001$) and turned to the ingroup-favoring author when seeking an answer to a question in which reliability was irrelevant ($p = .014$). Additionally, children who chose the reliable but outgroup-favoring story maintained their initial levels of bias (preferring the ingroup to the outgroup; $p = .026$), whereas children who chose the unreliable but ingroup-favoring story ended up even more biased against the outgroup ($p = .016$; see Figure 1). An ongoing third pre-registered study (current N = 34), replicates the above findings. Taken together, these studies show that when seeking information about groups, children attend to the quality of available information, but sometimes revise their opinions of groups in bias-confirming ways even in response to low-quality information.

PC-025 Now I know who was right before! When learning from others, preschoolers consider subsequent cues of informant reliability

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Preschoolers learn selectively from others based on the speakers' prior accuracy. This indicates that they recognize the models' (in)competence and use it to predict who will provide the most accurate and useful information in the future. Here, we investigated whether 5-year-old children are also able to use speaker reliability retrospectively, once they have more information regarding their competence. Children first experienced two previously unknown speakers who provided conflicting information about the referent of a novel label, with each speaker using the same novel label to refer

exclusively to a different novel object. Following this, children learned about the speakers' differing labeling accuracy. Subsequently, children selectively endorsed the object-label-link initially provided by the speaker who turned out to be reliable significantly above chance. Crucially, more than half of these children justified their object selection with reference to speaker reliability, indicating the ability to explicitly reason about their selective trust in others based on the informants' individual competences. Findings further corroborate the notion that preschoolers are able to use advanced, metacognitive strategies (trait reasoning) to learn selectively. In contrast, since learning preceded reliability exposure and gaze data showed no preferential looking toward the more reliable speaker, findings cannot be accounted for by attentional bias accounts of selective social learning. Data collection with 4-year-olds is ongoing.

PC-026 Can you give me the one that I like? Testing toddlers' preference understanding and helping behavior

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Early social-cognitive abilities, like understanding intentions, emotional expressions, and preferences, are fundamental for the development of further, more complex social-cognitive competences and are associated with learning trajectories in other developmental domains. Assessing social-cognitive abilities in toddlers requires procedures with low verbal demands measuring children's (spontaneous) behavior in social settings. In addition, real-life social situations usually tap more than one social-cognitive ability (i.e., understanding of preferences and associated emotional expressions). As part of the Bremer Initiative to Foster Early Childhood Development (BRISE), we developed a combined preference understanding and helping behavior paradigm to investigate whether toddlers between one and two years of age can appreciate another person's preference in a complex task. Preliminary results indicate less children to show preference understanding in the complex compared to a simple task (N = 19; age range 14-21 months). Further analyses on the effects of age and number of required prompts as well as differences in response strategies will be conducted on a larger sample size including more children around the age of two years. We hypothesize, that older children are more likely to succeed in the more complex task. Results will be discussed in the light of interpretability of behavioral responses and benefits and risks when testing multiple social constructs in a single, complex paradigm.

PC-027 The production of body movement impacted infants' learning about others' body movements

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In this study, we examined if infants' production of body movements had a long-term effect on their recognition of others' body movements. Nine- to eleven-month-old infants (n = 72) participated twice in this study, with an interval of one week. We used the infant-controlled habituation procedure with four video stimuli depicting abstract body movements (videos A, B, C, and D). On the first day, infants were habituated to video A as a target stimulus (Habituation 1), and were then presented with the target stimulus and video B as a novel stimulus (Test 1). After one week, infants were habituated to video C (Habituation 2) and were then presented with video C, the target stimulus, and video D as a novel stimulus (Test 2). We evaluated infants' looking times at the target stimulus and novel stimulus in Tests 1 and 2. We also recorded infants' body movements in reaction to the target stimulus during Habituation 1 using a 3D motion tracking system. Infants showed shorter looking times at the target stimulus as compared to the novel stimulus in Tests 1 and 2. In addition, we found that the infants moved their arms to match the body movement rhythm of the target stimulus during Habituation 1. There was a significant positive correlation between the infants' movement level in Habituation 1 and their capacity to discriminate others' body movements in Test 2. These results suggest that infants' production of body movements have a long-term impact on their recognition of others' body movements.

PC-028 Eleven-month-olds expect agents to act efficiently but also to repeat the movements of their group members

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Infants expect agents to act efficiently (Gergely et al., 1996) and expect group members to move alike (Powell & Spelke, 2012). Using looking-time violation-of-expectancy paradigm we investigated how these two tendencies interact when interpreting goal-directed actions. Across a series of studies infants first watched in familiarization agent(s) detouring a barrier to obtain the goal. At test - when the barrier was short and didn't block straight path to the goal - they saw an agent either repeat the previous detour-movement or take the straight path while obtaining the goal. If the detour-action in familiarization was efficient (due to long barrier blocking the straight path to the goal), and if the same agent was acting in familiarization and test, infants expected the agent to take the straight path at test (Experiment 1), thus replicating earlier findings. If two agents from one group detoured the barrier either inefficiently (Experiment 2) or efficiently (Experiment 3) in familiarization, then infants showed no clear expectations about the third group member's actions at test. However, when the test agent

did not belong to the same group as the familiarization agents detouring the barrier efficiently, then infants again expected the straight path (Experiment 4). This pattern of findings suggests that infants expect goal-directed agents both to act efficiently and to faithfully mimic movements of their group members, and that these two expectations may contradict each other (Experiments 2-3). However, when group membership is irrelevant (Experiments 1 and 4) efficiency is expected.

PC-029 Relation of Motor Competence and Neural motor activity during perception of means-end actions in Infancy

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The current study examined the presence and differences in neural motor activity during perception of means-end actions of grasps(familiar) and tool-use actions(unfamiliar), and how motor competence relates to neural motor activity in infancy. We first showed 9-month-olds a person grasp and pull a cane during the observation session presented via video. Then, during the execution session, we examined infants' production of grasps and tool-use action. Results show mu ERD indexing motor activity during perception of both familiar and unfamiliar means-end actions; yet, there were no evidence for differences between 9-month-old infants' neural mirroring of familiar and unfamiliar actions. Moreover, we found evidence that infants' competence in execution of the action (grasp or tool use) was associated with stronger action mirroring during observation of the corresponding action. Therefore, we conclude that the neural motor system supports the perception of actions beyond infants' motor repertoire; though, the coupling of action and perception is greater with motor competence in 9-month-old infants. We are further working on collecting data to explore whether 12-month-old infants, who have more experience with means-end action, show differences in neural mirroring for familiar and unfamiliar action, and whether motor coupling of action and perception result in interesting variation in relation to motor development.

PC-030 Children selectively favor leaders and prosocial agents in an economic exchange

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Most cooperative interactions involve the expectation of mutual reciprocation, and are based on interpersonal trust. How and when humans acquire interpersonal trust, and which factors influence its development is a window to understand complex social and economic relations. Here we investigated whether prior social and moral information about trading partners modulates the choice of preschool- (4-5 years) and school-age children (7-8 years) to share their own goods in a child-friendly

version of the Trust Game. In two studies, we addressed whether children's trust was modulated by characters possessing either prosocial or antisocial traits (Study 1, 'helpers vs. hinderers'), or displaying either respect-based power or fear-based power (Study 2, 'leaders vs. bullies'). Preschoolers trusted leaders more than bullies and showed an emerging tendency to trust prosocial agents more than antisocial agents. Results also showed that these tendencies were reliably stronger in school-age children than in preschoolers. Overall, the findings suggest that preschool children understand complex cooperative exchanges and already rely on socio-moral representations of agents to decide which partner to invest in, but they do so to a lesser extent compared to older children.

PC-031 False belief understanding in deaf children with cochlear implants

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Theory of mind (ToM) is the ability to attribute mental states to others. ToM is commonly assessed using False Belief Test (FBT), which is passed by typically developing (TD) children around the age of four. Children with deprived language exposure may be at risk of delayed ToM. Deaf children of hearing parents may be of interest in this respect.

The present study aimed at exploring ToM development in prelingually deafened children who are CI users. We explored the relation between FBT performance and grammar understanding, age at implantation, duration between first and second CI.

We tested 94 TD children (Mage = 4.48; age range 3-7) and 45 deaf children (Mage = 5.38, age range 3-7), who received their first CI up to 24 months of age (Mage = 12.67 months). We conducted a computerized FBT and The Test of Language Development (TRJ). Between group analysis by age, indicated that four and five year old children with CI performed worse than their TD peers ($p < .01$). Their performance was not significantly different from 3 years' old TD children ($p = .53$), which suggested a delay in understanding FB. This disparity between groups was no longer observable within 6 years' old children ($p = .12$). Further analysis suggests that the level of language development predicts the performance in FBT test ($p < .01$), even after including variables associated with implantation, such the age of implantation, implant use duration or time between first and second CI.

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PC-032 Understanding privileged access and second-order theory of mind

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The present poster reports two experiments on attribution of privileged access to mental states in children. The main question of Experiment 1 is the following: When and how does the child acquire the attribution of privileged access to mental states? We tested children between 4-and 6 years of age (N=100). We used a modified version of Bartsch and Wellman's (1989) experiment. Our subjects witnessed the following scenario in the form of a puppet play: „Here is Ann. Ann is looking for her kitten. The kitten is hiding under the chair. But Ann is looking for it under the piano. Why? What do you think?" In our modification, after answering this question another identical puppet appeared and the children's task was to select Ann on the basis of the puppets' first person verbal reports. One could argue that our selection task described above is equivalent to a second-order theory of mind task because the child has to select Ann on the basis of her report concerning her first-order mental states. This was the reason for running a second experiment on the relationship between attribution of privileged access and second-order theory of mind. So, in the second experiment we replicated the Ann task and complemented it with a specific second-order theory of mind task by Perner and Howes (1995). Our participants were between 4 and 6 years of age (N=127). We did not find a significant correlation between the Ann (selection) task and the Self-Reflection Question.

PC-033 Implicit theory of mind in preschool aged children: evidence from simultaneous gaze-recording and fNIRS study

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Anticipatory looking (AL) is a method frequently used to measure implicit sensitivity to others' beliefs, especially in young children (e.g. Southgate et al., 2007). However, in previously used AL experimental designs, anticipatory gaze was measured at the moment immediately preceding agent's belief-based behaviour. On the other hand, after Kovacs et al. (2010) study it is hypothesized that beliefs are coded at the moment of belief formation. A computerised non-verbal version of classic change-of-location task was developed, allowing simultaneous collecting of fNIRS neuroimaging data and gaze-based measures of early (at the stage of belief formation) and late (immediately preceding action) anticipation from preschool aged children (3-5 years). Within-subject design with three conditions (False Belief (FB), True Belief (TB) and No-Belief (NB), with 4 trials each was applied. Preliminary results of the looking behaviour analysis (N = 11 ; mean age = 3 years 6 months) revealed that early anticipation occurs more often than late anticipation (29 vs 16; p = 0,007). Additionally, within the group consisting of children consequently anticipating in all FB tri-

als (N = 4; mean age = 3 years 4 months) a peak of hemodynamic response originating from structures of the ToM neural network was observed following the belief- formation phase of the task. These results may account for recent replication failures of AL based ToM studies (e.g. Burnside et al., 2018, Kulke et al., 2018). The study is in progress and more data is expected to be collected.

PC-034 Effects of second language acquisition on children's character referencing in elicited narratives

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This study investgates how learning a second language which has different referential system than L1 is represented in character referencing in elicited narratives.In constructing narratives, children have to master how to refer to characters in a clear way so that they convey the correct information to the listener. In narratives, discourse functions of character introduction, reintroduction and maintenance require the use of specific linguistic forms which indicate whether the information is new (indefinite nominal), given (definite nominal) or presupposed (pronouns) (Givon,1989, Gundel et al.,1983).English has an article system for the definite(the)-indefinite(a/an) distinction.Turkish referential system does not have a formal article system, instead word order, case marking and the determiner bir ('one') are used to mark definite-indefinite distinction.One-hundred-and-ten 5- and 7-year-old monolingual (L1-Turkish) and bilingual (L1-Turkish;L2-English) children produced narratives for the book Frog,Where are you? Three referents were included in coding discourse functions and linguistic form: boy, dog and frog. In introducing characters, bilinguals used indefinite nominal more often than monolinguals for frog ($p=.005$), and trend was found for boy and dog. For reintroducing and maintaining the same characters, monolinguals used definite nominal more often than bilinguals ($p's<.01$) whereas bilinguals used more pronoun-drop forms compared to monolinguals ($p's<.01$). Results indicate that although bilinguals seem to use correct form of referencing for character introduction - a probable reflection of the article system in L2- they seem to have lapses in their referencing with overuse of pronoun-drop forms in both reintroducing and maintaining characters.

PC-035 Atypical lateralization of language-lelated tracts in non- or minimally verbal children with autism

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Up to 30 % of individuals with ASD are estimated to remain non- or minimally verbal throughout their lifetime. We designed a structural and functional MRI-protocol to study the organization of the language network in seven non- or minimally verbal children with autism (aged 8;3-17;8). Using DTI, we quantified the brain tissue microstructure lateralization of the main language-related white matter pathways. An extensive series of pre-tests confirmed diagnosis (ADOS, ADI-R) and single-word verbal status, levels of comprehension (Peabody Verbal Mental Age) between 1-4;3 years, absence of language in other modalities (gesture, sign, writing), and cognitive level (Leiter-R, ComFor). The Lateralization Index (LI) of the Fractional Anisotropy (FA) value for each tract was computed. All tracts were segmented using TractSeg, a novel convolutional neural network-based automatic tool. A significant rightward lateralization of the Arcuate Fasciculus (AR) was found (t-test: p=0.0312; Wilcoxon signed-rank test: p=0.0156). There was a trend towards leftward lateralization of the Inferior Fronto-Occipital Fasciculus (IFOF), where the t-test was significant (p=0.0298) but not the sign-rank test (p=0.0781). No significant results were found in the Inferior Longitudinal Fasciculus, the Uncinate Fasciculus, and the ventral component of the Superior Longitudinal Fasciculus (SLF-III). There were no significant relations between LI and age. Despite some variation, cognitive performance was floor-level. Since in previous studies of healthy controls, AR and IFOF are reported to be lateralized to the left and right sides, respectively, these preliminary results contribute to a possible language-related brain marker of non- or minimally verbal autism.

PC-036 Neural indicators of articulator-specific sensorimotor influences on infant speech perception

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Speech perception is multisensory from early in life. Behavioural evidence shows that at 6- months, sensorimotor information influences speech perception in an articulator-specific manner (Bruderer et al. 2015; Choi et al., 2019). The current study extends this work by examining the neural signature for

phonetic category change with and without sensorimotor influence. Using electroencephalography (EEG), we tested 3-4 months-old infants, an age at which infants discriminate native and non-native phonetic distinctions (Werker & Tees, 1984; Dehaene-Lambertz & Dehaene, 1994; Peña, Werker & Dehaene-Lambertz, 2012). In the auditory-only experiment, we tested discrimination of both English bilabial /ba/ vs alveolar /da/, and non-native dental /da/ vs. retroflex /Da/. We identified a robust mismatch response (MMR) for both distinctions in a cluster of left-anterior-sensors from 450-710ms following the critical stimulus onset. In the auditory-motor experiment, infants participated in the same EEG task while their tongue-tip movement was restricted with a teething-toy. We hypothesized that if there is a specificity in the relationship between oral-motor articulator influence and speech perception, then the tongue-tip movement restriction would selectively influence the MMR for the dental to retroflex but not the bilabial to alveolar phonetic category change. We observed an MMR from 290-500ms in a cluster of left-temporal-clusters of sensors only for the /ba/-/da/ change, demonstrating that restricting infants' tongue-tip movement selectively diminished the MMR for the alveolar /da/ - retroflex /Da/ phonetic contrast. These findings extend the previously reported behaviour results, providing electrophysiological evidence for articulator specific auditory-sensorimotor integration in pre-lingual infants.

PC-037 The development of time word comprehension & mental time travel in early childhood

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Time word comprehension in early childhood develops gradually between the ages of 3 and 7. Three-year-old children use deictic time words (e.g. yesterday, tomorrow) without associating them with adult-like meanings, an ability that only evolves by the start of elementary school (Tillman, Marghetis, Barner, & Srinivasan, 2017). First, children construct partial meanings of deictic time words based on language cues, while developing an insight into the domain of time (Tillman et al., 2017). Mental time travel (MTT), the cognitive capacity to project ourselves into the past and future is composed of the abilities of episodic memory and episodic future thinking, both emerging between the ages of 3 and 5 (Ferretti et al., 2018). Busby & Suddendorf (2005) suggested that children can travel mentally in time before they acquire a semantic understanding of time words. However, little is known about the interrelation between the development of time word comprehension and MTT abilities in early childhood. In this study, we assessed the performance of 64 children (age: 4-7 years) and 60 adults (age: 20-58 years) on a timeline task (Tillman & Barner, 2015) measuring time word comprehension; and on the Picture Book Trip task (Atance & Meltzoff, 2005) quantifying MTT abilities. Our results revealed that age had a significant effect on MTT scores ($p < 0.01$): 6 and 7-year-olds performed significantly better than 4-year-olds, but only 7-year-olds displayed adult-like skills. Additionally, children's time word comprehension predicted their MTT performance ($p < 0.01$), suggesting a joint developmental trajectory for the two abilities.

PC-038 The facilitative effect of phonetic context variability on early word learning: A habituation study with 14-month-old children

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Learning similar-sounding words is hard for children even though they are able to discriminate them (e.g. bih vs. dih, Stager & Werker, 1997). However, when the to-be-learnt word is presented with phonetic variability (e.g. different speakers, Rost & McMurray, 2009) or in different phonetic contexts (varying preceding syllables, Thiessen, 2011), children are able to learn minimal pairs. This study explores which type of variability is helpful by manipulating the phonetic context. Two groups of monolingual German 14-month olds (20 children in each) had to learn the word 'buk' (spoken by one speaker) by associating it to a novel object in a habituation paradigm. Prior to that one group was familiarised for 40s with informative variability (bak, dak, bek, dek, bik, dik, bok, dok, buk, duk), the other with uninformative variability (puk, tuk, fuk, luk, nuk, muk, buk, duk). Word learning was tested with same trials ('buk') and mismatch trials ('duk'). We hypothesized that vowel variability would highlight the place-of-articulation contrast and lead to successful learning whereas initial consonant variability would not. Significant differences in the looking times to mismatch vs. same trials in the informative variability group but not in the control group show that this is indeed the case. We conclude that phonetic variability is beneficial in word learning of minimal pairs if and only if the variability highlights the (stable) relation between the different cues marking the relevant contrast. Neither variability in itself is sufficient nor is the presence of different speakers necessary to achieve this facilitative effect.

PC-039 Mapping linguistic cues to causal events: A cross-linguistic study

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Languages provide different cues to causality such as syntactic frame (number of noun phrases) or verbal morphology (causative marker) that guide children in mapping causal sentences to causal meanings. Whether syntactic frame is a universally prominent cue or whether the language-specific cues, such as the causative marker, matter in this mapping is a question yet to be examined. In this study we examined Turkish, which express causality mainly with verbal morphology, and Swiss-German, which does so with the syntactic frame. We tested how 3- to 4-year-old Turkish and Swiss-German speaking children perform in mapping causal sentences to causal scenes. Three Turkish groups heard sentences that contained i) only a verbal morphological cue, ii) only a syntactic cue or iii) both cues. One Swiss group heard sentences with only a syntactic cue, because Swiss-German lacks a verbal morphology cue. In a preferential pointing task adapted from Kline et al. (2017), children pointed to either a causal scene or a non-causal scene upon hearing the positive and negative

versions of causal prompts using nonsense verbs (e.g. Where did the girl (not) gorp the tall thing?). Both the Swiss children and all three groups of Turkish children chose causal scenes upon positive causal prompts and non-causal scenes upon negative causal prompts at a level above chance (all ps < .02), without any difference across groups, indicating that at this age, children used any cue to causality equally well in mapping causal sentences to causal scenes.

PC-040 How language changes thought: Learning number words supports match-to-sample

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How can learning a language change thought? For adults, words can be used to compress perceptual information, which can be noisy and changeable, into stable and discrete summary symbols, which can then be compared directly, abstracting away from their content. We ask how learning number words affects children's ability to compare visible quantities and determine whether they match. Children's number learning is an especially useful case study of the relationship between language and thought for two reasons. First, the perceptual systems of pre- and non-linguistic animals are able to represent numerical information in two ways: either by tracking small sets of individual objects (up to about 4) or by estimating the approximate number of items in larger sets. Second, it takes much longer to learn number words. US children do not typically master the meaning of "five" until ages 3-4. This makes it possible to test children's ability to perform numerical match computations before and after they have learned the relevant number words. 100 children between the ages of 2 and 4 participated in a numerical match-to-sample task (e.g. given a choice between a picture of 3 fish and a picture of 4 fish, which matches another picture of 4?) We found that children did better on comparisons in which they knew the corresponding number words than comparisons where the numbers were above their knower-level. This suggests that number words can support a match computation by changing its format, from comparing individual objects to comparing summary symbols.

PC-041 Within - category object recognition may be associated with expressive vocabulary at 18 months

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Infants know the meaning of common nouns well before they begin to speak (e.g. Bergelson & Swingley, 2012). New evidence suggests that expressive vocabulary is related to object categorization (Hartley et al., 2017); specifically, a certain level of categorization is needed for new word learning (Yee et al., 2012). Our study uses the intermodal preferential looking paradigm to examine 18-month-olds' knowledge of word meaning, and to explore infants' ability to distinguish objects within the same category. Infants were presented with pairs of object drawings. One of each pair was labelled in infant directed speech using a carrier sequence (e.g. "Look, apple!"), and infants' fixations on the named objects were measured before and after naming. The object pairs were perceptually dissimilar, but matched for category (animate - inanimate), frequency and familiarity based on questionnaire data. Mothers of participating infants were asked to complete the Hungarian version of the MacArthur-Bates Communication Development Inventory I: Words and gestures, marking each word they thought their child 'understood' or 'understood and produced'. We expected infants with greater receptive and expressive vocabularies to show better word recognition as measured by change in fixations from pre- to post-naming. However, overall word recognition performance was only associated with expressive vocabulary. Further analyses revealed that infants with an expressive vocabulary of hundred or more words performed significantly better than infants with a smaller expressive vocabulary. Presumably, infants with a greater expressive vocabulary have better object categorization skills, and therefore better word recognition ability.

PC-042 Spatial Organization and Numeracy in American and Israeli Preschoolers

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Children spatially organize ordinal information (e.g., numbers, letters) in a way that reflects their culture's dominant script language. Here, we explored whether information conveyed with an emphasis on process or goals, with or against the spatial flow of the child's language, is preferentially recalled. Four- and 5-y.o.s in the US (English speakers, left-to-right (LR) script language) and Israel (Hebrew

speakers, right-to-left(RL) script language) viewed an experimenter lay out a series of numbered, lettered, or colored chips in a LR or RL manner. In the Process condition, the experimenter said "Do you see how I did it? Do it how I did it". In the Means-Ends condition, the experimenter said "Do you see what I'm doing? Do what I do." The board was removed and children were asked to recreate the scene, choosing from a set of all stimuli. They also performed a brief numeracy assessment. Children in both cultures recreated the scene more accurately in the Process condition than the Means-Ends condition. Children in Israel recalled RL information better than LR information overall, and RL letter information better than the US children. Better recall of LR direction and order of numbers is associated with better formal numeracy in Americans, and worse numeracy in Israelis. Thus, a) adult emphasis of the process of spatial structuring enhances memory (across multiple cultures), b) the spatial flow of information enhances memory in script-congruent specific fashion, and c) memory for these culturally relevant cues in the numerical domain is associated with better formal numeracy.

PC-043 Gaze-following in 5 months old infants in the context of infant-directed and adult-directed speech

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Young infants readily follow gaze of a person on a computer screen. However, evidence for gaze-following in infants younger than 6 months of age is still fragmentary. Ostension has been reported to facilitate gaze-following in young infants, but not all studies found this effect. The present study aims at testing the hypothesis that different patterns of results across studies investigating the role of ostension may be a product of different operationalization of gaze-following and valid trials. Gaze following was assessed in 5 months old infants across three conditions (modelled after Senju and Csibra, 2007), where the model's turning of the head towards of the two objects on the table was preceded either by infant directed speech (IDS), adult-directed speech (ADS) or computer generated no-speech sound (NO). The data was collected using Eyelink 1000Plus eye-tracker and analyzed using either stringent (N=36) or weak (N=73) inclusion criteria. On stringent criteria babies were required to provide a minimum of 3 valid trials, where they looked at model's head during the head-turn and immediately afterwards produced a direct saccade from the model's head to an object. On weak criteria, babies were required to provide a minimum of 1 valid trial, where there was a transition of gaze from the head to an object. Analyses are pending at the time of submission.

PC-044 Change of Limb Movements in Response to Auditory Feedback with Virtual Drum-Kit Device in Three-Months-Old Infants

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Playing musical instruments involves auditory-motor coordination and has been essential to our human culture. Researchers have been trying to understand the developmental origin of our musicality to play the instruments, yet early manifestations of auditory-motor interactions have not been fully investigated. In this study, we aimed to investigate the change of limb movements in response to auditory feedback of percussion sounds in three-months old infants. In the experiment, we attached a virtual drum-kit device to the limbs to provide feedback of percussion sounds. First, we measured the infant's movements without the feedback for two minutes (the baseline phase or 'Base'). Next, feedback was provided to the infants for eight minutes (the feedback phases, divided into four two-minutes phases or 'Feedback 1-4'). After that, the feedback was removed for two minutes (the washout phase or 'Post'). The movements were measured with a video camera and the data were analyzed with OpenPose software to detect the left and right wrist and ankle joint positions. We assessed the amount of movement of seven infants by calculating the length of the limb trajectories. Using one-way analysis of variance (ANOVA), we found a significant increase of the limb movement after the second phases of feedback (Feedback 2-4 and Post) compared with the first phase of the feedback (Feedback 1), $p < 0.05$, showing that the movements became more active after the Feedback 2. The results suggest that three-months-old infants already primed their bodies to interact with the auditory feedback of percussion sounds.

PC-045 Why can't I buy chocolate in the shop with my Monopoly money? - Understanding contextual boundaries in pretense play

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The aim of our study is to explore the reasoning of children around the age of 4 in scenarios involving pretense play. It has been proposed recently that pretense play could be the developmental cradle through which children understand how status functions and institutional facts are created in human societies (Searle, 1995; Rakoczy, 2008). Our main question is whether children at this age understand that object functions stipulated during pretense could only be known by people witnessing the stipulation, while object functions that are connected to an object in a given culture could be known by all members of that cultural group. During the experiments, children play together with an

experimenter and well-known objects. Two pretense play episodes are connected to each object: the first corresponds to the original function of the object with a given prop, and the second is made up on the scene with another prop. This happens in either the presence or the absence of a second experimenter. Following these episodes, the second experimenter decides to play with the object, and asks for a "missing" prop. We plan to measure how children interpret this request by recording their object giving choices. Our prediction is that in case the experimenter was present during the play episodes, more children would give the prop corresponding to the pretense stipulation, compared to when she was absent. Preliminary data from a pilot study supports this prediction (50% versus 22% giving of pretense prop in the present and the absent condition, respectively).

PC-046 Three-year-olds' imitative learning from peer and adult models

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We tested three-year-old children (N = 46) in an imitation task in which they had to learn how to retrieve a marble from a riddle box by watching either a peer or adult model perform relevant and irrelevant actions with both functional (magnetic) and non-functional tools. In order to match both learning contexts, we presented participants with yoked recordings of age-mates or adults in a semi-interactive video set-up allowing to combine both behavioral and eye-tracking measures. We investigated (1) how likely children were to succeed in retrieving the marble and (2) how often they would imitate irrelevant behaviors, as well as (3) how they distributed their attention during demonstration. In a second task, a puppet entered the scene and performed an entirely different set of actions on the apparatus. We were interested in (4) whether participants would protest and, hence, how readily they would attach normative value to actions witnessed from adults and age-mates. In a final task, the experimenter provided the participants with a set of five non-magnetic tools looking exactly like the magnetic tool. In a one-minute-exploration phase, we tested (4) how persistently children would try to elicit the feature from the inert items when having learned the function in different social contexts. Data collection for this study is finished and analyses will be complete by fall 2019.

PC-047 Infants' sensitivity to the signaling value of strange behaviors explains the pull of irrational leadership.

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People sometimes do strange, seemingly irrational, things, such as engaging in rituals or following bizarre fashions. We suggest that one of reason behind the cultural success of strange behaviors is their signaling value which comes from (i) their cost and (ii) the ease

with which their reproduction is detected. Assuming that irrational behaviors have a high signaling value makes a counter-intuitive prediction: A learner's reproduction of a model's behavior should be a stronger cue of influence when the model's behavior is seemingly irrational, than when it is rational. Here, we test this hypothesis in pre-verbal infants. Fifteen-months-old infants saw animations showing three geometric agents interacting. In three familiarization trials, one of the agents (follower) followed one of the other agents (rational leader) across a circuitous walls-delimited path. In other three familiarization trials, the same follower followed the remaining agent (irrational leader) in a similar scenario but in which no walls were present. Despite the absence of constraints, the irrational leader (and the follower) always took an unnecessarily long and complicated path to reach their final destination. Later in a test phase, the two leaders took different paths. We measured infants' looking time when the follower followed either the irrational leader or the rational leader. Infants' average looking times suggest that they expected the follower to follow the irrational leader (mean-irrational = 21,439 sec.; mean-rational = 14,008 sec.; p< 0,01) confirming our initial hypothesis. We will further discuss these results and their interpretation, as well as ongoing follow-up studies.

PC-048 Inequity aversion in preschooler children

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For human cooperation, fair resource sharing is very important which is promoted by inequity aversion. We measured the inequity aversion of children between the ages of 4 and 6 to examine how fairness behaviour functions in them. Our aim was to investigate how young children respond to disadvantageous inequity (when their partner gets more) and advantageous inequity (when they get more than the partner).

Children played with same sex individuals from another preschool group a simple choice game in which they decided between two allocation of candies. One of them acts as the decider who directly affect the choice between allocations of candies. In each treatment, they had to decide between equal amounts to both of them and different inequal amounts. Additionally, we asked the children about the reason of their decisions and analysed the answers with qualitative methods. We found that preschool children do not make random decision nor do they exclusively attend to their own pay-off. For the most part girls and boys did not differ in their choices. 65% of the children have shown an other-regarding choice (neutral for them, advantageous for the other children), but two-third

of them chose more candies instead of sharing it with the other children. Children can use different strategies through the game, although they cannot or do not want to tell the cause of their decisions.

PC-049 Social and physiological determinants of peer cooperation and competition in preschool children

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Social interactions are important for humans from birth as they support socio-cognitive development. Nowadays children often enter day-care at an early age, where they begin to engage meaningfully with their peers. These social interactions can be both cooperative and competitive. So far, questions about which social and physiological factors modify the development of peer cooperation and competition at that early age remain largely unanswered. Here we used a cross-sectional design to investigate cooperative and competitive interactions in the day-care context in six groups of children between the ages of 1 and 6 years (total N=102). During ten sessions we observed all naturally occurring social interactions during unstructured playtime. To investigate the influence of androgen on children's social interactions, we assessed prenatal androgen exposure via the 2nd-to-4th digit ratio (2D:4D). Additionally, for a sub-sample of children aged between 3 and 6 years (N=47), we measured fluctuating testosterone from saliva samples. We found that the number of cooperative social interactions increased with age, while there was no such connection for competitive interactions. Physiologically, both fluctuating testosterone and prenatal androgen exposure seemed to influence the children's interactions: children with high levels of fluctuating testosterone and low 2D:4D ratios (reflecting high prenatal androgen exposure) had fewer interaction partners than children with low levels of testosterone and high 2D:4D ratios. Our results show a clear influence of age on peer cooperation, but not on competition in preschool children and hint towards an influence of fluctuating testosterone and prenatal androgen exposure at this young age.

PC-050 Girls, not boys, are strong reciprocators in a one-shot, sequential, and costly interaction

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Evolutionary models attribute a key role for the evolution of cooperation to reciprocal mechanisms, i.e., matching ones actions to the prior actions of a partner, directly towards the original

partner or in-directly towards a new partner. Behavioral findings converge to suggest that the underlying motivations for reciprocity (or lack of) involve various degrees of self-oriented considerations (e.g., maximizing self-benefit) and relational ones (e.g., gratitude/resentment). To assess the relative weight children attribute to these types of considerations, the current studies implemented a one-shot, sequential and costly reciprocal interaction. In Study 1, 96 7-year-olds played four consecutive rounds of a binary 'Dictator game', first three rounds as recipients, and lastly as distributors. Two variables were manipulated between participants: Partner's behavior – participants either interacted with an 'egalitarian' or a 'selfish' partner during the first three rounds (chose 3-3 or 5-1) and Reciprocal mechanism – whether participants' responded directly toward the original partner or in-directly towards a new partner. In the critical condition, i.e., following an interaction with an 'egalitarian' partner, only girls responded in a grateful manner towards original partners as well as towards new ones, and at extreme rates (100%, 90%). To assess the developmental trajectory of this gendered-behavior, Study 2 included 96 4- and 5-year-olds and focused on direct reciprocal interaction. An identical gendered-behavior was found among 4-year-olds, but not among 5-year-olds. The U-shaped-age and gender differences in relying upon self- and relational-considerations are consistent with evolutionary and socialization accounts of their origin, and offer insights to socio-developmental, economic, and evolutionary models.

PC-051 Children hold leaders more accountable than subordinates in joint deeds

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Adults attribute leaders a wider scope of responsibility than subordinates: Leaders are held more accountable than subordinates for their own words and acts, as well as for those of others'. Building on children's capacities to (a) identify social rank, and (b) distinguish between ideas and labor, we examined the scope of responsibility they attribute to leaders versus subordinates in joint deeds. In three experiments, children ages 4 to 6 years (N=192) were presented two vignettes involving a group of three protagonists. Each vignette described a deed that was instigated by one protagonist ('instigator'), and carried by another protagonist ('actor') toward a third protagonist ('target'). Experiment 1 focused on anti-social deeds. In one vignette, a leader instigated a misdeed via a subtle preference expression, and a subordinate carried it out toward a 'target' subordinate. In another vignette, these roles reversed: A subordinate instigated a misdeed via a subtle preference expression that the leader carried out toward the 'target'. Children punished, on behalf of the target, the leader more than the subordinate, regardless of the involvement it had (instigator or actor), and whether the instigator was present or absent during the deed. This effect was eliminated in Experiment 2, when controlling for sheer salience of one protagonist over others, via labeling. Experiment 3 presented pro-social deeds, and similar results to Experiment 1 were obtained with respect to children's reward alloca-

tion, on behalf of the target, as credit for deeds. Together, our findings suggest children recognize asymmetries in accountability between leaders and subordinates.

PC-052 Fourteen-month-olds' imitation is influenced more strongly by a model's competence than by a model's certainty

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Infants are more likely to learn from certain and competent models than from uncertain and incompetent models. However, it is unknown which of these cues to a model's reliability infants consider more important. In Experiment 1, we investigated whether 14-month-old infants (n=35) imitate and adopt preferences selectively from an uncertain but competent compared to a certain but incompetent model. Infants watched videos in which an adult expressed either uncertainty but acted competently or expressed certainty but acted incompetently with familiar objects. In two preference tasks, the adult then chose one of two objects to operate an apparatus, and in two imitation tasks, the adult then demonstrated a novel action. Infants did not adopt the model's choice in the preference tasks but they imitated the uncertain but competent model more often than the certain but incompetent model in the imitation tasks. In Experiment 2, 14-month-olds (n=33) watched videos in which an adult expressed only either certainty or uncertainty in order to test whether infants are sensitive to a model's certainty. Infants imitated and adopted the preference from a certain model more than from an uncertain model. These results suggest that 14-month-olds acknowledge both a model's competence and certainty when learning novel actions. However, they rely more on a model's competence than certainty when both cues are in conflict. The ability to detect proficient models when learning how to handle cultural artifacts helps infants to become well-integrated members of our culture.

PC-053 Racial out-group target heightens 3-4-year-olds' perspective-taking abilities

Carlota Saumell[1], Mireia Hernandez[1], Ferran Pons[1], Yarrow Dunham[2]

[1]Institute of Neurosciences, Barcelona, Spain; [2]Yale University, New Haven, USA

The ability to take another person's perspective when it is in conflict with one's own starts around the age of 3 and is generally acquired by the age of 5. The goal of this study is to explore whether this ability is modulated by the target's racial group membership during perspective-taking development in preschoolers. Using a between-groups design with random assignment (N=80; 40 3-4-year-olds; 40 5-6-year-olds) we tested children's ability to attribute mental states to racial in-group and out-group members through a target-modified version of a five-item preschooler Theory of Mind scale. As expected, 5-6-year-olds performed at ceiling, leaving no room for a target's effect. However, children within the developmental period (3-4-year-olds) exhibited an advantage in theorizing about

the mental states of the racial out-group targets. This effect was not correlated with children's in-group biases (explicit and implicit) or verbal intelligence. The present results suggest that activating an out-group mind-set enhances the cognitive capability of theorizing about others' thoughts. This finding adds a new perspective in the understanding of the development of social biases towards out-group members during the preschool years.

PC-054 Young children use meta-talk to convince their partners to make rational collaborative decisions

Kirstie Hartwell[1], Silke Brandt[2], Laura Boundy[1], Grace Barton[1], Bahar Köymen[1]

[1]University of Manchester, UK; [2]Lancaster University

Collaborative decision making requires partners to provide reasons for their proposals (Mercier and Sperber, 2011) and explain why some reasons are better than others, referred to as "meta-talk". To date, only children aged 7 and older have been shown to produce meta-talk (Köymen & Tomasello, 2018). In two studies, we explored whether young children (pre-schoolers) can produce meta-talk. In Study 1, 5 and 7-year-old peer dyads (N=128) heard two informants providing conflicting information about what a novel animal needs. The reliable informant prefaced the information with, "I know", and the less reliable informant with "I think". Both age groups could correctly choose the items supported by the reliable informant and justify their choices with meta-talk (e.g., "Because she said 'I know'"). In Study 2, in a simplified paradigm, 3- and 5-year-olds (N=44; data collection to be completed by January) had to jointly decide with E1 where a toy was hiding from a choice of three houses. One house had footprints of the toy in front of it. After the child and E1 decided that the toy must be in the house with the footprints, E1 left the room and E2 moved the toy to a new house. E1's belief of the toy's location was now outdated and the child had to convince E1 that the toy was in a new house without the footprints using meta-talk (e.g., "Because I saw it there"). Thus, preschool children can compare the evidence behind conflicting proposals using meta-talk to make rational cooperative decisions.

PC-055 The developmental trajectory of altercentrism in human ontogeny

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[1]University of Copenhagen, Denmark; [2]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany

Humans have a well-documented a tendency to be influenced by the perspective of others in their own actions. This phenomenon, which we refer to as altercentric modulation, has been found in various contexts in adults (Samson et al, 2010) as well as in infants (Kovács et al, 2010). With regard to the ontogeny of understanding other's mental states, the common view is that human infants start from a me-first position, and through themselves they begin to understand others. On this account, altercentric modulation should increase during development.

Here we propose an opposite trajectory, where infants at a young age start out highly altercentric and through development become less susceptible to other's perspective. In particular, through the emergence of self-concept infants would increasingly focus on themselves, and begin to separate their own perspective from that of others. This view predicts a decrease of altercentric modulation with age. To test this hypothesis, we use a task where altercentric modulation has been found with 14-month-old infants (Kampis & Kovács, submitted). There, infants tended to search longer in a box when another person believed an object to be present than when she believed the box to be empty. Here we use this paradigm with children between 1 to 6 years. Preliminary results with n=162 children show a significant decrease in altercentric modulation with age (Pearson's r=-.234, p= .014). We will discuss the developmental patterns together with the relationship between altercentric modulation and measures assessing the emergence of self-concept.

PC-056 Early attachment as a predictor of children's friendship: A longitudinal study

Nika Čermak, Ljubica Marjanovič Umek

University of Ljubljana, Slovenia

The central premise of attachment theory is that attachment security and the model of early child-parent relationship is reflected in the child's interpersonal relationships across the life span, including friendships. The child-parent relationship at different developmental stages is thus considered one of the most important predictors of the social development of children. Present study examined the longitudinal connection between early attachment of toddlers and the quality of their friendships in middle childhood. The sample consisted of 129 toddlers (52 % boys), from which 118 participated in the second wave of data collection. Toddler attachment was assessed with Attachment Q-sort at age 15 months, while friendship quality at 9 years was assessed with three measures, namely self-report, observations and sociometric measure. We found a significant correlation between attachment and observed friendship quality, while attachment was not related to self-report friendship quality and number of reciprocal friendships. Furthermore, we examined causality links between attachment and friendship quality by proposing a structural model. Individual quality of child interaction was found to be a significant mediator of the path from attachment security to peer competence, as reflected in the number of reciprocal friendships. Despite their significance, low correlations are most consistent with moderate influence of secure attachment on friendship quality. Obtained findings regarding association and influences of attachment on friendship quality can be beneficial in counselling and providing help to children with problems in social interaction.

PC-057 Joint object play in 10-month-olds predicts their developmental outcomes at the age of 3 years - study in siblings of children with ASD

Alicja Radkowska[1,3], Alicja Niedźwiecka[1], Anna Malinowska[1,3], Sonia Ramotowska[2], Rafał Kawa[1], Ewa Pisula[1], Przemysław Tomalski[1,3]

[1]University of Warsaw, Poland; [2]University of Amsterdam, Netherlands; [3]Institute of Psychology Polish Academy of Sciences, Warsaw, Poland

Triadic engagement is a situation in infant-parent interaction while two partners share a focus of gaze and manual activity. Studies indicate that triadic engagement supports the development of language (Adamson et al., 2019) and social cognition (Brandone et al., 2019). Joint attention skills can differentiate infants who have an older sibling [Sibs] with diagnosis of autism spectrum disorder [ASD] from their typically developing peers [TD] already during the first year of life (Nystrom et al., 2019). Less is known in regard to relation between the amount of triadic engagement and (i) sensory processing profiles or temperament dimensions as well as (ii) developmental outcomes in Sibs. Our prospective study investigated parallel attention and action on objects in infant-parent interactions at 10, 14 and 24 months in TD and Sibs infants. We also checked the predictive value of time spent in this dyadic state at 10 months for infants' developmental outcomes at the age of 3 years. We found that at 10 months sibs, who developed typically [Sibs-T] spent more time in parallel attention and manipulation of objects than sibs who had a diagnosis of ASD or elevated ADOS scores at the age of 3 [Sibs-A]. There was also a statistical tendency for difference in slopes of change between 10 and 14 months among TD and HR-A infants. Moreover, time spent in parallel attention and action on objects at 10 months predicted developmental outcomes across domains - receptive language, social skills, adaptive behavior, sensory sensitivity and negative affect.

PC-058 Children's selectivity in informing others: Exploring the roles of knowledge type and group affiliation

Didar Karadağ[1,2], Gaye Soley[1]

[1]Boğaziçi University, Turkey; [2]Lancaster University, UK

Children are quite selective and take various factors into account when learning from others. On the other hand, much less is known about factors that guide children's teaching. We investigated whether children would prioritize members of their group when teaching and if so, whether this would depend on the type of knowledge that is being transferred (i.e., social-conventional vs. moral norms). Five- and 6-year-old children (N = 64) were first assigned to minimal groups on the basis of their color preference (i.e., green vs. orange). Then, children were introduced to two potential targets differing in their group membership, and were asked to choose one or both of these targets to teach social-conventional or moral norms. Both targets were introduced as being ignorant of the norms. Finally, children were asked to rate their liking of own- and other-group members. Results

showed that children chose ingroup members when teaching social-conventional norms, whereas they chose both members when teaching moral norms. In both conditions, children's liking scores were higher for ingroup members. Taken together, these findings suggest that children consider social-conventional norms as inherently related to groups and transfer them selectively to own-group members. On the other hand, they might consider moral norms as more universal and binding for everyone regardless of their group status.

PC-059 Tap with them or tap with it: Exploring social facilitation and intentionality effects on children's visuomotor synchrony ability

Ellen M. Howard[1], Bahar Tunçgenç[1], Roger Newport[2], Danielle Ropar[1]

[1]School of Psychology, University of Nottingham, Nottingham, United Kingdom; [2]School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough, United Kingdom

We explored how movement synchrony, a vital part of human social function, develops in children. Across two experiments we investigated the effects of intentionality, social context, and age on children's ability to tap in time with a visual stimulus. We predicted that synchronisation would be greater in the intentional as compared to spontaneous condition, with social as compared to non-social stimuli, and in older children. Forty-eight children aged 4.8-14 years (Exp.1: N=26 M=8.78; Exp.2: N=22, M=9.05) participated. A mediated-reality system called MIRAGE was used, which enabled participants to view a live image of their hand and pre-recorded stimuli in a realistic way. In a counterbalanced within-subjects design, children tapped with an adult (social) and a bouncing ball (non-social). In Experiment 1, children were asked to tap as fast or as slow as they desired, whilst in Experiment 2, they were asked to purposefully tap in time with the visual stimulus. We obtained children's tapping tempo using a sliding-window analysis and compared the children's tempo to the stimulus tempo. Comparisons between the spontaneous and intentional experiments revealed no effect of intentionality on children's synchronization accuracy (p=.18). Children of all ages synchronized similarly proficiently within the spontaneous (r=.01, p=.97) and intentional conditions (r=-.27, p=.22). As predicted, children were significantly more likely to spontaneously synchronize with social compared to non-social stimulus (p=.011). However, a social facilitation effect was not observed in the intentional synchrony experiment (p=0.42). These findings elucidate how intrinsic reward mechanisms may mediate the social function of visuomotor synchrony across childhood.

PC-060 Is early location memory about remembering what the agent did?

Velisar Manea[1], Dora Kampis[1], Charlotte Grosse Weismann[2], Victoria Southgate[1]

[1]Copenhagen University; [2]Max-Planck-Institut für Kognitions- und Neurowissenschaften

Early in life human infants spend much of their time observing others. We report on the first two of a series of studies aimed to test the hypothesis that, for infants, others' actions serve as a cue

for prioritizing which events to encode. A review of studies of location memory in young infants (e.g. Baillargeon & Graber 1988; Wilcox et al., 1994; Newcombe et al., 1999; Ruffman et al., 2005) shows that in most of them it is an agent that hides the object of interest. Additionally, we recently found no evidence for location memory in young infants with a paradigm designed to minimize any cue of agency. Against this background, we hypothesize that infants encoding of the location of an object is influenced by whether this location was brought about by an agent or not. The current looking-time studies present 7-8-month-old infants with an object being placed behind one of two occluders by either an agent (here a hand) or an automaton (here, a conveyor belt). At the end of each presentation, one of the occluders is lowered to reveal no object. Half of those absences are congruent with reality, and the other half incongruent. While we expect infants to generally look longer at the incongruent outcomes, we predict a larger effect when the object was placed by the hand rather the automaton. Two samples of 32 infants each were preregistered and data collection is ongoing.

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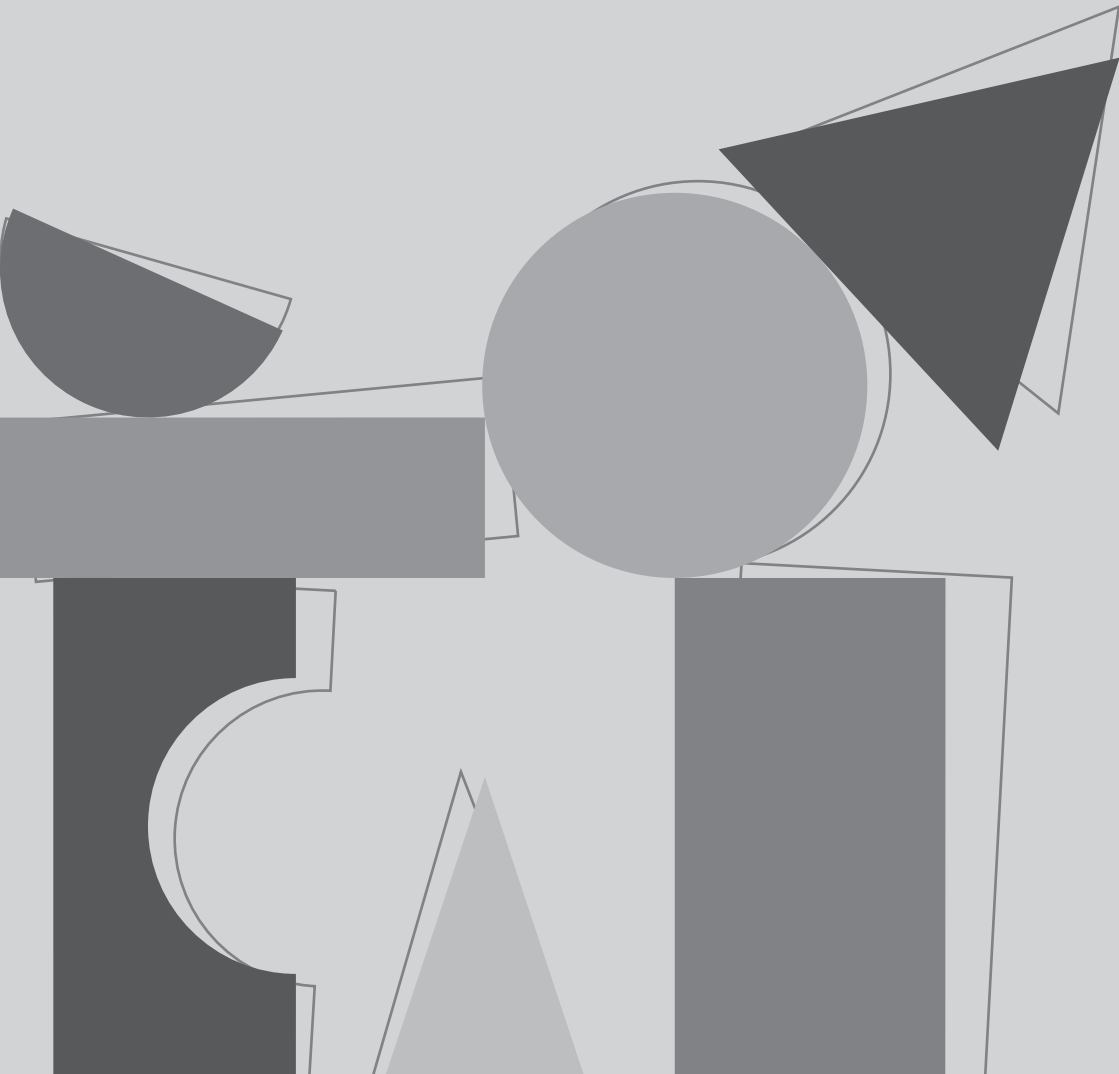


MAPS AND RESTAURANTS

FOOD PLACES AROUND CEU

1. HUMMUSBAR €
Október 6. utca 19
Middle Eastern, Street Food, Vegetarian-Friendly

2. SOUP/PASTA CULTURE €
Október 6. utca 19
Soups, Sandwiches, Pasta

3. ISTANBUL KEBAB €
Október 6. utca 22
Self-service, Fast food

4. GOOD KARMA €€
Október 6. utca 21
Contemporary Indian, Vegetarian-Friendly

5. BÖRZE €€-€€€
Nádor utca 23
Hungarian

6. DELIBABA €€
Nádor utca 19
Soups & Sandwiches, Vegetarian-Friendly

7. TERV PRESSZÓ €€
Nádor utca 19
Hungarian

8. TRATTORIA POMO D'ORO €€-€€€
Arany János utca 9
Italian

9. GOVINDA €
Vigyázó Ferenc utca 4
Indian(ish), Vegetarian

10. TRAKTOR €€-€€€
Zrínyi utca 2
Farm-to-Table

11. BAMBA MARHA €
Október 6. utca 6
Burger Bar

12. PAD THAI WOKBAR €€
Október 6. utca 4
Asian, Fast food

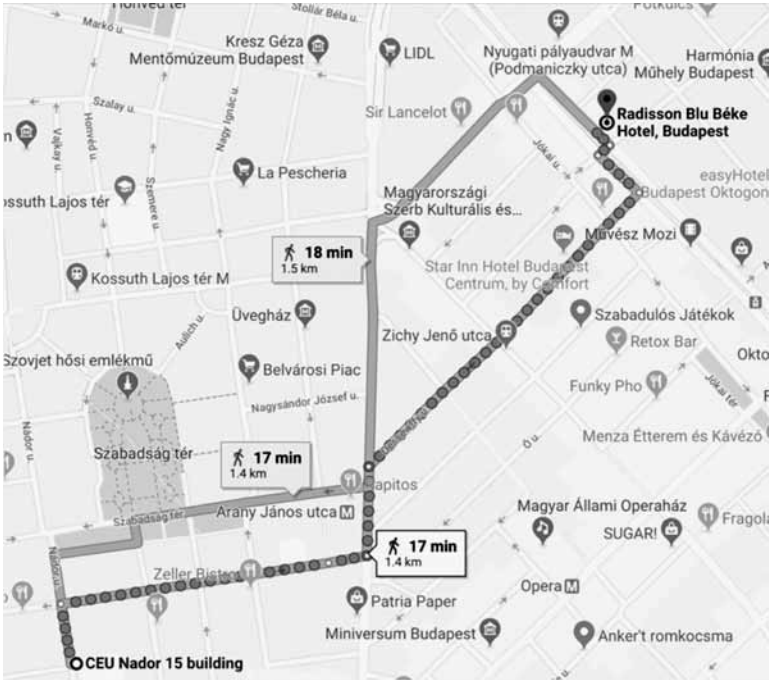
13. PIZZA ME €€
Sas utca 10
Fast Food

14. FRUCCOLA €€
Arany János utca 32
Soups & Sandwiches

15. PAPITOS €€
Podmaniczky Frigyes tér 4
Mexican Street Food, Vegetarian-Friendly

16. ARTIZÁN BAKERY €
Hold utca 3
Pastry, Sandwiches, Vegetarian-Friendly

Magyar Nemzeti Bank
Retro Lángos Büfé
Arany János utca M
Bank Center
Vera és Donald Blinken Nyílt...
Iberostar Grand Hotel Budapest
UniCredit Bank Magyarország
Országgyűlési Múzeum
á table
Mr. Funk
eFusion
Zeller Bistro
Espresso Embassy
Prime Steak & Wine Étterem
Akadémia Italia Budapest
Basilica
Café Kör
OTP Bank Rt. Pénzügytörténeti...
Prestige Hotel Budapest
Japanika
Szent István Bazilika
Subway
Szent István tér
Central European University
Ötkert Club
Duna Palota
Budapest 5 posta
Four Seasons Hotel Gresham Palace
Tigris
Padthai Wok
Bajcsy-Zsilinszky út M
High Note SkyBar
Aszú Étterem
Borkonyha


Kresz Géza Mentőmúzeum Budapest
LIDL
Nyugati pályaudvar M (Podmaniczky utca)
Harmónia Műhely Budapest
Sir Lancelot
Radisson Blu Béke Hotel, Budapest
La Pescheria
Magyarországi Szerb Kulturális és...
easyHotel Budapest Oktogon
Művész Mozi
18 min
1.5 km
Kossuth Lajos tér M
Star Inn Hotel Budapest Centrum, by Comfort
Üvegház
Szabadulós Játékok
Zichy Jenő utca
Retox Bar
Szovjet hősi emlékmű
Belvárosi Piac
Funky Pho
Nagysándor József u.
Menza Étterem és Kávézó
Szabadság tér
17 min
1.4 km
Arany János utca M
Magyar Állami Operaház
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17 min
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Opera M
Patria Paper
Miniversum Budapest
Anker't romkocsma
CEU Nador 15 building

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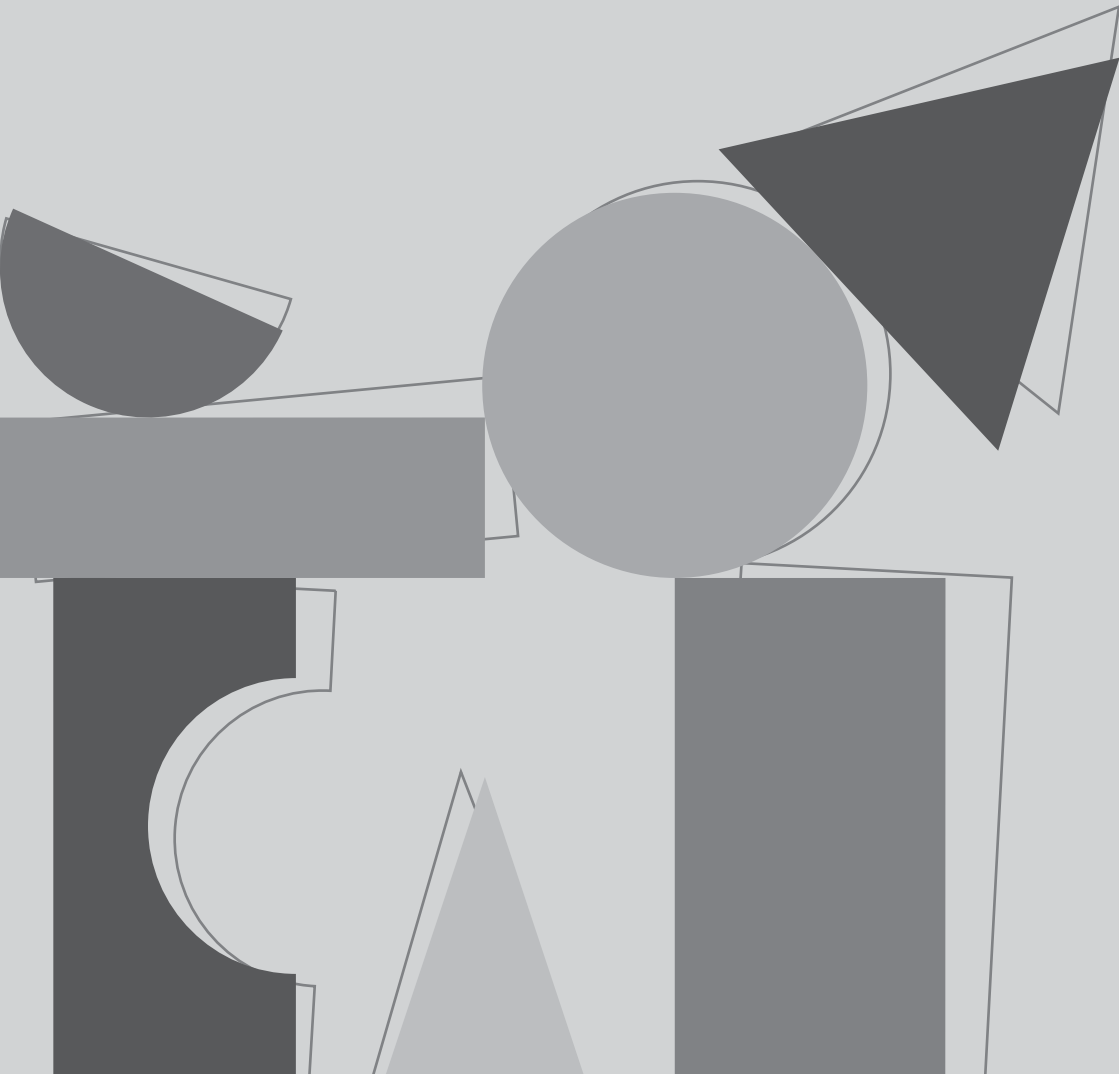

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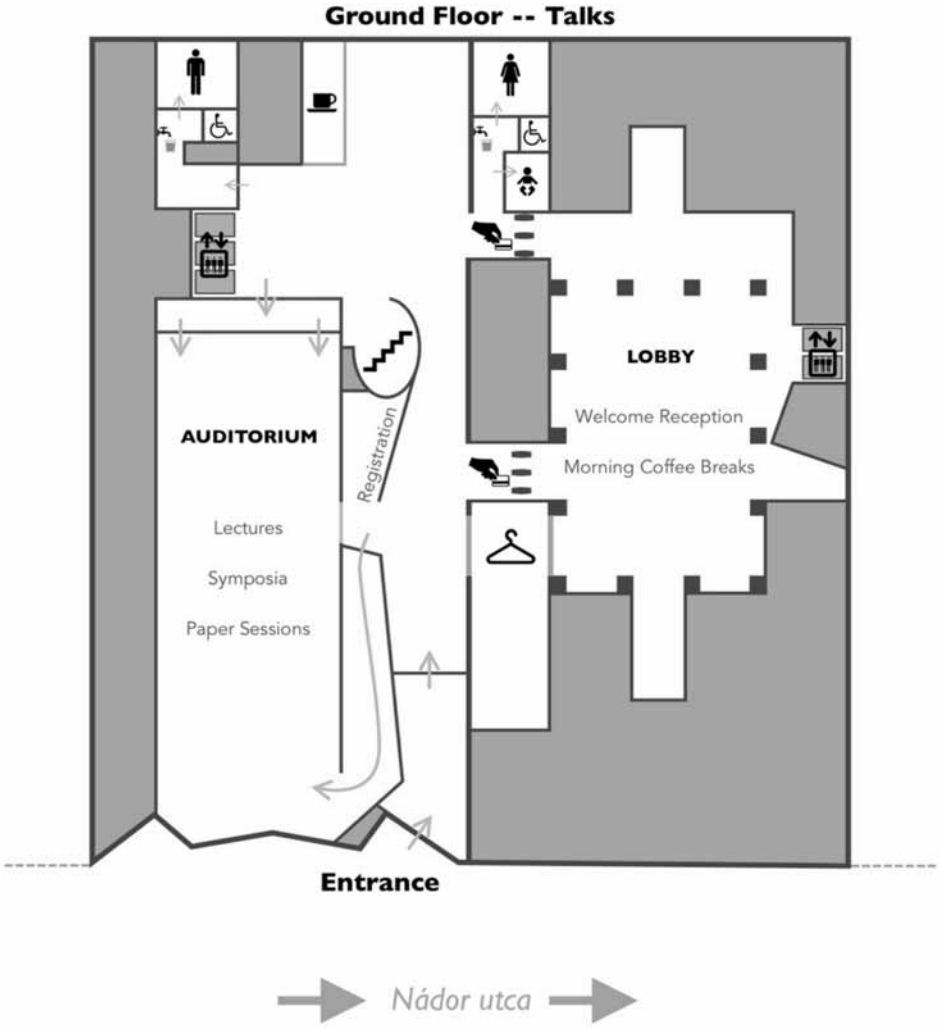
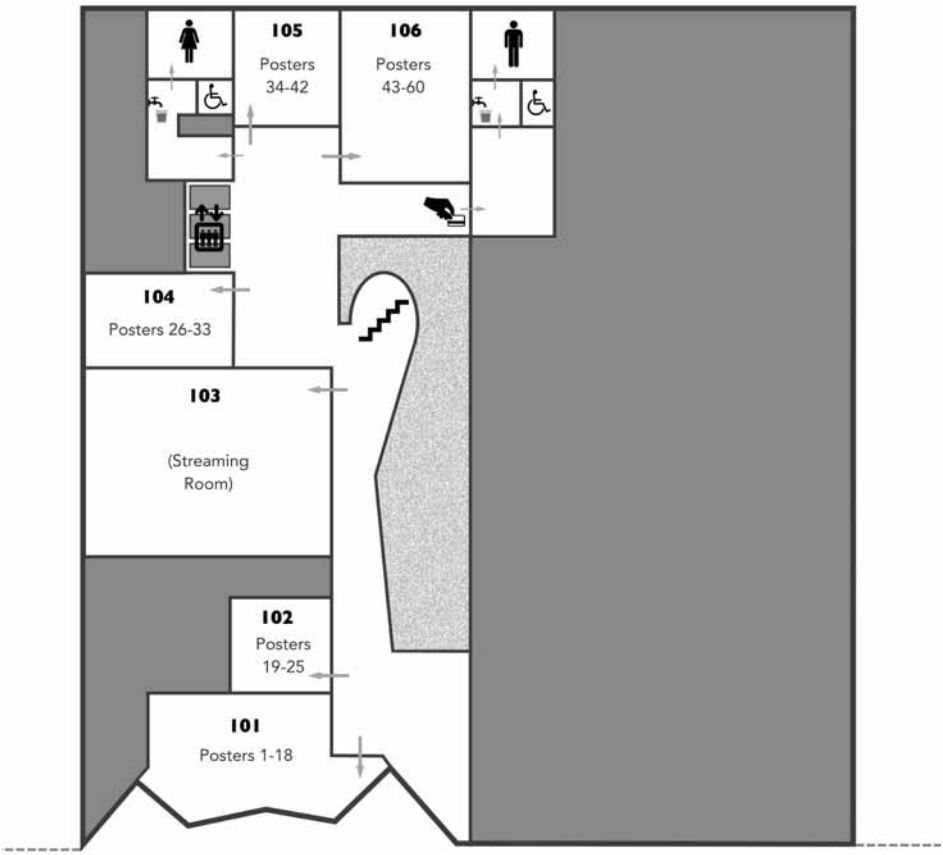

Ground Floor -- Talks
AUDITORIUM
Lectures
Symposia
Paper Sessions
Registration
LOBBY
Welcome Reception
Morning Coffee Breaks
Entrance
Nádor utca

First Floor -- Posters



Nádor utca

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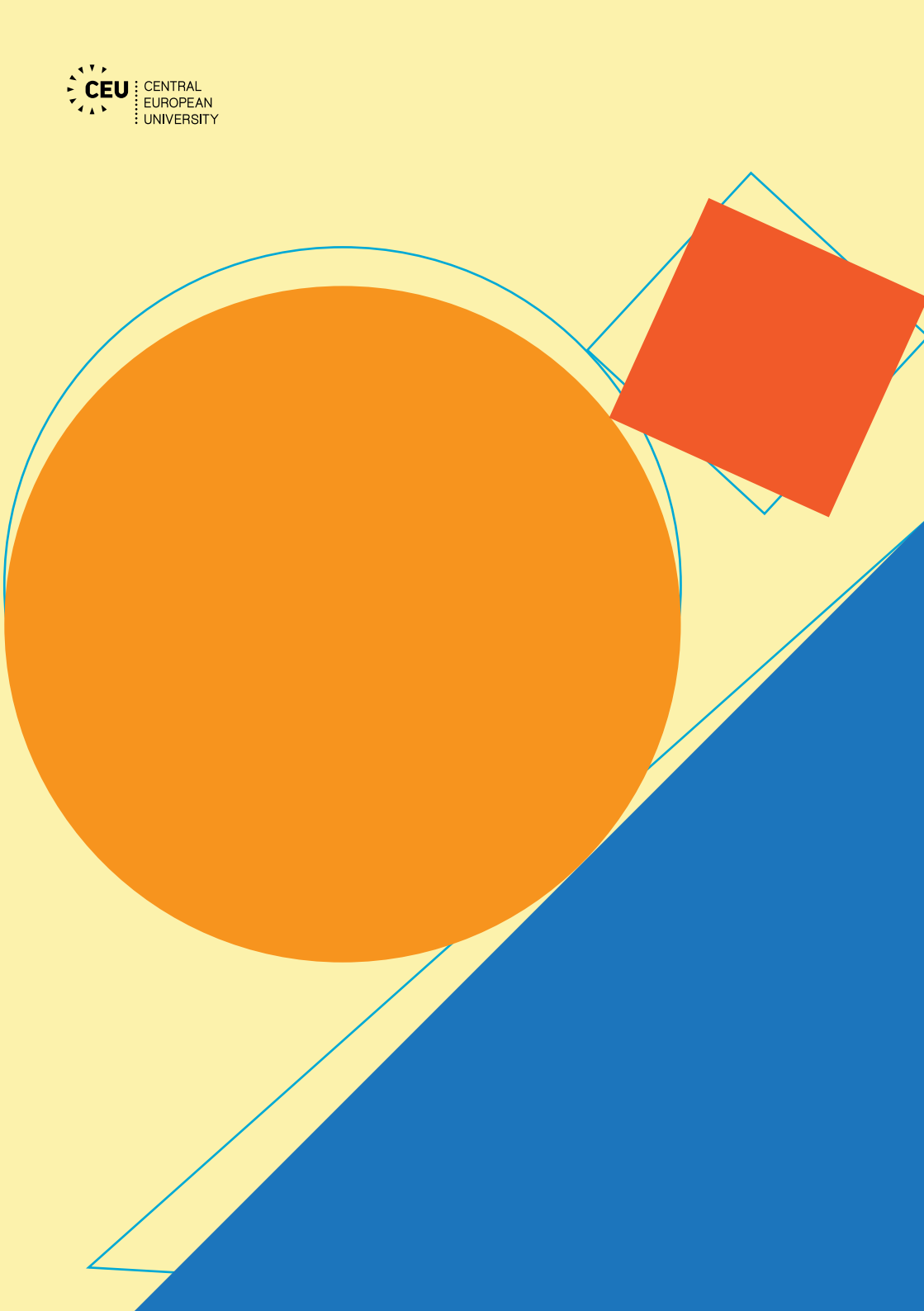
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