



BUDAPEST
CEU CONFERENCE
ON COGNITIVE
DEVELOPMENT

2026



	Thursday, January 15	Friday, January 16	Saturday, January 17
08:30	Pre-conference tutorial Session A		
09:30		Invited Talk 2 Luca Bonatti <i>Auditorium</i>	Invited Talk 3 Amanda Seed <i>Auditorium</i>
10:15	Coffee Break <i>Lobby</i>		
10:45	Pre-conference tutorial Session B	Coffee Break + Group Photo <i>Lobby</i>	Coffee Break <i>Lobby</i>
11:15		Paper Session 2 Communication <i>Auditorium</i>	Paper Session 4 Self & Other <i>Auditorium</i>
12:15		Lunch Break	Lunch Break
13:00	Welcoming Remarks		
13:15	Symposium 1 <i>Epistemic Rationality Meets Parochiality: Comparative and Developmental Perspectives on Social Learning</i> <i>Auditorium</i>	Symposium 2 <i>Development of Reflective Rationality</i> <i>Auditorium</i>	Symposium 4 <i>Attachment, Caregiving, and Infant Social Cognition</i> <i>Auditorium</i>
14:30	Poster Session A with coffee & snacks <i>1st floor</i>	Poster Session B with coffee & snacks <i>1st floor</i>	Poster Session C with coffee & snacks <i>1st floor</i>
16:30	Paper Session 1 Probabilities/Possibilities <i>Auditorium</i>	Paper Session 3 Object representation <i>Auditorium</i>	Paper Session 5 Cross-cultural <i>Auditorium</i>
17:30	Short Break	Short Break	Short Break
17:45	Invited Talk 1 Lisa Feigenson <i>Auditorium</i>	Symposium 3 <i>Different Perspectives into the Action Perception Link at Infancy</i> <i>Auditorium</i>	Symposium 5 Development of Modal Cognition <i>Auditorium</i>
18:45			
19:00	Welcome Reception 19:00-21:00 <i>Lobby</i>	Mulled Wine Reception 19:15-21:00 <i>Rooftop Terrace</i>	Gala Dinner 20:00-03:00 <i>Radisson Blue Béke Hotel</i>

BCCCD 2026

Budapest CEU Conference
on Cognitive Development

Program and Abstracts

ORGANIZED BY

Cognitive Development Center
Central European University

January 15-17, 2026
Budapest, Hungary
<https://bcccd.org/>

CONFERENCE ORGANIZATION

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

CONFERENCE CHAIRS

Anna Kispál, Bartuğ Çelik

SCIENTIFIC COMMITTEE

Current members of the Cognitive Development Center at CEU and valued reviewers with expertise in areas related to cognitive development.

PROGRAM COMMITTEE

Beyza Gökçen Çiftçi, Dilara Özalp, Fatma Sila Cakmak, Fuju Liu, Giovanni Lumicisi, Luisa Andreuccioli, Maja Blesić, Maria Mavridaki, Mariem Diané, Munther Ahmed, Shubhamkar Bajrang Ayar, Xingyue Han, Yi-Lin Li

CONTACT

Edit Vitrai, CDC Coordinator
cdc@ceu.edu

COVER DESIGN; TYPESETTING

Vida Farzaneh; Krisztina Kósik, White Bird Group Ltd.

ORGANIZING SECRETARIAT

Asszisztencia Congress Bureau
Szent István krt. 7, H-1055 Budapest, Hungary
Phone: +36 1 350 1854
E-mail: bcccd@asszisztencia.hu

CONTENTS

BCCCD26 SCHEDULE.....	8
PRE-CONFERENCE EVENTS.....	16
INVITED PROGRAM.....	26
SYMPOSIA & PAPER SESSIONS.....	32
POSTERS	
SESSION A: THURSDAY.....	74
SESSION B: FRIDAY.....	118
SESSION C: SATURDAY.....	162
RESTAURANTS & MAPS.....	204
NOTES.....	210



THURSDAY, 15 JANUARY

08:30-12:30 PRE-CONFERENCE EVENTS

Thinking Like a Baby: Using Concept Mapping to Build an Infant Cognition Framework (Tutorial)	16
The format and structure of thought in the developing mind (Workshop)	19
Hands-on Generalised Mixed-Effects Models in R (Tutorial)	21

13:00-13:15 BCCCD26 WELCOME

13:15-14:30 SYMPOSIUM 1

EPISTEMIC RATIONALITY MEETS PAROCHIALITY: COMPARATIVE AND DEVELOPMENTAL PERSPECTIVES ON SOCIAL LEARNING **32**

Chimpanzees respond to counter-evidence in rational ways; so do children—unless they are in a group **33**

Jan M. Engelmann

Preschoolers resist updating beliefs that are central to group identity **34**

Tamar Kushnir, Zoe Finiasz

How speaker knowledge modulates social learning across development **35**

Marjorie Rhodes, Jessica Stephenson, Marianna Zhang, Mark Ho

Developmental changes in children's preferences for informational sources in intergroup contexts **36**

Gil Diesendruck, Sondos Abofoul, Arielle Ankri-Guedj,

Hagar Sharabi, Meytal Nasie

14:30-16:30 POSTER SESSION A **74**

(with coffee & snacks)

THURSDAY, 15 JANUARY

16:30-17:30 PAPER SESSION 1

PROBABILITIES/POSSIBILITIES 37

**Can children represent mere possibilities?
Probing comprehension of “if” and “when”
with task persistence 37**

Yanwan Zhu, Roman Feiman

**Developing Metacognition
in Probability Judgements 38**

Cate MacColl, Jonathan Redshaw

**Differences Between Online and Offline Testing
in Early Childhood: Evidence from a Probability
Learning Task 39**

Anna I. Thoma, Christin Schulze

17:30-17:45 SHORT BREAK

17:45-19:00 INVITED TALK 1

The Cradle of Curiosity 26

Lisa Feigenson

19:00-21:00 WELCOME RECEPTION

FRIDAY, 16 JANUARY

09:30-10:45 INVITED TALK 2

**(Logical) Reasoning in Infancy:
The (Little we Know about the) What and the
(Most Plausible Theory about the) Why** **27**
Luca Bonatti

10:45-11:15 COFFEE BREAK + GROUP PHOTO

11:15-12:15 PAPER SESSION 2

COMMUNICATION **40**

**Young children's developing understanding
of the relation between symbol and referent
in the graphic domain** **40**
Gregor Kachel, Daniel Haun, Cathal O'Madagain, Manuel Bohn

**Do 18-month-olds prefer to look at gesture forms
than other manual action forms?** **41**
Shreejata Gupta, Lucie Greco, Eulalie Péquay, Caroline Coindre,
Clément François, Isabelle Dautriche

**Infants' expectations about communicative
transmission of social norms** **42**
Tibor Tauzin, Maja Blesić, Ildikó Király, György Gergely

12:15-13:15 LUNCH BREAK

13:15-14:30 SYMPOSIUM 2

DEVELOPMENT OF REFLECTIVE RATIONALITY **43**

Scope and limits of early explicit metacognition **44**
Marlene M. Meyer, Marina Proft, Jan Engelmann, Hannes Rakoczy

**3-year-olds Engage in Joint Action,
but 5-year-olds Engage in Joint Ideation** **45**
Cathal O Madagain, FatimaZahra Benmarrakchi, Nouhayla Majdoubi

Rationality Before the Age of Reason **46**
Kirsten Blakey, Brina Recelj, Chloe Dow, Zsófia Virányi,
Giacomo Melis, Eva Rafetseder

14:30-16:30 POSTER SESSION B **118**

(with coffee & snacks)

FRIDAY, 16 JANUARY

16:30-17:30 PAPER SESSION 3

OBJECT REPRESENTATION	47
“Core Perception”: Re-imagining Precocious Reasoning as Sophisticated Perceiving	47
Dawei Bai, Alon Hafri, Véronique Izard, Chaz Firestone, Brent Strickland	
How do 15-to-18-month-olds represent unseen objects when such objects are being named?	48
Elena Luchkina, Emily Yang, Sandra Waxman	
Developmental Trajectories of Feature Integration: Evidence from FPVS-EEG in Infants and Adults	49
Samar Naderi, Jean-Rémy Hochmann	

17:30-17:45 SHORT BREAK

17:45-19:00 SYMPOSIUM 3

DIFFERENT PERSPECTIVES INTO THE ACTION PERCEPTION LINK AT INFANCY	50
The neural-maturational basis of the action-perception link in infancy	51
Sayani Banerjee, Moritz Köster	
From Kicking to Causality	52
Xia Xu, Jochen Triesch	
The Role of Motor Skills in the Development of 3D Mental Rotation from Infancy to Preschool	53
Gudrun Schwarzer, Tharanirakshita Asokan	

19:15-21:00 MULLED WINE RECEPTION

(Rooftop terrace)

SATURDAY, 17 JANUARY

09:30-10:45 INVITED TALK 3

Taking Control: The Evolution of Cognitive Control in Primates 28
Amanda Seed

10:45-11:15 COFFEE BREAK

11:15-12:15 PAPER SESSION 4

SELF & OTHER 55

Synchrony and the Self: Oxytocin, Interpersonal Coordination, and the Emergence of Infant Self-Awareness 55
Emanuela Yeung, Dimitris Askitis, Velisar Manea, Helle Lukowski, Ivana Konvalinka, Victoria Southgate

Chimpanzees rationally revise their beliefs in social situations 56
Hanna Schleihau, Emily Sanford, Florian Bühler, Laura Lewis, Josep Call, Esther Herrmann, Jan Engelmann

Children's Understanding of the Objectivity of Reality 57
Leon Li, Sebastian Grueneisen, Juliette Chartier, Michael Tomasello

12:15-13:15 LUNCH BREAK

13:15-14:30 SYMPOSIUM 4

ATTACHMENT, CAREGIVING, AND INFANT SOCIAL COGNITION 58

Infants expect an adult to comfort a crying baby only when the two belong to the same social group 59
Kyong-sun Jin, Joo Hyang Park, Renée Baillargeon

The longitudinal predictive significance of maternal caregiving for infant attachment cognitions 60
Rylie Putrich, Tingyan Liu, Madeline Patrick, Gloria Chang, Kristy van Marle, Ashley Groh, Yuyan Luo

Attentional and Neural Biases in Infants with Disorganized Attachment While Processing Emotional Expressions and Interactions 61
Szilvia Biro

14:30-16:30 POSTER SESSION C 162
(with coffee & snacks)

SATURDAY, 17 JANUARY

16:30-17:30 PAPER SESSION 5

CROSS-CULTURAL 63

How the Development of Children's Normative Beliefs about Egalitarianism and Self-Maximisation Shapes Cultural Diversity in Sharing 63

Gideon Salter, Sophie Marshall, Georgia Birchenough, Joanna C. Buryn-Weitzel, Joan Isabella, Charlotte V. Knapper, Ellen Lavender, Beatrice Peringa, Joseph Rusenjule, Lucy Stafford, Florence Tusilme, Claudia Wilke, Rebecca Willis, Katie Slocombe, Bailey House

Development of Intellectual Humility: Behavioral Evidence from Children in Germany, India, and Canada 64

Daniil Serko, Azzurra Ruggeri

The cultural origins of egocentric thinking in children 65

Yağmur Deniz Kisa, Roman Stengelin, Daniel B. M. Haun

17:30-17:45 SHORT BREAK

17:45-19:00 SYMPOSIUM 5

DEVELOPMENT OF MODAL COGNITION 66

Twelve-month-olds categorize events as likely or unlikely, rather than certain or uncertain 67

Seref Esmer, Nicolò Cesana-Arlotti

Imagine All the Possibilities: Toddlers Adapt to Alternative Futures 68

Hande Melis Altunay, Laura Ziemann, Nora Swaboda, Azzurra Ruggeri

Control over outcomes boosts modal reasoning in 3- and 4-year-olds 69

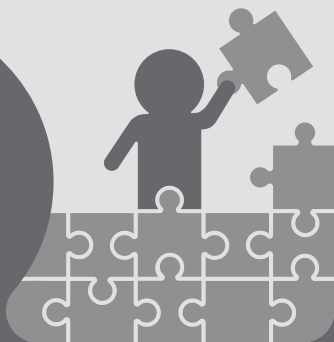
Leonie Baumann, Lydia Paulin Schidelko, Marina Proft, Tanya Behne, Hannes Rakoczy

Calculating probabilities from simulated possibilities is hard for 4-year-olds 70

Brian Leahy, Vicente Vivanco, Sam Cheyette, Kevin Smith, Josh Tenenbaum, Laura Schulz

19:00-19:15 CLOSING

20:00-03:00 GALA DINNER & CLOSING PARTY (Radisson Blue Béke Hotel)



PRE-CONFERENCE EVENT 1

Thinking Like a Baby: Using Concept Mapping to Build an Infant Cognition Framework (Tutorial)

Thursday, 15 January 2026, 8:30 – 12:30

Organizers:

Lorraine Afflitto and Gen Tsudaka

The Center for Research with Infants and Toddlers at The New School for Social Research

Invited speaker:

Ruthe Foushee, The Center for Research with Infants and Toddlers at The New School for Social Research

Despite encouragement to “think like a baby” (Zetterstein et al., 2025) and our own desire to do so, researchers still face a central challenge: What does it truly take to think like an infant? We wrestle with this question as we attempt to see the world through an infant’s eyes, uncover their intuitive responses, trace emerging concepts, and follow the unfolding of developmental trajectories.

The “Thinking Like a Baby” tutorial is inspired by nursing’s commitment to patient-centered care, where care is guided by patients’ responses—essentially, “thinking like a patient.” Nurses rely on established frameworks, such as the NANDA nursing diagnosis model, to interpret experiences. The process is straightforward, from patient data collection to data visualization via care-relevant domain concept mapping, and finally to interpretation. Interpretations are called nursing diagnoses- a clinical judgment about a patient’s response to an actual or potential health problem or life process.

Building on this approach, the “Thinking Like A Baby” tutorial proposes a bottom-up, data-driven approach to constructing an infant cognition framework. By mapping empirical data onto cognitive constructs and their corresponding mental representations, participants “think like a baby.” In turn, they can explain/predict infant behavior with a judgment based on ontogenetic, epistemological, and empirical considerations, of an infant’s intuitive reaction or tendency (predisposition) to respond to environmental or lab-based stimuli.” Agreeing with Cusack et al. (2024), infants are active, goal-directed agents who engage with their environment and structure their own cognitive frameworks. In synchrony with the infant’s own cognitive framework building, our framework affords researchers the

opportunity to identify relationships among constructs, uncover gaps in the literature, and generate new, testable hypotheses grounded in the infant experience.

Researchers across career stages in cognitive developmental psychology/cognitive science who conduct preverbal infant research and want a practical, shareable, standardized methodology that targets the infant experience. Early career and graduate student researchers interested in exploring a novel approach to data schematics, construct development, measures and hypotheses.

Learners will be able to:

1. Understand the process behind creating an Infant Cognition Framework grouped by specific developmental cognitive constructs and their respective mental representations.
2. Identify the cognitive constructs that are meaningful and broadly applicable in infant cognition research (e.g. core knowledge domains, naive/innate/lay theories, and language and communication).
3. Understand how infants might mentally represent cognitive constructs within each domain (e. g. thick vs thin relationships within the core knowledge social groups cluster (Thomas, et al., 2020); and word–referent mappings that extends beyond direct caregiver–infant interaction with the language and communication cluster (Foushee & Srinivasan, 2024)).
4. Explain the research tools, steps, and strategies that guide this framework-building — including data collection, concept mapping, interpretation, and hypothesis generation.
5. Apply all of the above in creating an Infant Cognition Framework for developmental research.

This highly interactive session blends didactic and hands-on learning- anchored in real-world examples. Participants learn about each element of the methodological strategy in brief lectures or discussions and immediately apply that knowledge through small-group activities. Modeled on the NANDA nursing diagnosis framework, which nurses use to systematically interpret and respond to the patient experience, this program introduces a structured approach for understanding infant cognition.

8:30 - 9:00	Registration
9:00 - 9:15	Welcome and Introductions
9:15 - 10:00	Interactive lecture Translating the NANDA Model: Concept Mapping from Data to Cognitive Constructs to Mental Representations Here we introduce an adaptation of the NANDA nursing diagnosis framework for infant cognition. Participants learn how to use concept

mapping to connect data, cognitive constructs, and mental representations within a structured, infant-centered framework.

10:00 - 10:20 Coffee break

10:20 - 12:00 Hands-on learning

Framework Development Lab: Mapping Data to Constructs and Mental Representations Participants apply concept mapping to translate data into cognitive constructs and mental representations, collaboratively building an infant-centered framework.

12:00 - 12:30 Debrief

The program concludes with a debrief led by Ruthe Foushee, where participants reflect on their learning and explore implications for infant cognition research and practice.

12:30 Adjourn

PRE-CONFERENCE
EVENTS

PRE-CONFERENCE EVENT 2

The format and structure of thought in the developing mind (Workshop)

Thursday, 15 January 2026, 8:30 – 12:30

Organizers:

Barbara Pomiechowska, University of Birmingham

Eric Mandelbaum, City University of New York

What is it to think like a baby? What are the building blocks of the human mind that predate the mastery of language? What kinds of mental representations and structures are available in infancy to support learning, communication, and inference? How do they change over developmental time?

Evidence from developmental cognitive science shows that human infants are able to set up discrete structured representations, which support object and numerosity tracking, action interpretation, and language acquisition. Even though some of the representational processes and structures involved have been well described (e.g. object files, core concepts), their format and functions have not been fully understood (e.g. when an infant will deploy a concept vs. an object file vs. both; what formats object files and core cognition take). Others remain elusive and their availability in early development is debated (e.g. symbols, logical operators). It is also an open question when and how infants begin to combine these representations into complex thoughts.

Goals. The goals of this workshop are to (1) review the latest empirical evidence and theoretical trends, (2) connect different lines of theory and empirical enquiry, (3) brainstorm how to tackle the outstanding questions in theoretically and empirically fruitful ways.

Overview. The workshop will open with an introductory talk highlighting key themes and questions. Then, across five talks, speakers will explore different formats and structures of thought. The workshop will conclude with a panel discussion that will tie together different perspectives and explore directions for future research.

9:00 From format to architecture, Eric Mandelbaum (CUNY)

9:20 Symbolic depictions, Gergely Csibra (CEU)

9:40 Representing relations, Jean-Remy Hochmann (CNRS)

10:00 Generalization in language and thought, Marjorie Rhodes (NYU)

10:20 coffee break

- 10:45 On the minimal format of object representations, Melissa Kibbe (Boston University)
 - 11:05 Compositionality and combinatorial thought, Barbara Pomiechowska (University of Birmingham)
 - 11:25 Discussion by Susan Carey (CUNY)
 - 11:45 Open discussion
- The program ends at 12:15.

Hands-on Generalised Mixed-Effects Models in R (Tutorial)

Thursday, 15 January 2026, 8:30 – 12:30

Organizers:

Francesco Poli

MRC Cognition and Brain Sciences Unit, University of Cambridge

Developmental and comparative data are often messy: infants and children respond differently to the same stimuli, fatigue over trials, and outcomes are frequently non-normal (right-skewed reaction times, binary choices, etc.). Standard t-tests/ANOVAs can miss these complexities. A modern workflow treats linear models (LMs), linear mixed-effects models (LMMs), and generalised linear mixed-effects models (GLMMs) as a continuum: start simple, then add the structure your data demand (nesting, random effects) and the distribution your outcome actually follows (e.g., Gamma for RTs, binomial for accuracy). Building on DevStart's core principles of free, open-source, collaborative, and practical science, we assume minimal prior knowledge and learn by doing.

All examples use R/RStudio with transparent code that attendees can lift into their own projects. We work with an eye-tracking dataset, but the workflow generalises to EEG, accuracy/choice, and count data. By the end, participants can fit, check, interpret, and visualise GLMMs that are publication-ready, and, crucially, understand why those choices make sense for developmental science.

We follow a hands-on approach in which we engage in live coding in R from scratch. We will have micro-exercises (2–6 minutes) that we will solve together with a structure: “run → tweak → interpret.” We will think-aloud together and decide next steps. At the end, attendees can bring a question/design; we map it to a GLMM template. Everything will be accessible, with plain-language explanations before math, and all code shared for reuse.

By the end of the tutorial, participants will be able to:

- Diagnose what statistical model is preferable for the specific data they have
- Choose appropriate families and links for GLMMs.
- Specify random effects (intercepts/slopes; nesting vs. crossing) that match their design.
- Run GLMMs with `glmer()` and extract, visualise, and explain effects using `modelbased/emmeans` (predictions, estimated means, contrasts, slopes).

- Check assumptions and fit with performance::check_model(), compare models (AIC), and report results clearly and reproducibly.
- Implement an end-to-end, open, reusable analysis pipeline for their own datasets.

Prerequisites: Basic familiarity with R is helpful but not required.

Participants bring: Laptop with R and RStudio installed (instructions will be circulated before the tutorial); headphones.

We follow a hands-on approach in which we engage in live coding in R from scratch. We will have micro-exercises (2–6 minutes) that we will solve together with a structure: “run → tweak → interpret.” We will think-aloud together and decide next steps. At the end, attendees can bring a question/design; we map it to a GLMM template. Everything will be accessible, with plain-language explanations before math, and all code shared for reuse.

08:30-09:00 Why GLMMs on top of t-tests/ANOVAs?

When Gaussian fails; outcomes & links; nesting and random effects (quick LM→LMM→GLMM staircase).

09:00-09:30 Fitting your first GLMM

glmer() syntax; choosing Gamma/log for RTs; convergence tips.

09:30-10:00 Random-effects structures

Intercepts vs. slopes; model comparison (AIC).

10:00-10:30 Coffee break (flexible based on actual final schedule)

10:30-10:45 Diagnostics

performance::check_model() to check assumptions of linear models

10:45-11:30 Telling the story

Predictions, estimated means, contrasts, and slopes (modelbased/emmeans); publication-ready plots.

11:30-12:15 Mini-clinic & wrap-up

Map attendee designs to GLMM templates (binary accuracy, counts); Open questions.



INVITED TALK 1

The Cradle of Curiosity

Thursday, 15 January 2026, 17:45-19:00

Chair:

Ágnes Kovács

Presenter:

Lisa Feigenson, Johns Hopkins University, US

Curiosity underpins the greatest of human achievements, from exploring the reaches of our solar system to discovering the structure of our own minds. Where does this drive come from? Here I suggest that far from being reliant on language and sophisticated metacognitive skills, curiosity is present from our earliest days. In support of this claim, I discuss work showing that preverbal infants not only experience curiosity but harness it: when babies' predictions fail to accord with their observations, they look longer, learn more, and produce exploratory behaviors. Critically, their exploration is guided by a desire to explain—long before they have the words to describe what they see, babies seek to understand why things happen as they do. In this sense, the curiosity that emerges in infancy lays the foundation for a lifetime of discovery.

INVITED TALK 2

(Logical) Reasoning in Infancy: The (Little we Know about the) What and the (Most Plausible Theory about the) Why

Friday, 16 January 2026, 9:30-10:45

Chair:

Ernó Téglás

Presenter:

Luca Bonatti, Universitat Pompeu Fabra, Spain

I will revise the current evidence for reasoning processes in infancy. I will explore various alternative theories. I will suggest that the most plausible account of infants' abilities involves a language of thought endowed with some form of logical operations. I will speculate on the relation between potential logical primitives, natural language phenomena and other worked out cases of languages of thought proposed to account for specific inferential abilities in adults. I will suggest that all this may indicate a direction for a common explanation, involving set concepts. And this will put an end to my wild and poorly grounded speculations.

INVITED TALK 3

Taking Control: The Evolution of Cognitive Control in Primates

Saturday, 17 January 2026, 9:30-10:45

Chair:

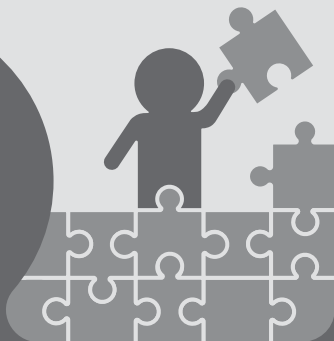
Gergely Csibra

Presenter:

Amanda Seed, University of St Andrews, Scotland

Cognitive control—the capacity to regulate thoughts and actions in pursuit of goals—varies widely across primate species and emerges gradually during human development. Our team has been examining the evolutionary and developmental foundations of cognitive control by integrating evidence from comparative cognition, developmental psychology, and computational modelling. First, I will outline how cross-species comparisons reveal meaningful differences in memory systems among primates, including how limitations in short-term and working memory constrain the kinds of strategies different species can deploy when solving problems. These findings provide a foundation for understanding how cognitive control capacities may have diverged across the primate lineage, but leave open the details of what and how specific mechanisms have evolved. I will then discuss empirical work investigating the structure of executive functions in chimpanzees and young children. Using task batteries designed to probe inhibition, working memory, and cognitive flexibility, this work shows both shared components of executive control across species and unique features in humans. Broadly, this work supports suggestions from developmental psychology that the hierarchical structure of executive functions seen in adults emerges (in development, and perhaps also in evolution) from a less differentiated structural organisation. Thirdly, I present evidence from cross-sectional studies demonstrating how human children develop increasingly sophisticated levels of cognitive control, moving from reliance on noisy, diffuse strategies to the deliberate, flexible, rule-based behaviours characteristic of adults. Finally, I will introduce collaborative work with computational and evolutionary modelling that explores how changes to control systems impact the computational power of working memory, and the predicted trajectory for correlated but non-monotonic evolution between cognitive capacity and cognitive control. Together, these lines of research inform the theory that changes in cognitive

control and representational capacity have undergone correlated evolution in primates, offering a richer understanding of what makes human cognition distinctive—and how it arises from shared primate foundations.



SYMPOSIUM 1

EPISTEMIC RATIONALITY MEETS PAROCHIALITY: COMPARATIVE AND DEVELOPMENTAL PERSPECTIVES ON SOCIAL LEARNING

Thursday, 15 January 2026 - 13:15-14:30

Organizers:

Gil Diesendruck, Bar-Ilan University

Meital Nasie, Tel-Aviv University

Speakers:

Jan M. Engelmann, University of California at Berkeley, US

Tamar Kushnir, Duke University, US

Marjorie Rhodes, New York University, US

Gil Diesendruck, Bar-Ilan University, Israel

SYMPOSIUM AND
PAPER SESSIONS

A central tenet of cognitive development is that children are not passive receptacles of knowledge, but instead actively seek out information that fulfils their curiosity and needs. In fact, even infants (e.g., Xu & Kushnir, 2013), and more robustly children (e.g., Lucas et al., 2014; Schleihaufer et al., 2022), develop beliefs based on rational epistemological practices, seeking information needed to confirm beliefs and revising beliefs based on evidential strength. However, recent research suggests that in social contexts, such rational practices falter (Confer et al., 2025; Ronfard et al., 2018). This may be especially the case when the beliefs and/or the informants, align or not with children's group membership. In such contexts, children's intergroup conceptual (Rhodes & Baron, 2019) and informational biases (Nasie et al., 2022) may lead them to forego rational evaluations of evidence, siding instead with information that sustains their parochialism.

The four papers in this proposed symposium will provide complementary perspectives on how children and nonhuman primates integrate information based on the group-relevance of the information and the informants. Paper 1 explores belief revision in the face of counterevidence in both chimpanzees and 4- to 6-year-old children. Consistent with rational updating, chimpanzees revised their beliefs based on the strength of the counterevidence. Children too, showed rational belief revision, unless their beliefs were aligned with those of a group, in which case group loyalty dampened responsiveness to

counterevidence. Paper 2 extends this finding by showing that the identity-centrality of the beliefs matter. Namely, 4- and 5-year-olds who joined a group based on a shared belief resisted updating that belief even when faced with clear counterevidence, whereas children in groups based on non-ideological beliefs readily revised their views. Papers 3 and 4 add to this dynamic also effects deriving from informants' characteristics. Paper 3 reveals that upon hearing a speaker refer to a novel social category with generics, 5-year-olds essentialized the category regardless of the speaker's epistemic status. In turn, 10-year-olds and adults were more selective, manifesting essentialism primarily when the speaker was knowledgeable. Paper 4 combines these parameters, examining how children's preferences for informational sources is shaped by both intergroup biases and epistemic considerations. The paper shows that whereas Israeli Jewish and Arab 5-year-olds consistently prefer in-group sources, by 8- and especially 10-years, children's preferences increasingly reflect considerations of expertise and topic relevance—particularly when the information relates to the out-group.

Taken together, these studies demonstrate that although human children—and our primate relatives—possess robust cognitive mechanisms for rational information processing, these mechanisms operate within a social framework that can enhance or constrain their application. The developmental findings point to increasing sophistication in integrating epistemic and social cues, though biases can persist even in older children. Future research could explore how to foster the integration of rational evaluation with social sensitivity in ways that counteract harmful biases, and how these processes operate in diverse cultural and intergroup contexts.

Chimpanzees respond to counter-evidence in rational ways; so do children—unless they are in a group

Jan M. Engelmann

University of California at Berkeley, US

The selective revision of beliefs in light of new evidence is considered one of the hallmarks of rationality. In the first two experiments, we investigated chimpanzees' (N =15) response to counter-evidence. A piece of food was hidden in one of two locations. Next, chimpanzees were given evidence that the food was in one of the locations and made their first choice. Subjects were then given a different form of evidence that favored the other location and made a second choice. We varied whether the second evidence was stronger than the first (strong evidence first condition), or not (weak evidence first condition). Across both

experiments, chimpanzees were significantly more likely to revise their beliefs in the weak evidence first condition than in the strong evidence first condition (Exp 1: $\chi^2 = 14.03$, $df = 1$, $p < .001$; Exp 2: $\chi^2 = 20.52$, $df = 1$, $p < .001$).

In Experiment 3, we investigated 4- to 6-year old ($N = 60$) children's response to counter-evidence and the influence of group membership. Children were told about the different beliefs two groups had about the contents of boxes. Children were then asked about their own belief and the confidence they had in that belief. Following this, children saw two pieces of evidence that opposed their initial belief. Then, children were asked again what they believed and how confident they were in that belief. As predicted, when children were not a member of a group, they showed a stronger reduction in confidence after seeing counterevidence than children who were a member of a group ($\chi^2 = 60.00$, $df = 1$, $p = .02$). These findings demonstrate that chimpanzees and children are capable of responding to counter-evidence in rational ways. In children, this capacity can be masked by a drive to align with group beliefs.

Preschoolers resist updating beliefs that are central to group identity

Tamar Kushnir, Zoe Finiasz

Duke University, US

Children's group identities influence learning in ways that are facilitative, guiding them towards information that has cultural relevance. But can group identity also be disruptive to learning? We ask whether young children – who are portrayed as more open-minded, curious, and motivated to learn than adults (Gopnik & Wellman, 2012; Lucas et al, 2015) – might resist updating beliefs that are central to group identity.

Across studies, 4- to 5-year-olds ($N=120$) initially guess which of two colored blocks activate an electronic toy. In one condition a puppet invites the child to join their group based on the shared belief (e.g. "Since you also think the orange ones make it go you can be on the orange team!"). In a contrasting condition (Study 1), the puppet invites the child to join the group based on the fact that she is "also nice." Thus, both groups share the child's belief, but only one group is ideological – the shared belief is the basis of group membership.

After joining the group, children observe that their belief is wrong through a direct demonstration. Results show that, even without the group member present, children who belong to a group based on a shared belief hold on to this belief despite the counterevidence, while children in a group based on social characteristics willingly change their minds ($p < .001$). In Study 2, we find that professed uncertainty mitigates the influence of group identity.

When invited to join a group is based on a shared “guess” rather than a shared “belief,” children change their minds when presented with counterevidence ($p < .001$). These findings demonstrate that children’s learning can be disrupted if accepting evidence potentially threatens their identity as a member of a group. These findings have implications for understanding the development of polarized belief systems, critical thinking, and humility.

How speaker knowledge modulates social learning across development

Marjorie Rhodes, Jessica Stephenson, Marianna Zhang, Mark Ho

New York University, US

Language shapes the development of children’s representations of social categories. For example, hearing generic descriptions (e.g., “Girls do ballet,” “Jews celebrate Passover”) leads children to think of the referenced categories in more essentialist terms (e.g., as more homogeneous, distinct, and natural) than when they hear similar information presented in other linguistic or non-linguistic formats.

The present research combines developmental and computational approaches to consider the mechanisms by which language has these effects. We hypothesized that listeners interpret generics as a cue to the speaker’s beliefs—as indicating that the speaker thinks of the category as a coherent and objective kind that supports broad generalization. On this account, the effects of generics go beyond their informational content and should depend on listeners’ beliefs about the epistemic status of a speaker who generates generic claims.

Two experiments with children (ages 5-10) and adults manipulated the language listeners heard about a novel category (generic or specific descriptions) and the knowledge state of the speaker (whether the speaker had the background to know if a category reflects a meaningful social division). Adults developed more essentialist beliefs only when they heard generic claims uttered by a culturally knowledgeable speaker. These effects developed around age seven; younger children developed essentialist beliefs from generic language regardless of the epistemic status of the speaker. Ongoing work aims to distinguish if this is the case because younger children expect social knowledge to be more broadly shared (rather than something that varies across individuals) or more generally have difficulty integrating information about speaker knowledge into their developing representations. This work is guided by a computational framework that distinguishes the semantic and pragmatic processes underlying the effects of

generics, which can identify the sources of developmental change in how language shapes conceptual and social development.

Developmental changes in children's preferences for informational sources in intergroup contexts

Gil Diesendruck, Sondos Abofoul, Arielle Ankri-Guedj, Hagar Sharabi, Meytal Nasie

Bar-Ilan University, Israel, Tel-Aviv University, Israel

Three studies investigated how group identity and epistemic considerations shape children's information-seeking strategies. The first two studies examined Israeli Jewish and Arab 5- and 8-year-olds' (N=260) preferences for in- vs. out-group informants when seeking information about non-social (Study 1) and social (Study 2) targets. Children were presented with scenarios in which informants varied by group membership (in-group, conflict out-group, neutral out-group) and were asked to evaluate informants' expertise, indicate informant preference, and decide whose advice to follow. Study 1 found robust in-group favoritism across ages and ethnicities. Study 2 introduced a tension between social identity and epistemic relevance by associating target individuals and informants with specific group memberships (e.g., having children choose between an in- vs an out-group informant, for information about an in- or an out-group target). Results showed that across ages and ethnicities, children favored in-group informants when the target was an in-group member. In turn, when the target was from a conflict out-group, whereas younger children still exhibited strong in-group bias, older children – especially Jewish ones – preferred informants from the same group as the target. The third study focused on Israeli Jewish 5-, 8-, and 10-year-olds' (N=128) preferences for sources of information regarding different topics. Specifically, we assessed whether children preferred familiar human sources (e.g., parents, teachers) vs. non-human sources (e.g., TV, internet), regarding topics either pertinent to the in-group (e.g., relations between Jews and Arabs) or not (e.g., relations between Russians and Ukrainians). Consistent with the previous studies, here too we found that younger children preferred familiar human sources for all topics, especially in-group pertinent ones. Older children, in turn, were more discerning, selecting sources based on presumed expertise. The findings reveal the developmental dynamics between rational epistemic considerations and intergroup biases in children's social curiosity, particularly in contexts involving high intergroup conflict.

PAPER SESSION 1

PROBABILITIES/POSSIBILITIES

Thursday, 15 January 2026 - 16:30-17:30

Chair:

Munther Ahmed

Can children represent mere possibilities? Probing comprehension of “if” and “when” with task persistence

Yanwan Zhu, Roman Feiman

Brown University, US

Adults can think about possible outcomes of non-actual events. In contrast, children under age 4 struggle to deploy modal concepts across several behavioral studies, and some researchers have proposed that they cannot think about events as merely possible (Leahy & Carey, 2020). At the same time, 3-year-olds already produce several modal words, including conditional “if” and “when” (“If/When [Antecedent], (then) [Consequent]”; Bloom, 1991). Still, it isn’t clear they understand that these words mark possibilities (Leahy & Zalnieriunas, 2022).

We tested 3- and 4-year-olds’ comprehension of the contrast between “if” and “when”. For adults, “when” is used to talk about antecedents that the speaker thinks are, or will be, true (“[When/ If] I wake up, I have tea”), while “if” is used with uncertain antecedents (“[When/If] I win the lottery, I’ll splurge”), marking them as merely possible (i.e. possibly true and possibly false; von Fintel & Iatridou, 2002). Inspired by studies on children’s persistence (Leonard et al., 2020), we hypothesized that how long children spend trying to open a puzzle box would depend on whether an adult said, “if you open it...” (indicating they are not sure whether the child will open it) or “when you open it...” (indicating they think the child will).

In our pre-registered study, 91/(planned 120) 3-4 year-olds did one trial. An experimenter demonstrated that something is hidden inside a puzzle box by shaking it, and said, “[If/ When] you open it, you’ll get to see what’s inside”. We found children tried longer in the when than the if condition ($M_{diff} = 13.3s$; 96.8% posterior probability, bayesian linear regression), with no effect of age or interaction. These results suggest that 3-year-olds

already represent the difference between actual and merely possible events – and which one a speaker means to communicate with “when” or “if”.

Developing Metacognition in Probability Judgements

Cate MacColl, Jonathan Redshaw

The University of Queensland, Australia

The developmental origins of metacognition remain highly contentious. Tasks using implicit measures suggest that even infants show signs of decision uncertainty, while tasks using behavioural measures and explicit reports find variable evidence for metacognition, sometimes appearing as late as 6 years of age. In the present study, we induce decisions with both low and high probability of accuracy and measure young children’s metacognitive confidence with a uniquely sensitive novel scale. Children aged 3 to 6 years make predictions about the colour of a ball to be randomly selected from a jar containing varying proportions of four colours. In this task, even the best prediction sometimes has a relatively low probability of accuracy compared to standard two-alternative tasks (e.g., 1/4 when all four colours are equally represented in the jar), and actual predictions can range from a 1/12 chance up to guaranteed selection. Using such granular manipulation of outcome probability, we investigate children’s decision processes and metacognitive reflections through (1) reaction time as an implicit measure of confidence, and (2) a novel continuous scale probing explicit confidence. Using these outcomes, we aim to chart the origin and development of multiple facets of metacognition and distinguish strategies of random simulation from more calculated selection of probable (or improbable) outcomes. We predict that younger children’s confidence will be relatively invariant with probability (reflecting that they simulate a single outcome and commit to it), whereas older children’s confidence will increasingly track probability in a linear manner. Data collection is ongoing, with 48 children tested from a pre-registered sample of 64, and analysis will await collection of the full sample.

SYMPOSIA AND
PAPER SESSIONS

Differences Between Online and Offline Testing in Early Childhood: Evidence from a Probability Learning Task

Anna I. Thoma, Christin Schulze

Max Planck Institute for Human Development, Germany

In recent years, online data collection has gained popularity in developmental studies with children and infants. Compared to traditional offline approaches, online data collection holds multiple advantages: For instance, it enables researchers to reach larger and more diverse samples cost-effectively and to recruit from populations outside the vicinity of laboratories. However, it is crucial to validate the comparability of online and offline methods when assessing children's cognitive processes and behavior. Previous research validating young children's (i.e., < 5 years) behavior in online versus offline settings reports mixed findings. Some developmental patterns appear consistent across testing modalities. Yet, in several instances, young children have been reported to perform less well when tested online, for instance, by making fewer correct responses. Here, we examined differences in 3- and 4-year-olds' choice behavior and strategy use in a probability learning task when tested either online via video chat ($n = 60$) or offline in person ($n = 39$). Consistent with previous research, children's performance across the two testing modalities was similar when averaged across trials. However, we found an interaction between testing modality and trial block: Children tested online were less likely to choose the more frequently rewarded option toward the end of the task than children tested offline. On a behavioral level, this decrease in performance was reflected in a lower proportion of win-stay/lose-shift conform trials. Additionally, we performed computational modeling analyses to investigate whether behavioral differences result from qualitative or quantitative differences in strategy use. In sum, our findings highlight the importance of considering task length and the characteristics of the online testing environment to ensure valid comparisons between online and offline studies in developmental research.

PAPER SESSION 2

COMMUNICATION

Friday, 16 January 2026 - 11:15-12:15

Chair:

Beyza Gökçen Çiftçi

Young children's developing understanding of the relation between symbol and referent in the graphic domain

Gregor Kachel¹, Daniel Haun², Cathal O'Madagain³, Manuel Bohn¹

¹Leuphana University Lüneburg, Germany; ²MPI Evolutionary Anthropology Leipzig, Germany;

³Université Mohammad VI Polytechnique, Morocco

In a multi-study research project, we traced the development of the comprehension of graphic symbols from the third to the seventh birthday and across a variety of symbol-referent relationships using touch-screen-based symbolic object-choice tasks.

A first set of studies tested when children can spontaneously find meaning in novel signs whose symbol-referent relationship is based in iconicity, pars-pro-toto, and analogies in shape (study 1, N = 106), orientation and position (study 2, N = 99) as well as number and size (study 3, N = 99). While children are generally able to grasp iconic representations prior to their third birthday, converging results from conditions employing abstract and conceptual reference point to a qualitative shift in symbolic competence around the fourth birthday. To understand the interplay of cognitive abilities and enculturation, study 4 (N = 224, 48 to 60 months) combined the most reliable items from studies 1-3 with tasks evaluating children's knowledge of conventional symbols, vocabulary and pragmatic abilities. Results highlight the central role of pragmatics in the development of symbolic literacy. An additional set of studies was devoted to the understanding arrows and markers. Study 5 (N = 72) established that children already understand both at 34 months, while study 6 (N = 96) demonstrated that children ignore proximity and focus on the direction at around 50 months of age, when presented with ambiguous stimulus arrangements. Study 7 (N = 48) established that children by 41 months are such apt arrow-readers that they can read any asymmetric shape as a directional cue. Together with an additional investigation of children's ability to interpret movement in graphic representations (study 8, N = 96), this project provides one of the most comprehensive

and methodologically coherent investigations of young children's understanding of symbols in the graphic domain to date.

Do 18-month-olds prefer to look at gesture forms than other manual action forms?

Shreejata Gupta, Lucie Greco, Eulalie Péquay, Caroline Coindre, Clément François, Isabelle Dautriche

CNRS, Aix-marseille Université, France

The ability to selectively attend to meaningful signals is critical for early communication development. Infants show early preferences for speech over non-speech sounds^{1,2} and preferentially look at matching mouth movements^{3,4}, suggesting that multimodal language cues guide attention in infancy. Beyond speech, infants also begin to use and understand gestures within the first year of life⁵⁻⁷. While early sensitivity to speech has been widely studied, less is known about infants' attention to gesture forms.

In a preferential looking task using eyetracking, we investigated whether 18-month-olds ($n = 30$) look more at gestures (pointing and iconic) over matched manual actions (fig 1), similar to their early speech preference. We found evidence for greater attention to gestures over manual actions, but only when considering the time course of eye movements (fig 2 a & b). A cluster-based permutation analysis⁸ on the time course of eyegaze revealed six significant clusters where infants looked more towards gestures ($p < 0.001$). However, this may be the result of a confound in gaze direction: In the gesture videos, the actress looks up (simulating communicative intent), whereas in the action videos, she maintains gaze on the objects. To control for gaze, we then restricted our analyses to selected regions of interest (ROIs) where only the gestures and the matching actions were performed (fig 1). Infants looked more at gesture ROIs than action ROIs ($p = 0.04$, fig 3a). Cluster analysis on these ROIs revealed three significant clusters (all $p < 0.001$) (fig 3b), mostly aligning with the beginning of the gesture occurrences in the test phase videos.

This suggests that only static measures of average looking may overlook important temporal dynamics in processing precise gesture forms. Patterns of dynamic looking indicate a preference for communicative gestures over non-communicative actions, driven by specific zones of gesture performance.

Infants' expectations about communicative transmission of social norms

Tibor Tauzin¹, Maja Blesić², Ildikó Király³, György Gergely²

¹University of Vienna, Austria; ²Central European University, Austria; ³Eötvös Loránd University, Hungary

Humans are a highly social species with a unique propensity to acquire socially transmitted behavioural norms which often require sub-efficient but normatively expected manner of acting in specific contexts. It is widely assumed that the cultural transmission of such behavioural norms relies on humans' species-unique ability and inclination to imitate social partners. However, normative expectations about how actions ought to be performed in particular contexts are frequently transmitted through ostensive communication of relevant information that is acquired without imitative behavioural copying. Here, we investigated whether 13-month-olds can understand that through the exchange of communicative signals—in contrast to non-communicative auditory responses—an agent can induce its partner to adopt a social norm. In the learning phase, we presented infants with two unfamiliar agents. One of them started to approach a distal goal-object following an efficient straight-line pathway. During this approach, the onlooking other agent intervened by emitting a sound signal that made the first agent turn around and go back. Then the two agents exchanged either communicative variable sound signals or non-communicative repetitive auditory responses. Subsequently, the goal-pursuing agent modified its efficient straight-line goal-approach and followed instead an inefficient winding path turning left and right until it reached the target. At test, the onlooking agent was not present anymore and the goal-pursuing protagonist approached its target either following the most efficient straight-line trajectory or the normative winding trajectory. Infants' looking times indicated that they expected the goal-pursuing agent to approach the target following the normative winding trajectory in the communicative ($p < 0.05$), but not in the non-communicative condition leading to a significant interaction between conditions ($p < 0.01$). This suggests that infants can understand that ostensive communication enables the transmission of socially relevant non-episodic information about behavioural norms to be inferred and adopted by the addressed social partner.

SYMPOSIUM 2

DEVELOPMENT OF REFLECTIVE RATIONALITY

Friday, 16 January 2026 - 13:15-14:30

Organizer:

Hanna Schleihauf, Utrecht University, Netherlands

Discussant:

Giacomo Melis, University of Stirling, UL

Speakers:

Marlene M. Meyer, Göttingen University, Germany,

Cathal O'Madaigain, Université Mohammed VI Polytechnique, Morocco

Kirsten Blakey, University of Toronto, Canada

Humans have the capacity to reflect on their beliefs. For example, they might wonder whether they really packed their passport, reconsider why they believe they had, and then compare their perspective with a companion who recalls seeing it on the table. Such reflection requires (1) metacognitive awareness that enables a sense of uncertainty, (2) the ability to examine the reasons underlying one's beliefs, and (3) the capacity to jointly focus on a thought with others. In this symposium, researchers from three international labs investigate how these core aspects of reflective reasoning emerge in development. The first contribution, presented by Marlene Meyer, examines the early emergence of explicit metacognition. Across six studies, 3-year-old children were able to provide explicit judgments of their own (un-)certainty, especially when their evaluations were needed by a cooperative partner. Further preliminary results suggest that this early competence is limited in scope: children can acknowledge uncertainty in the here and now, but face difficulties when required to choose between certain and uncertain alternatives. These findings indicate that explicit metacognition emerges earlier than often assumed but is initially restricted to socio-communicative contexts and specific task demands.

The second contribution, presented by Kirsten Blakey, examines children's responsiveness to undermining evidence as a window into early reflective rationality. In a first study, children aged 3–6 revised their beliefs more often after they were presented with evidence that challenged the basis of their belief than after evidence that supported it. A second study,

utilizing a non-verbal eye-tracking paradigm confirmed this sensitivity in 3- to 6-year-olds and adults, but not in 2-year-olds. These findings suggest that by age three, children revise their beliefs in a way consistent with reflecting on their reasons, challenging the view that children reach the “age of reason” around six years of age.

The third contribution, presented by Cathal O’Madaigain, turns to children’s capacity to coordinate not only on actions but also on ideas. In collaborative tasks, both 3- and 5-year-olds successfully coordinated joint actions, but only 5-year-olds were able to create a joint plan before acting. Moreover, performance on explicit false belief tasks predicted success in joint ideation, highlighting the central role of theory of mind in supporting joint reflection of mental content. These findings suggest that while young children can act together from early on, the ability to collaborate on ideas emerges later and depends on developing social-cognitive capacities.

Lastly, Giacomo Melis will serve as discussant, providing an integrative synthesis that situates these findings within broader theoretical frameworks of rationality and social cognition.

Collectively, this symposium sheds light on the developmental roots of reflective reasoning. By tracing how explicit metacognition, sensitivity to reasons, and joint ideation emerge in early childhood, the contributions offer new insights into how humans come to engage in rational discourse and coordinate thought across minds.

Scope and limits of early explicit metacognition

Marlene M. Meyer¹, Marina Proft¹, Jan Engelmann², Hannes Rakoczy¹

¹University of Göttingen, Germany; ²UC Berkeley, United States

Knowing about one’s own knowledge and (un-)certainty is fundamental for reflective rationality. From evolutionary and developmental perspectives, it remains unclear when and how such explicit metacognition emerges. Much prior research suggests protracted developmental trajectories: While implicit forms of metacognitive sensitivity (such as information-seeking when uncertain) develop early in infancy, converging evidence from more direct tasks suggests that proper, explicit metacognition emerges well into middle childhood (e.g., Rohwer et al., 2012; Kloo et al., 2017). However, many of these studies may have radically underestimated earlier metacognitive competence due to performance factors of the tasks.

The current studies test for these possibilities and delineate earliest trajectories of explicit metacognition. First, we build on accounts that emphasize the social origins and primacy of metacognition (e.g., Shea et al., 2014). According to these, metacognition is primarily for communication and coordination; thus, earliest competence should be seen when

children do not privately think about their own thinking but need to communicate their (un-)certainty to others. Consistent with this idea, Studies 1-4 (N = 195) found that already 3-year-olds provide explicit metacognitive judgments about their epistemic (un-)certainty, particularly when a cooperative partner relied on their advice (compared to when asked academic test questions individually).

Furthermore, we investigate how robust 3-year-olds' metacognitive competencies are across different task formats and uncertainty types (Studies 5+6, N=170). Data collection is ongoing, but will be completed by the time of the conference. Preliminary results suggest that early metacognitive competence may initially be restricted in scope such that children can locally acknowledge (un-)certainty about a given situation, but have difficulty in related tasks that require decisions between certain and uncertain alternatives. Taken together, these findings show that explicit metacognition is in place earlier than widely assumed, but may initially be most prominent in socio-communicative usage, and limited to specific task demands and formats.

3-year-olds Engage in Joint Action, but 5-year-olds Engage in Joint Ideation

Cathal O'Madagain, FatimaZahra Benmarrakchi, Nouhayla Majdoubi

School of Collective Intelligence, Université Mohammed VI Polytechnique, Morocco

Collaboration is a foundational element of human social behavior. This can mean joint action, such as hunting deer together, or building a barn together. Here, the collaborators interact around concrete objects like the deer, or the barn. But it can also mean 'joint ideation', where we collaborate on the creation of plans, beliefs, or theories - collaborating on developing a plan for a picnic, or for creating a new business. In these cases, there are no concrete objects to interact around - merely ideas, reasons, and arguments, and it is often thought to be in this context that responsiveness to others' reasons will play a central role. Here we compare three and five year olds' performance on collaborative tasks that required either joint action, or joint ideation. We found that three and five year olds engaged in joint action, but only five year olds succeeded in creating a joint plan before acting ($z=2.513$, $p=0.01$). We found that performance in explicit false belief tasks predicted joint ideation, indicating the centrality of theory of mind to this later developing ability ($\beta = 3.22$, $SE = 1.1$, $p < .01$). These results add to our understanding of the nature and development of human collaboration and joint reasoning, showing that collaboration on ideas requires theory of mind abilities not yet available to younger children.

Rationality Before the Age of Reason

Kirsten Blakey¹, Brina Recelj², Chloe Dow², Zsófia Virányi³, Giacomo Melis², Eva Rafetseder²

¹University of Toronto, Canada; ²University of Stirling, United Kingdom; ³Messerli Research Institute, University of Veterinary Medicine, Vienna, Medical University of Vienna, University of Vienna, Austria

Young children often revise their beliefs in response to new evidence. Some philosophers argue, however, that this does not demonstrate rationality, claiming that rationality requires reflecting on one’s beliefs and the reasons behind them—a capacity linked to the ‘age of reason’ around six years. Recent proposals suggest that responding to undermining evidence—evidence challenging the basis of a belief—may itself be a form of reflection (Melis & Blakey, 2025; Melis & Monsó, 2023), though empirical work is limited. One exception is Schleihauf et al. (2022), who found that 4- and 5-year-olds revised their beliefs more often after undermining than positive evidence, suggesting that children may have reflected on their reasons for beliefs. These findings provide early evidence for rationality and raise the possibility that even minimally verbal or non-verbal individuals may be capable of reflective belief revision. We conducted two studies to examine how children revise beliefs in response to verbal and non-verbal undermining evidence. Study 1 (N = 39) replicated and extended Schleihauf et al. (2022) with 3- to 6-year-olds. Children—including 3-year-olds—were significantly more likely to revise their beliefs in response to verbal undermining evidence. Study 2 used a minimally verbal eye-tracking version of the task with 2- to 6-year-olds (N = 81) and adults (N = 23), replacing testimony with visual and auditory cues to present evidence non-verbally. Adults and 3- to 6-year-olds again revised their beliefs more often after undermining evidence, even when it was presented non-verbally. This pattern was not found in 2-year-olds. Together, these findings indicate that children as young as age three revise their beliefs in ways consistent with reflection on, or sensitivity to, the reasons for those beliefs, challenging the idea that rationality emerges only at the ‘age of reason.’

PAPER SESSION 3

OBJECT REPRESENTATION

Friday, 16 January 2026 - 16:30-17:30

Chair:

Mariem Diané

“Core Perception”: Re-imagining Precocious Reasoning as Sophisticated Perceivin

Dawei Bai^{1,2,3}, Alon Hafri⁴, Véronique Izard^{5,6}, Chaz Firestone⁷, Brent Strickland^{2,3,7}

¹Yale University, US; ²ENS-PSL, France; ³Institut Jean Nicod, France; ⁴University of Delaware, US;

⁵Université Paris Cité; ⁶CNRS, France; ⁷Johns Hopkins University, US; ⁷UM6P

“Core knowledge” refers to a set of cognitive systems that underwrite early representations of the physical and social world, appear universally across cultures, and likely result from our genetic endowment. Although this framework is canonically considered as a hypothesis about early-emerging *conception* — how we think and reason about the world — here we present an alternative view: that many such representations are inherently *perceptual* in nature. This “core perception” view explains an intriguing (and otherwise mysterious) aspect of core-knowledge processes and representations: that they also operate in adults, where they display key empirical signatures of perceptual processing. We first illustrate this overlap using recent work on “core physics”, the domain of core knowledge concerned with physical objects, representing properties such as persistence through time, cohesion, solidity, and causal interactions. We review evidence that adult vision incorporates exactly these representations of core physics, while also displaying empirical signatures of genuinely perceptual mechanisms, such as rapid and automatic operation on the basis of specific sensory inputs, informational encapsulation, and interaction with other perceptual processes. We further argue that the same pattern holds for other areas of core knowledge, including geometrical, numerical, and social domains. In light of this evidence, we conclude that many infant results appealing to precocious reasoning abilities are better explained by sophisticated perceptual mechanisms shared by infants and adults. Our core-perception view elevates the status of perception in accounting for the origins of conceptual knowledge, and

generates a range of ready-to-test hypotheses in developmental psychology, vision science, and more.

How do 15-to-18-month-olds represent unseen objects when such objects are being named?

Elena Luchkina¹, Emily Yang², Sandra Waxman²

¹The University of Texas at Dallas, United States; ²Northwestern University, United States

By 15 months, infants can form representations of unseen novel objects from audiovisual category priming (object images plus labels) and link them to novel nouns (Luchkina & Waxman, 2025). This raises two questions: (1) Are images necessary, or can labels alone suffice? (2) Does the breadth of the primed category affect infants' representations of unseen objects?

We tested these questions in an intermodal preferential looking task (Figure 1) with 224 15-to-18-month-olds (Mage=16.9). Each of four trials included a Priming phase and a Test phase. During Priming, an actor either retrieved and named three familiar objects from a certain category (Visual and lexical priming) or named them without showing (Lexical only priming). During Test, infants viewed two novel objects: one from the primed category and one from a distant category. We manipulated:

Priming mode (Lexical only vs. Visual and lexical; within-subject).

Category breadth (narrow vs. broad exemplars; between-subject).

Target typicality (typical vs. atypical exemplar; between-subject).

We predicted that Visual and lexical priming and Typical exemplars (especially under Narrow priming) would yield stronger preferences for the target object. This would be due to easier access to the relevant semantic category (to support representation of the unseen object) and easier recognition of the typical target as a member of that category. Contrary to our predictions, infants showed greater preference in the Lexical only condition and no effects of Category breadth or Target typicality (Table 1, Figure 2). These findings suggest that images are not required for infants to represent unseen objects. Labels alone may be more effective, possibly because (a) identifying familiar exemplars during priming taxes attention, or (b) visual input narrows representations, limiting later recognition. Thus, infants can form abstract representations of unseen objects from linguistic input alone, highlighting the central role of labels in the development of representational and referential capacities.

Developmental Trajectories of Feature Integration: Evidence from FPVS-EEG in Infants and Adults

Samar Naderi, Jean-Rémy Hochmann

ISC Marc Jeannerod (UMR 5229 CNRS), France

Feature Integration Theory proposes that basic visual features are registered automatically and in parallel in an initial pre-attentive stage, while the perception of coherent object representations results from binding multiple features in a second, presumably slower stage that relies on limited attentional resources. We test whether these two processing stages are characterized by different speed limits across development using fast periodic visual stimulation (FPVS) with electroencephalography.

Adult participants (N=24, aged 18–35) viewed rapid streams of colored geometric shapes (3 shapes × 3 colors), presented at a base rate of 12 or 30 Hz. Each participant completed two conditions. In the Conjunction condition, one specific color–shape pair (e.g., a blue triangle) appeared regularly at 2.4 Hz, while the other 8 pairs appeared randomly. Detecting the target regularity required the visual system to integrate both features. In the One-Feature condition, the color of the target did not appear in any other pair, distinguishing the regular target without requiring integration.

Steady-state visual evoked potentials (SSVEPs) at 2.4 Hz and harmonics were observed in all conditions. Crucially, responses were reduced at 30 Hz compared to 12 Hz in the Conjunction condition but not in the One-Feature condition, reflecting a more stringent speed limit for feature integration than for processing individual features.

We extended this paradigm to infants aged 6 months (n = 14) and 9 months (n = 25). Infants were tested with 12 Hz stimulation in both conditions. Results showed robust SSVEPs at 2.4 Hz and harmonics for both groups, suggesting rapid feature integration by 6 months. No difference was observed between conditions. Tests with faster stimulations are ongoing. These findings provide novel insights into the ontogeny of feature integration, linking attentional development with the emergence of structured visual representations.

SYMPOSIUM 3

DIFFERENT PERSPECTIVES INTO THE ACTION PERCEPTION LINK AT INFANCY

Friday, 16 January 2026 - 17:45-19:00

Organizer:

Sayani Banerjee, University of Regensburg, Germany

Speakers:

Jochen Triesch, Frankfurt Institute for Advanced Studies, Germany,

Tharanirakshita Asokan, Justus Liebig University Giessen, Germany

Sayani Banerjee, University of Regensburg, Germany

Discussant:

Gudrun Schwarzer, Justus Liebig University Giessen, Germany

At infancy, perception and action are tightly intertwined, driving early cognitive development. Understanding how infants' actions shape their perceptual world (and vice-versa) is central to explaining developmental milestones. This symposium unites three perspectives on investigating the action–perception link, spanning computational modeling, experimental studies, and neuroimaging, concluding with a discussion that integrates these approaches to highlight how infants' actions drive perception (and vice-versa).

The first talk, by Xu and Triesch, offers a computational perspective on the action–perception link. Their work examines what learning mechanisms may lead to an emerging understanding of cause and effect in infants. They propose and compare different computational models and investigate their ability to capture infants' behavior in the classic mobile paradigm. In particular, they propose an active learning model that explicitly estimates cause and effect relationships. They also show that a violation of expectation mechanism can capture the so-called extinction burst, i.e., the finding that after a limb is disconnected from the mobile, the infant will transiently move it even more. Overall, Xu and Triesch show what learning mechanisms may support infants' successful learning of cause and effect relationships.

In the second talk, Asokan and Schwarzer take a longitudinal experimental approach. They investigated how early motor experiences like crawling support spatial cognition,

SYMPOSIA AND PAPER SESSIONS

specifically mental rotation (MR), the ability to mentally manipulate objects. Their study followed children from infancy to preschool. Results revealed a longitudinal correlation between infant and preschool MR performance, with both infant and preschool motor skills linked to later MR abilities. Notably, infants who crawled at 9 months showed higher MR scores at 9 months and preschool age. Thus, Asokan and Schwarzer demonstrate that early self-produced actions like crawling play a crucial role in laying the foundation for later spatial perception, particularly mental rotation.

Banerjee and Köster, in the third talk, investigate the neural basis of the action–perception link in infancy by examining spatial navigation, an essential perceptual skill linked to motor development. Because small infant samples limit brain–behavior inferences, they combined a behavioral–neuroimaging study on a smaller sample with large-scale MRI data from the Baby Connectome Project (BCP). Analyses of 873 scans from birth to 24 months revealed that growth in sensorimotor and hippocampal–entorhinal regions was positively associated with gross motor ability. In another study of 84 twelve-month-olds, gross motor skill was positively correlated with spatial navigation performance as well as motor and hippocampal volume. Together, these findings highlight how motor and neural development are interconnected in infancy, providing a neural perspective on the action–perception framework.

Gudrun Schwarzer, as discussant, synthesizes these approaches, emphasizing how computational, experimental, and neural evidence converge to show that infants' actions are central to early development. Her conclusion underscores that studying the action–perception link provides key insights into developmental mechanisms and points toward promising directions for future research. Overall, the symposium demonstrates how investigating the action–perception link deepens our understanding of how learning, cognition, and brain development emerge, establishing it as a crucial focus for developmental science.

The neural-maturational basis of the action-perception link in infancy

Sayani Banerjee, Moritz Köster

University of Regensburg, Germany

Infant motor development plays a central role in shaping perception and cognition. Yet, neural basis of this motor–perception link remains poorly understood. The transition from crawling to walking is not only associated with spatial navigation abilities but also coincides with rapid growth in brain regions such as the hippocampus and cerebellum. Thus, the

link between newly acquired walking abilities and spatial navigation provides a unique window into brain maturation.

A caveat in studying the neural basis of cognitive development is typically small infant samples. To address this, we complemented a behavioral–neuroimaging study with large-scale MRI data from the Baby Connectome Project (BCP), deriving up-to-date brain charts as reference models. Using 873 anatomical scans from birth to 24 months (BCP), we characterized developmental trajectories of sensorimotor and hippocampal-entorhinal regions, revealing how they mature relative to overall brain growth. Residuals of these regions were positively associated with gross motor ability ($r = 0.19$, $p < .05$).

Applying these brain models to a dataset of 84 twelve-month-old infants, we examined the link between motor skills, spatial navigation, and neural development. Gross motor skills correlated positively with navigation performance ($r = 0.30$, $p < .05$) as well as with motor cortex ($r = 0.39$, $p < .05$) and hippocampal volumes ($r = 0.38$, $p < .05$). Mediation analyses provide initial evidence that brain growth in these regions partly explains the predictive link between motor proficiency and emerging spatial navigation. Looking ahead, machine-learning and connectivity analyses applied to large-scale datasets will further substantiate these models.

Overall, our study contributes initial evidence on the close connection between motor proficiency, spatial navigation, and neural development in infancy. By uncovering the neural basis of spatial navigation, these findings bridge a crucial gap in linking early motor development to key perceptual changes in the infant years.

From Kicking to Causality

Xia Xu, Jochen Triesch

FIAS, Germany

In the classic mobile paradigm, an infant’s leg is connected to a mobile via a string, allowing the infant to move the mobile via moving their leg. Over a few minutes, infants exhibit an increase in the frequency of movement of the connected leg. This behaviour is sometimes interpreted as an indication that infants experience the efficacy of causal control. However, some researchers have argued that an underlying causal model is not necessary to explain infants’ behavior and that a simple reinforcement learning model that habitually favours movements is already sufficient. Interestingly, after the mobile is disconnected from the leg, infants transiently show an even higher frequency of movement, a phenomenon known as the extinction burst, that is hard to reconcile with a simple reinforcement learning model.

In this study, we propose different computational models and study to what extent they are capable of capturing infants' behavior. In particular, we construct an active-learning causal model that estimates the underlying cause-effect relationship without the need to specify either the cause or the effect in advance. We also propose an active-learning expectation violation-based mechanism, that can be combined with the proposed causal model (and a number of alternative models) to give rise to an extinction burst. Overall, our work sheds light on possible learning mechanisms giving rise to infant's developing understanding of the causal link between their action and perception.

The Role of Motor Skills in the Development of 3D Mental Rotation from Infancy to Preschool

Gudrun Schwarzer, Tharanirakshita Asokan

Justus Liebig University Giessen, Germany

Mental rotation (MR), the ability to imagine and manipulate objects across orientations (Linn & Peterson, 2008), is a hallmark of spatial cognition and a predictor of academic achievement (Wai et al., 2009). As a fundamental skill, MR requires the integration of perception and action, which plays a critical role in everyday tasks (Newcombe et al., 2010). From early in life, infants rely on the integration of perception and motor activity to build up a spatial understanding. Experiences such as manual exploration and crawling are linked to anticipating object transformations and refining MR ability (Schwarzer et al., 2022; Kubicek et al., 2017).

Although MR has been examined cross-sectionally in infancy (Quinn & Liben, 2014) and preschool age (Hawes et al., 2015), longitudinal developmental trajectories remain less clear, particularly when using three-dimensional (3D) objects. Hence, the present study investigated the development of three-dimensional mental rotation (3D-MR) in relation to motor competence from infancy to preschool. During infancy, we used a screen-based habituation paradigm (Moore & Johnson, 2008) to assess 3D-MR and categorised infants as crawlers or non-crawlers using a movement calendar. For preschool age, we created a set of novel age-adjusted 3D-MR tasks, using the same stimuli as in infancy: a block-fitting task (combining perception and action) and a screen-based MR Task. The standardised BIRT test validated these novel tasks. Fine and gross motor skills were assessed using the standardised LoMo assessment.

Results showed significant longitudinal correlations between infant and preschool 3D-MR performance ($r = .64$). Furthermore, both infant and preschool motor competence were

related to 3D-MR performance during preschool age. Notably, infants who crawled at 9 months had higher 3D-MR scores and demonstrated stronger 3D-MR when they were between 4 and 6 years of age. This suggests that early action experience scaffolds the emergence of higher-order spatial skills in early childhood.

SYMPOSIA AND
PAPER SESSIONS

PAPER SESSION 4

SELF & OTHER

Saturday, 17 January 2026 - 11:15-12:15

Chair:

Luisa Andreuccioli

Synchrony and the Self: Oxytocin, Interpersonal Coordination, and the Emergence of Infant Self-Awareness

**Emanuela Yeung¹, Dimitris Askitis², Velisar Manea¹, Helle Lukowski¹, Ivana Konvalinka²,
Victoria Southgate¹**

¹University of Copenhagen, Denmark; ²Technical University of Denmark, Denmark

Early caregiver–infant interactions are critical for development, yet the mechanisms by which behavioural synchrony, a key component of caregiver-child interaction, shapes early social-cognitive development remain elusive. We present findings from a study that investigated how interpersonal synchrony, the temporal coordination of movement and behaviour between mother and infant, affects the development of self-awareness. We tested the idea that synchronous interactions lead to increased self–other blurring, delaying the emergence of distinct self-representation. This delay may be adaptive, allowing infants to remain oriented toward others, who serve as primary sources of social and epistemic input. A key candidate mediating this process is oxytocin, a neuropeptide known to enhance social bonding and sensorimotor prediction. Oxytocin may both facilitate synchrony and be upregulated by synchronous interactions, creating a feedback loop that reinforces self–other blurring.

To investigate this, we gathered data from 120 infants and their mothers when the infants were 8-, 12-, and 18-months of age. Salivary oxytocin was collected when infants were 8- and 12 months old. To measure interpersonal synchrony, infants and their mothers wore a pair of accelerometer sensors on their dominant arm and leg during a free play session in the lab, and for 8 days at home when infants were 12 months of age. At 18 months, the dyads returned to the lab for a mirror self-recognition task, which was used as a measure of objective self-awareness.

Contrary to our initial hypothesis, infants who demonstrated mirror self-recognition at 18 months exhibited greater interpersonal synchrony during naturalistic interactions

at home ($t(89) = -2.87, p < .01$) and higher salivary oxytocin concentrations at 8 months ($t(88) = -2.44, p = .02$). These findings suggest that rather than delaying self-awareness, synchronous interactions may facilitate the emergence of self-representation, potentially by enhancing embodied social experiences that scaffold self–other differentiation. However, our operationalisation of synchrony, based on accelerometer data, may not capture the precise co-occurrence of movement patterns originally theorised to drive self–other blurring, highlighting the need for more temporally sensitive measures.

Chimpanzees rationally revise their beliefs in social situations

Hanna Schleihauf¹, Emily Sanford², Florian Bühler², Laura Lewis³, Josep Call⁴, Esther Herrmann⁵, Jan Engelmann²

¹Utrecht University, Netherlands; ²University of California, Berkeley, United States; ³University of California, Santa Barbara, United States; ⁴St. Andrews University, United Kingdom; ⁵University of Portsmouth, United Kingdom

Rationality is a hallmark for evaluating human thought, and it has long been assumed to be unique to humans. Reasoning is considered rational only when it is grounded in, and supported by, the evidence available to the thinker. In social contexts, this involves weighing the evidence underlying one's own beliefs against the evidence supporting the beliefs of others. In the present study, we investigated whether chimpanzees rationally revise their beliefs in light of both their own and others' evidence.

In Study 1, we examined whether chimpanzees follow evidence that was either presented to themselves or a competitor. Each chimpanzee—subject and competitor—could either see which box contained food (strong evidence) or remain ignorant (no evidence). Subjects chose the correct box significantly more often when they themselves had evidence than when they did not ($z = -3.986, p < .001$). They also followed the competitor's choice more often when the competitor based their decision on evidence ($z = 2.613, p = .009$) compared to when the competitor did not receive evidence.

In Study 2, we tested whether chimpanzees rationally revise their choices when their own belief conflicted with their partner's. The subject first made an initial choice, based either on evidence or no evidence. Then the competitor made an opposite choice, also either with or without evidence. Importantly, the subject could see whether the competitor's choice was evidence-based, even if they did not see the evidence directly. Results showed that subjects rationally integrated the strength of their own and the competitor's evidence: they revised their choice more often when they themselves lacked evidence and the competitor

had strong evidence, compared to when they themselves had strong evidence and the competitor lacked it ($z = 2.020$, $p = .043$).

Children's Understanding of the Objectivity of Reality

Leon Li¹, Sebastian Grueneisen¹, Juliette Chartier², Michael Tomasello³

¹Leipzig University, Germany; ²University of Minnesota, United States; ³Duke University, United States

Much research has examined children's (lack of) understanding of the subjectivity of beliefs, yet little research has examined the other side of the issue: How well do children understand the objectivity of reality? We presented 4- to 5-year-old children ($N = 83$) with two kinds of tasks: (i) the false belief task, which assessed children's understanding that a character's subjective beliefs may not correspond to a changed objective reality and (ii) our novel objectivity task, which assessed children's understanding that the objective reality may not correspond to a character's changed subjective beliefs. Children's performance on the two tasks improved in a similar trajectory from 4 to 5 years of age and were also correlated (including when controlling for age), suggesting similar underlying developmental processes. These findings importantly overturn the tacit assumption that children understand the objectivity of reality by default and provide empirical support for the analytical supposition that subjectivity and objectivity are interdefined concepts, such that understanding either requires understanding the other.

SYMPOSIUM 4

ATTACHMENT, CAREGIVING, AND INFANT SOCIAL COGNITION

Saturday, 17 January 2026 - 13:15-14:30

Organizer:

Yuyan Luo and Ashley M. Groh Department of Psychological Sciences, University of Missouri-Columbia, USA

Speakers:

Kyong-sun Jin, Sungshin Women's University, South Korea
Yuyan Luo, University of Missouri-Columbia, USA
Szilvia Biro, Leiden University, The Netherlands

Discussant:

Ashley J. Thomas Harvard University, USA

SYMPOSIUM AND PAPER SESSIONS

A rapidly growing body of work demonstrates infants' rich understanding of the social world (Baillargeon et al., 2015; Scott et al., 2022; Woo et al., 2022). For example, infants form expectations about social interactions using relationship cues, group markers, or early emerging conceptual knowledge such as sociomoral principles (Jin & Baillargeon, 2017; Jin et al., 2024; Thomas et al., 2022; Ting et al., 2019). The present symposium focuses on infant representations of attachment-relevant interpersonal interactions – a critical facet of early social cognition crucial for infant development and wellbeing (Groh et al., 2017; Luo et al., 2024).

In a series of three papers, we demonstrate the role of infant knowledge and experiences in early emerging attachment cognitions, including expectations of an unfamiliar adult to comfort a crying baby and to return to the crying baby following separation (Biro et al., 2015; Jin et al., 2018; Johnson et al., 2010). Together with prior work (Jin et al., 2018), Talk1 reports that in violation-of-expectation (VOE) tasks, although infants as young as 4 months hold expectations for one woman to comfort a crying baby, by 10 months, infants make more nuanced predictions based on group membership markers. After being introduced to two women from different minimal groups, infants only hold comforting expectations for the woman from the same group as the crying baby, but not the one from a different group,

illustrating how infants' group-based sociomoral knowledge may impact their attachment-relevant considerations over the first year. Talks 2 and 3 examine the contribution of caregiving experience and attachment to infant attachment cognitions. Talk2 uses both comforting and separation scenarios in VOE tasks with 14-month-olds and finds that observations of infants' experienced parenting in response to their distress signals at 8 months and their attachment (secure vs. insecure and disorganized behavior) at 12 months longitudinally predicts individual differences in infant expectations of responsiveness to infant distress in comforting and separation scenarios. Talk3 further demonstrates that individual differences in infants' processing of their mothers' emotional facial expressions at 7 months and their processing of computer-animated separation scenarios at 10 months reliably differentiate disorganized (v. organized) infants at 12 months, demonstrating the early emergence of attachment cognitions and their subsequent significance for infant attachment behavior.

Findings from this set of talks advance the field of infant cognition by demonstrating the critical importance of considering the role of conceptual knowledge and experiences in shaping social cognition. Moreover, findings advance the field of socioemotional development by elucidating the developmental processes by which attachment representations are constructed in the early life course. In synthesizing these findings that highlight how infants flexibly construct representations of attachment-relevant scenarios as a function of their conceptual knowledge, attachment, and caregiving experiences, the discussant will apply a novel theoretical angle (Thomas et al., 2025) to characterize cognitive representation of caregiving in infancy and beyond.

Infants expect an adult to comfort a crying baby only when the two belong to the same social group

Joo Hyang Park¹, Renée Baillargeon², Kyong-sun Jin¹

¹Sungshin Women's University, Department of Psychology, South Korea; ²University of Illinois at Urbana-Champaign, Department of Psychology, United States

In previous research, 4–12-month-olds expected a woman alone with a crying baby to comfort the baby (Jin et al., 2018). Building on these findings, we asked the following question: If group memberships were marked, would infants expect the woman to comfort the baby whether or not the two belonged to the same group? Two experiments addressed this question.

In Experiment 1, 10-month-olds were assigned to an ingroup or an outgroup condition.

Infants were first introduced to two women from different minimal groups marked by shirts with different patterns. In the test trials of the ingroup condition, one of the women folded towels at a table; nearby stood a bassinet that matched her shirt, suggesting that she and the baby belonged to the same group, and a chair with more towels. When the baby began to cry, the woman either walked to the bassinet and rocked it gently (comfort event) or walked to the chair to gather more towels (ignore event). The outgroup condition was similar except that the woman and the baby belonged to different groups. Infants in the ingroup condition looked significantly longer at the ignore than at the comfort event, whereas infants in the outgroup condition looked equally at the events. Infants thus expected the woman to comfort the baby when both belonged to the same group, but not otherwise. In Experiment 2, a second woman, whose shirt matched the baby's bassinet, brought the bassinet into the room and then left. When the baby cried, the ingroup or outgroup woman either comforted or ignored the baby, as before. The results replicated those of Experiment 1.

Thus, infants expect adults to comfort ingroup babies in distress, but they hold no particular expectation about outgroup babies. Our results thus provide new evidence for an early-emerging sense of ingroup support.

The longitudinal predictive significance of maternal caregiving for infant attachment cognitions

Rylie Putrich¹, Tingyan Liu¹, Madeline Patrick¹, Gloria Chang¹, Kristy vanMarle², Ashley Groh¹, Yuyan Luo¹

¹University of Missouri - Columbia, United States; ²The University of Arizona, United States

Infant attachment has enduring significance in subsequent development through internal working models (IWMs). However, infant IWMs are rarely investigated.

Cognitive research has revealed infants' rich understanding of the social world. Relevant to attachment, infants at 4-12mo expect an adult to comfort (v. ignore) a crying baby, and secure (v. insecure) infants expect an adult to return to a crying baby following separation. However, attachment-relevant experiences are not consistently assessed, and infant expectations in comfort and separation scenarios are examined separately, leaving it unclear whether these expectations are specific to attachment or part of general sociomoral knowledge.

We examine the predictive significance of caregiving experiences for infant cognitions assessed with both scenarios. Specifically, maternal caregiving at 8mo in distressing tasks

(e.g., SFP) are coded for sensitivity (extent to which mothers promptly and appropriately respond to infant crying). At 12m, infant attachment (secure or insecure) is assessed with the strange situation procedure (SSP), during which infant disorganized behavior is also scored. Finally, at 14mo, infant expectations in both scenarios from previous research are assessed in two violation-of-expectation tasks (VOE; ~1mo apart; order counterbalanced). So far, performance in VOEcomfort and VOEseparation are moderately associated ($r=.26$), suggesting that expectations in these attachment-relevant scenarios are related but not redundant. Critically, while 14mo infants find unexpected adult unresponsiveness to baby crying (VOEcomfort), the extents to which they are surprised are associated with maternal sensitivity at 8m ($r=.22$), longitudinally linking caregiving to infant comforting expectations. Additionally, the less disorganized infants are at 12mo, they are more surprised by adult unresponsivity in both scenarios at 14mo (r 's $=-.09$; $-.27$), and secure infants are more surprised in VOEcomfort than insecure infants ($p=.025$), suggesting links between infant attachment and relevant expectations.

The present study thus elucidates the construction of infant IWMs and demonstrates how experiences contribute to individual differences in attachment cognitions.

Attentional and Neural Biases in Infants with Disorganized Attachment While Processing Emotional Expressions and Interactions

Szilvia Biro

Leiden University, Netherlands

Infants with disorganized attachment exhibit (momentary) breakdowns in coherent behavioral strategies during interactions with their caregiver. Several risk factors have been suggested in developing disorganized attachment, including maltreatment, unpredictable environment, frightening/frightened and highly insensitive parenting, chronic marital discord, and neurological abnormalities. Disorganized attachment predicts lower social competence, behavioral problems, and increased risk for psychopathology in later life. Several theoretical accounts proposed that disorganized individuals differ in the way they perceive and evaluate social and emotional information from early on, however very little research has been done with infants.

I will discuss three recent studies in which we demonstrated that 7-12 months infants with disorganized attachment already display biases in processing social-emotional stimuli. In Peltola et al. (2025), 7-month-olds viewed their mother's angry and happy facial expressions while EEG recorded the Nc component. Disorganized infants showed a larger Nc response

to angry faces than organized infants, with no group differences for happy expressions. In Biro et al (2021), 10-month-olds observed abstractly depicted “parent-child” separation while frontal EEG asymmetry was measured. Organized infants exhibited the expected right-sided (withdrawal-related) asymmetry, whereas disorganized infants did not. In Biro et al (in prep), 12-month-olds’ monitoring strategies for similar interactions were recorded using eye tracker. We found that only organized infants’ fixation on the “parent” character was affected by the type of outcome of the interaction, and that disorganized and organized infants’ fixations were differently modulated by the positive vs negative emotional cue accompanying the interactions.

I will propose that these attentional and neural biases together suggest a dysregulation in emotional-motivational responses as well as hyper vigilance for threatening and distressing social cues in infants with disorganized attachment. These biases may serve as core mechanisms linking early infant-caregiver interaction patterns to later developmental trajectories.

SYMPOSIUM AND
PAPER SESSIONS

PAPER SESSION 5

CROSS-CULTURAL

Saturday, 17 January 2026 - 16:30-17:30

Chair:

Giovanni Luminici

How the Development of Children's Normative Beliefs about Egalitarianism and Self-Maximisation Shapes Cultural Diversity in Sharing

Gideon Salter¹, Sophie Marshall², Georgia Birchenough², Joanna C. Buryin-Weitzel², Joan Isabella³, Charlotte V. Knapper², Ellen Lavender², Beatrice Peringa³, Joseph Rusenjule³, Lucy Stafford², Florence Tusiime³, Claudia Wilke², Rebecca Willis², Katie Slocombe², Bailey House²

¹Department of Psychology, University of York and School of Psychology, Liverpool Hope University, United Kingdom; ²Department of Psychology, University of York, United Kingdom; ³Budongo Conservation Field Station, Uganda

Cultural variation in sharing is likely influenced by societal differences in normative beliefs, but how do different beliefs combine to influence sharing behaviour? For example, some suggest egalitarianism predominates in industrialised and market-integrated societies because it enables efficient resource exchanges with strangers, but individuals may be egalitarian because they believe that it is “right” to be egalitarian, or because they believe that it is “wrong” to be self-maximising, or both. We therefore explored how egalitarian and self-maximising normative beliefs develop across societies that differ in industrialisation and market integration (peri-urban UK and rural Uganda), and how these beliefs combine to shape sharing behaviour.

Using a binary-choice Dictator Game, we asked 3.5–12-year-old children and their caregivers (UK, N=163; Uganda, N=185) to judge whether egalitarian and self-maximising options were (i) right to choose and (ii) wrong to choose (two separate yes/no questions), before allowing them to select one of the options (behavioral choice).

In both groups children and caregivers typically believed egalitarian choices were right and not wrong, though in children these beliefs developed later in the UK. Ugandan participants typically believed that self-maximising choices were right and not wrong, but UK participants

were mixed (Fig1). The strength of children's egalitarian and self-maximising beliefs predicted their sharing (behavioral choices) in both cultural groups, but only egalitarian beliefs showed an increasing influence on children's sharing from middle childhood (Fig2).

These findings highlight that cultural variation in sharing is influenced by culture-specific beliefs about whether egalitarian and self-maximising choices are "right". The findings support claims that children's sensitivity to social norms increases in middle childhood, and suggests that increasing sensitivity to norms motivates them to share equally, against their self-interest. This sharing is most likely when children believe both that egalitarian choices are "right" and that self-maximising choices are "wrong".

Development of Intellectual Humility: Behavioral Evidence from Children in Germany, India, and Canada

Daniil Serko¹, Azzurra Ruggeri²

¹Technical University of Munich, Germany; ²Central European University, Vienna; Technical University of Munich, Germany

Successfully navigating the social world requires balancing strict adherence to social norms with their flexible interpretation. This poses a particularly interesting problem for early development: learning when to strictly follow rules and when not.

Across two preregistered experiments, we examined how 6- to 11-year-old children evaluate agents who follow different rule strategies: adaptive (adapting to context), rigid (strict adherence), or noncompliant (knowingly neglecting the rule). Children rated the agents and chose one to guide them on an unknown planet.

Study 1 (n = 162) presented a safety-relevant rule scenario: agents crossed a street with a traffic light at either a busy or an empty road. The adaptive agent crossed only when the road was empty, the rigid agent always waited for green, and the noncompliant agent always crossed, regardless of the light. Younger children's ratings were more favorable of the rigid agent, while older children increasingly favored the adaptive one, suggesting a developmental shift in rule evaluation. We found no age-related differences in children's choices of a guide for the unknown planet.

To test whether children's flexibility depends on the type of rule, Study 2 (ongoing, n = 99) uses an arbitrary social rule: wearing a hat to avoid upsetting locals on a new planet. Agents followed adaptive, rigid, or noncompliant strategies. Preliminary results suggest that with age, children's ratings of the adaptive agent increased relative to the rigid agent. Children's likelihood of selecting the adaptive agent as their guide showed a positive trend

with age, though the effect did not reach conventional levels of significance. To further explore these developmental patterns, we plan to collect additional data for both studies, extending the samples to adolescents and adults.

The cultural origins of egocentric thinking in children

Yağmur Deniz Kısa, Roman Stengelin, Daniel B. M. Haun

Max Planck Institute for Evolutionary Anthropology, Germany

The traditional view in developmental psychology holds that children are primarily egocentric: They represent space using body-centered frames of reference (FoR; left/right) starting from infancy, whereas even adults struggle with representing space allocentrically, independent of their own viewpoint. Yet cross-cultural findings challenge the primacy of egocentric FoR: egocentric language is not universal and may be characteristic mainly of urban, postindustrial groups. Moreover, great apes and 4-year-old children show an allocentric bias when learning spatial relations, whereas an egocentric bias appears only in older children and adults who use egocentric language. These findings led to an alternative proposal: Children are primarily allocentric—displaying an inherited bias—which is overridden later by learning egocentric language (Haun et al. 2006).

We tested this proposal in 120 German children aged 4–6, who had not yet mastered egocentric words. Across three tasks, we examined children’s preferred FoR: (i) cups (Haun et al., 2006) for learning spatial rules; (ii) animals-in-a-row for remembering object locations; and (iii) gesture for depicting motion. Children preferred allocentric FoR in the cups task (accuracy was 18% higher for allocentric than egocentric rules), replicating Haun et al. (2006), but preferred egocentric FoR in the other two tasks (83% in animals-in-a-row; 71% in gesture). This indicates that egocentric thinking emerges before children master egocentric language. Interestingly, across all tasks, children showed more allocentric behavior than adults (e.g., 29% of children gestured allocentrically vs. no adults)—consistent with the idea that an early allocentric bias is gradually overridden by cultural experience.

Our results indicate children may be allocentric early on, with egocentric thinking emerging through cultural experience rather than language alone. Non-linguistic factors, such as contact with urban material culture, may make children more egocentric. Together, these findings suggest that culture shapes how children think about space.

SYMPOSIUM 5

DEVELOPMENT OF MODAL COGNITION

Saturday, 17 January 2026 - 17:45-19:00

Organizer:

Seref Esmer, Yale University, US

Speakers:

Seref Esmer, Yale University, US

Hande Altunay, Technical University of Munich, Germany

Leonie Baumann, University of Göttingen, Germany

Brian Leahy, Massachusetts Institute of Technology, US

Children demonstrate remarkable abilities to reason under uncertainty, which guide their exploration and learning (Goddu & Gopnik, 2024; Schulz, 2012). However, environmental uncertainty is not a uniform dimension: outcomes can be guaranteed, likely, unlikely, or impossible. How can children successfully navigate their way under such probabilistic variability? One possibility is that children, and perhaps even infants, have cognitive resources to track such variability. Supporting this view, seminal studies have revealed infants' surprise at improbable outcomes (e.g., Téglás et al., 2007; Xu & Garcia, 2008), even without prior experience with their base rates (Téglás et al., 2011). Yet, more recent research documented striking fallacies in the modal reasoning of young preschoolers, raising questions about the source of early probabilistic intuitions (Leahy & Carey, 2020; Leahy et al., 2022).

The discrepancies of findings across age groups and tasks point to a major, unanswered question: What is the nature of early possibility representations, before modal language and formal probability, that may account for the highs and lows of modal reasoning? A thorough investigation of the development of modal cognition is indispensable to answering this puzzle. This symposium undertakes this quest by surveying emerging modal competence across the age range of 1 to 4 years, through the lens of various paradigms (e.g., visual categorization, strategic action planning, decision-making under uncertainty).

Esmer & Cesana-Arlotti's paper, "12-month-olds categorize events as likely or unlikely, but not certain or uncertain", explores how infants categorize probabilistic outcomes in a

visual habituation paradigm, and found support for comparative modal concepts (likely vs. unlikely). Altunay and colleagues' contribution, "Imagine All the Possibilities: Toddlers Adapt to Alternative Futures," presents how 2- to 4-year-olds' strategies for catching or searching for a goal differ when its location is certain or uncertain, suggesting a discernment of this epistemic distinction. Baumann and colleagues, in their work "Control over outcomes boosts modal reasoning in 3- and 4-year-olds", examine multiple factors that may affect modal decisions in children (children's own vs. others' agentic control over the tasks, physical uncertainty vs. epistemic uncertainty, and possible properties vs. possible locations), with findings in support of early modal competence. Finally, Leahy and colleagues' talk, "Calculating probabilities from simulated possibilities is hard for 4-year-olds," investigates children's betting strategies (diversifying across alternative options vs. maximizing a single one) by contrasting situations requiring the simulation of multiple certain outcomes with those requiring multiple possible outcomes. Children's strategic decisions reveal new evidence of a protracted development of modal representations.

Together, these four contributions advance our understanding of the origin and development of modal thought by addressing the factors that undermine or heighten human children's understanding of possibilities and uncertainty. The variety of paradigms yielding conflicting results will set the stage for a discussion on what is essential to early modal cognition, ultimately hinting at finer-grained conceptualization and methodologies for future research.

Twelve-month-olds categorize events as likely or unlikely, rather than certain or uncertain

Seref Esmer, Nicolò Cesana-Arlotti

Yale University, US

Developmental research has revealed that children's attention, exploration, and learning are modulated by environmental uncertainty from very early on (Schulz, 2012; Stahl & Feigenson, 2015, 2024). However, it is unclear how variability in environmental uncertainty (whether an outcome is guaranteed, likely, or unlikely) is represented before formal education, and possibly even in preverbal minds (Téglás et al., 2007). Some proposed that infants represent probabilities as ratios estimated from observable object-distributions (Denison & Xu, 2019). Others argued that they may distinguish likely outcomes from unlikely ones by contrasting alternative possibilities (Cesana-Arlotti et al., 2012). Recently, Leahy & Carey (2020) offered accounts of previous findings that do not require representing

probabilities at all. Here, we advance a new paradigm to study the modal representations, if any, available to one-year-old infants.

In three preregistered experiments, we employed a lottery simulation (Téglás et al., 2007) to investigate whether 12-month-olds categorize probabilistic outcomes as “certain”, “likely”, or “unlikely” (Fig.1). We first measured baseline relative-looking-preference (RLP) between outcomes with distinct probability levels, presented sequentially (100% vs. 66% in Exp1; 66% vs. 33% in Exp2&3). Then, we habituated infants to a specific probability level (66% in Exp1 & 2, 33% in Exp3), varying items trial-by-trial. Finally, we again presented the movies used for baseline to test the boundaries of infants’ modal categories. If two probability levels are sorted into distinct categories, infants should increase RLP at the non-habituated probability level.

Infants habituated to 66%-probability-outcomes didn’t dishabituate to those with 100%-probability (Exp1; N=35, BF=0.19), but did to outcomes with 33%-probability (Exp2; N=24, BF=8.25). Habituated with 33%-probability outcomes, infants dishabituated to 66% ones (Exp3; N=24, BF=87.56). This striking pattern indicates that infants can already categorize probabilistic events as “likely” or “unlikely”. These preverbal logical categories may guide infants’ and children’s early probabilistic inferences, predating modal language and formal education.

Imagine All the Possibilities: Toddlers Adapt to Alternative Futures

Hande Melis Altunay¹, Laura Ziemann², Nora Swaboda³, Azzurra Ruggeri⁴

¹Technical University of Munich, Germany; ²Max Planck Institute for Human Development, Germany;

³University of Potsdam, Germany; ⁴Technical University of Munich, Central European University, Germany

Adaptive decision making is the process of flexibly adjusting strategies and behaviors in response to changing task demands and environmental characteristics. It is characterized by the ability to dynamically consider multiple alternatives, update one’s approach as new information emerges, and is especially crucial during childhood, when we know the least yet have the most to figure out.

Although infants are often described as adaptive decision makers capable of considering alternatives, research with preschoolers suggests that adaptive decision making and possibility reasoning emerge only later in childhood. This discrepancy raises questions about when in development children begin to integrate possibility reasoning into adapting their strategies under uncertainty. To address this gap, we tested 202 children aged two to four years across two experiments.

In Experiment 1, two- and three-year-olds ($n = 156$) completed a Search task (locating a ball) and a Catch task (catching a falling ball) under the conditions: i) Skewed condition: the ball always comes from the same exit, and ii) Uniform condition: the ball is equally likely to come from any exit. Children learned two alternative actions: a constraint-seeking (CS) action targeting multiple possibilities, and a hypothesis-scanning (HS) action targeting a single possibility. In the Catch task, 24- to 33-month-olds showed adaptiveness, performing the HS action more often in the Skewed condition and the CS action more often in the Uniform condition (0.632 , $p = .02$, 95% CI [0.53 , 1.00]). In the Search task, 33- to 43-month-olds showed adaptiveness (0.636 , $p = .011$, 95% CI [0.54 , 1.00]). In Experiment 2 ($n = 46$), children were more likely to perform the CS action under the Uniform condition regardless of age. These results suggest that adaptive decision-making emerges as early as age 2, emphasizing the importance of designs that capture children's adaptiveness while contributing to the literature on possibility reasoning.

Control over outcomes boosts modal reasoning in 3- and 4-year-olds

Leonie Baumann, Lydia Paulin Schidelko, Marina Proft, Tanya Behne, Hannes Rakoczy

University of Göttingen, Germany

When does the ability to reason about alternative possibilities emerge during cognitive development? This has been a matter of considerable dispute. Conservative accounts assume that modal reasoning emerges relatively late, not before age 4 (Carey et al., 2020). Evidence for these accounts comes from tasks where children fail to consider mutually incompatible possibilities. However, it is unclear whether these failures truly reflect competence deficits, or rather performance limitations. One recent suggestion is that modal reasoning tasks are mastered earlier if children need to deliberate about which outcome they could bring about rather than respond to events beyond their control (Phillips & Kratzer, 2024). The present studies tested this suggestion. In Study 1, 3- and 4-year-old children ($N = 60$) received two tasks (a coin tossing task and a marble slide task) in which they could exert agentive control over the realization of the outcome: they chose between performing an action that must lead to a reward and an action that might lead to a reward. Study 2 ($N = 62$) examined whether children's performance is influenced by superficial task factors, by the type of agentive control (acting oneself vs. directing someone else's action), and by the type of uncertainty (reasoning about what could be the case in the future vs. what could be the case at present but is (still) unknown). Across both studies, even the youngest 3-year-olds showed robust modal reasoning competence in the coins tasks by

consistently choosing the option that must lead to a reward. In Study 2, this competence was even found in 3-year-olds in contexts of epistemic uncertainty. Our results moreover indicate that it does not seem to matter whether children perform the action themselves or direct someone else's action. Altogether, our findings suggest that modal reasoning possibly emerges earlier than conservative accounts assume.

Calculating probabilities from simulated possibilities is hard for 4-year-olds

Brian Leahy, Vicente Vivanco, Sam Cheyette, Kevin Smith, Josh Tenenbaum, Laura Schulz

MIT, US

Can infants and preschoolers analyze probabilities by repeatedly simulating one event? Some studies suggest that preschoolers are limited to a single simulation (Leahy et al. 2022, Leahy 2023). But in those studies children's difficulties could arise from extrinsic task demands, not challenges inherent to running multiple simulations.

We introduce a closely controlled paradigm that rules out many task-demand explanations for children's struggles. Four-year-olds ($n=72$ in studies 1-3) had to place 2 "cushions" under a falling ball. If a ball hit one cushion it grew; if it hit another cushion it grew again. If the ball did not hit any cushions, children had a 5 second timeout. Children saw 3 trial types. In 1-deterministic-ball trials, there is one ball on a deterministic path; 4-year-olds reliably placed both cushions where the ball would land. In 2-deterministic-ball trials there were 2 balls on deterministic paths; 4-year-olds reliably placed one cushion under each ball. This shows that participants can simulate two distinct paths for two distinct objects. In 1-uncertain-ball trials, participants must simulate the trajectory of one ball on an indeterministic path; the ball might land in either of two equally-likely places. Children must simulate two distinct trajectories for one ball. Many 4-year-olds treat the 1-uncertain-ball trials like the 1-deterministic-ball trials, not like the 2-deterministic-ball trials. They fail to simulate two versions of one event, though they have no problem on closely-matched trials where they must simulate two distinct events.

Our first study establishes the basic phenomenon. Studies 2 and 3 rule out alternative explanations for the findings. Study 4, a preregistered large-scale online replication with children aged 4-8 ($n=250$), gave children a 3-alternative forced-choice. Four-year-olds still opted to stack their cushions up on 1-uncertain-ball trials. Performance improved slowly with age. Children's calculation of probabilities via simulation undergoes protracted development.



PA-01 Children's memory for rejected statements: Investigating mechanisms of belief formation

Mohit Mukherji¹, Eric Mandelbaum², Marjorie Rhodes¹

¹New York University, United States; ²The Graduate Center, City University of New York, United States

Children struggle to process negated statements for many reasons—for example, because of unsupportive pragmatic contexts or inhibitory demands. Here, we explored another factor that might make negation hard for children—while propositions are accepted implicitly and automatically upon being encountered, rejecting them might require more effortful control (Gilbert, 1991), and thus might be especially tough for younger children with developing executive function capacities. We presented 3- to 8-year-old children (N=176) with a memory task based on Gilbert et al. (1990). Children were introduced to two characters, a novice and an expert, who were learning about 'modis'—a new kind of animal. In the learning phase, the novice made statements about modis (e.g., "Modis roar loudly") which the expert either confirmed or denied ("Yes, that's right!", or "No, that's wrong!"). Children heard 12 such statements in the learning phase, half of which were denied. After they heard these 12 statements, children were asked 12 questions about the statements they heard earlier (e.g., "Do modis roar loudly?"). Each of these was a forced-choice yes/no question. Mixed-effects binomial regression models found that younger children disproportionately misremembered denied statements as true, and the difference in memory for denied and affirmed statements diminished with age (denial X age interaction, $p = .011$). Two months later, children completed a measure of executive function (EF), and repeated the memory test from Session 1 (without any additional reminders or learning phase). Children's EF predicted how well they remembered denied statements—but not affirmed ones—in the test phases of Session 1 ($p < .001$) and Session 2 ($p = .027$).

These results are consistent with a Spinozan view of belief formation (Gilbert, 1991; Pion et al., 2025). Rejecting a proposition thus places cognitive demands on processing denials beyond semantic and pragmatic factors, possibly as a result of cognitive architecture.

PA-02 Developmental changes in the processing of verb argument structure: Evidence from reading studies with children, adolescents, and adults

Anna Teresa Porrini, Veronica D'Alesio, Matteo Greco

IUSS Pavia, Italy

The study focuses on the processing of Italian sentences presenting dative clitics, realised as either arguments of a trivalent verb

(a) or non-arguments — i.e., adjuncts — to a bivalent verb (b).

a. Martina mi ha prestato una bicicletta.

Martina to.meDATIVE.CLITIC has lent a bicycle .

"Martina lent me a bicycle".

b. Martina mi ha riparato una biciletta.

Martina for.meDATIVE.CLITIC has repaired a bicycle.

"Martina repaired a bicycle for me".

The first experiment consisted of a masked, progressive self-paced reading (SPR) with three groups of Italian native speakers: 85 adults (mean age = 34, standard deviation = 7), 85 adolescents (m.a. = 14;5, s.d. = 0;5) and 42 children (m.a. = 11;4, s.d. = 0;3). The experiment used ten sentence duplets manipulating verb type (trivalent/bivalent) to allow either an argument (a) or a benefactive adjunct (b). Items were counterbalanced across two lists, presented in random order with 70 fillers. Reaction times were trimmed for outliers, log-transformed, and analysed with linear mixed models. Results show that adults and adolescents read trivalent verbs (a) more quickly than bivalent ones (b) after a dative clitic, even accounting for length and frequency (respectively: $p = 0.01$, $p = 0.05$). This supports the hypothesis that while arguments can be lexically retrieved, adjuncts require syntactic computation, thus leading to more effortful processing. This effect, however, is not observed in children, and a follow-up experiment using eye-tracking (35 children, m.a. = 10;5, s.d. = 0;3) confirmed its absence. Overall, the findings suggest that children have not yet reached adult-like maturation and may therefore be unable to lexically access argument structure with the same ease during online processing while reading, leading to adults and adolescents — but not children — predicting the presence of a trivalent verb during processing by using the argumental dative clitic as a cue.

PA-03 The role of visual input on early speech: social presence, phonology and babbling rates

Eugenia Lukin, Erika Bergelson

Harvard University, United States

Does visual input play a measurable role in early speech production, in terms of social or articulatory learning? Blind infants constitute a natural case study for examining these questions: they rely on non-visual social cues (e.g. hearing others talk) and cannot see visual phonetic features sighted peers can. We compared babbling in blind infants and their age-matched sighted peers ($N=20$, 6–15 mo.) by analyzing daylong LENA recordings. We focused on three main features of babbling: how much infants vocalized, whether vocalizations were adult-like (i.e. consonant-vowel sequences), and whether the sounds infants babbled were visually salient or not (e.g. 'p' vs. 'k'). We also examined how likely infants were to vocalize as a function of whether others were detectably present (by determining for each 2-minute time window whether an adult was speaking.)

In both groups, a similar proportion of vocalizations were linguistically mature based on a Wilcoxon test (MeanSighted=.18(.16), MeanBlind=.10(.14); $W=69$ $p=.161$), but sighted infants had greater odds of producing visually salient consonants based on β -regression (model-implied means: MeanSighted=.43, MeanBlind=.20; $\beta=-1.10$, $p=.044$; OR=0.33). Intriguingly, infants in both groups produced fewer vocalizations alone (MeanSighted=.57, MeanBlind=.33) than in conversation with

others (MeanSighted=1.34; MeanBlind=1.25; $\beta=-0.094$, $p=.001$), but this effect was larger for blind children ($\beta=-.144$, $p<.001$), who also vocalized less overall ($\beta=-.77$ $p<.001$).

These findings suggest that in broad strokes, babbling development is largely similar across blind and sighted infants. At the same time, both social and articulatory factors were connected with whether or not infants had visual access, shaping the types of sounds infants produced, and whether they vocalized when alone.

PA-04 Invariant encoding of phonetic features supports speech processing in infants

Claire Njoo-Deplante¹, Giulia Gennari², Elena Kalugina¹, Marion Losdat¹, Marie Palu¹, Ghislaine Dehaene-Lambertz¹

¹UNICOG, Neurospin, CEA Saclay, France; ²Neuroscience Institute, New York University Grossman School of Medicine, New York, United States

From birth or after a few months onwards, infants are already capable of discriminating subtle differences in speech sounds (Jusczyk & Derrah, 1987; Kuhl, 1983) and of overriding the acoustic variability produced by changes in talkers voice, speaking rate and coarticulation (Eimas & Miller, 1980; Hillenbrand, 1984; Mehler et al., 1988) to categorize speech sounds. To explore what neural representation supports these early perceptive abilities for speech, we measured the brain responses of 3-month-old infants (N=30) listening to a set of natural syllables, using a 128-channel EEG system. The syllables were either a consonant followed by a vowel or vice-versa and varied along two orthogonal consonantal phonetic features -voicing and place of articulation- and two vocalic phonetic features - height and backness.

Using multivariate pattern analysis (MVPA), we extended previous results by showing that preverbal infants encoded all phonetic features, no matter how and by whom they are pronounced. More importantly, we demonstrated that these phonetic features are encoded independently from the place of the phoneme within a syllable, suggesting that alike adults, pre-verbal infants possess a position-invariant code for phonetic content. Next, we examined how this phonetic representation evolved across time and showed that infants parallelly extracted and combined phonetic features, enabling them to identify phonemes. Finally, we also ran the same experiment in neonates (N=25) and compared the content and the dynamics of the phonetic encoding. Preliminary results suggested that already at birth, the brain encodes vocalic phonetic features independently from the context, and integrates them into vowels. Overall, this study sheds light on the neural representation behind infants' early perceptual abilities concerning speech and contributes to a better understanding of what encoding mechanisms support rapid language acquisition in the first months of life.

PA-05 Delay of Gratification and Social Well-Being in Children

Zorana Zupan, Lenka Protić, Kristina Dukić, Milica Mitic, Marina Videnovic

University of Belgrade, Faculty of Philosophy, Serbia

The ability to delay gratification is a cornerstone of self-regulation and linked to adaptive outcomes. While many studies highlight its predictive value for later functioning, fewer examine its relation to children's immediate behavior and well-being. This study explored the role of Delay of Gratification (DoG) and a spontaneous intake (SI) baseline condition, as well as their associations with age, inhibition, body mass index (BMI), and pediatric health-related quality of life (HRQoL), which reflects physical, emotional, and social well-being. This in-person study complements a larger cross-cultural investigation using a remote version of the same paradigm (Zupan et al., in preparation). A total of 130 children aged 5–10 years (Mage = 88.73 months, SD = 14.60; 69 female) participated. Children were randomly assigned to either the DoG condition (N = 63), where they could wait 10 minutes before eating M&Ms to earn an additional reward, or the SI condition (N = 67), where the same amount of M&Ms was presented without reward framing. The number of M&Ms consumed served as the primary behavioral outcome. Children also completed a Go/No-Go task, and parents reported socio-demographic variables, BMI, and HRQoL. Children's behavior in the DoG condition was significantly associated with parent-reported HRQoL ($\beta = 0.259$, $p = .040$), with the strongest effect for social well-being ($\beta = 0.334$, $p = .007$), explaining 11% of the variance. These associations were specific to the delay context and absent in the SI condition. No associations emerged with BMI, age, or inhibition. Findings suggest that the ability to delay gratification reflects broader adaptive functioning in social contexts. Delay task performance may mirror children's capacity to manage interpersonal demands, underscoring their value for understanding current psychosocial functioning in addition to long-term outcomes.

PA-06 Episodic-like recall of contextual information in 18-month-old infants

Nicolas Goupil, Dora Kampis

University of Copenhagen, Denmark

Episodic memory is elusive to characterize, and its ontogeny still debated. One aspect of episodic remembering is to bind contextual information to a representation, such as location or source information. Memory capacities and neural substrates allowing binding undergo substantial development after the second year of life (e.g., Newcombe et al., 2014). The emergence of remembering episodic information has been also linked to the developing self-concept, whereby the cognitive self may provide an anchor for episodic memories (Howe et al., 2003).

The current study used a paradigm developed to test contextual binding in toddlers (Newcombe et al, 2014). Infants (ongoing, currently $n=100$, 17-19mo) participated in a hiding game in 2 different rooms with the same four containers arranged differently in the two rooms, with distinct contextual cues (name, decoration, experimenters). Children searched for two different toys in the two rooms,

sequentially, in two different containers. Then they returned to the rooms and were asked to retrieve the objects. Replicating previous research, infants found the toy across the two rooms above chance ($M=0.33$, $P=0.014$), but also made comparable amount of source-errors (searching where the toy was in the other room, $p = 0.072$), suggesting that contextual binding is present, but not robust at this age. Only about 10% of infants searched correctly in both rooms, and further profiles of errors across trials will follow. Infants who recognized themselves in the mirror found the toy more on the first test trial (21/48) and across both trials made numerically more source-errors ($p=0.079$). Non-recognizers found it less often (10/36) and searched more where the toy was never hidden.

These data are in line with previous findings showing non-robust episodic-like contextual binding in the second year of life, and with the possibility that a self-concept may serve as anchor for binding contextual information in episodic memory.

PA-07 Early differentiation of the cortical networks for mathematics: a longitudinal fMRI study from preschool to second grade

Théo Morfoisse¹, Séverine Becuwe¹, Marie Palu¹, Cassandra Potier-Watkins², Ghislaine Dehaene-Lambertz¹, Stanislas Dehaene¹

¹Cognitive Neuroimaging Unit, CEA, Inserm, Université Paris-Sud, Université Paris-Saclay, NeuroSpin Center, 91191 Gif/Yvette, France, France; ²Collège de France, 11 Place Marcelin Berthelot, 75005 Paris, France, France

How does the developing brain, initially equipped with only elementary mathematical intuitions, acquire symbolic and more abstract mathematics? Through a longitudinal functional MRI study, following a large cohort of children from preschool through first and second grade – a pivotal period of rapid cognitive and educational change – we tracked how neural responses to both mathematical (e.g., “five is between seven and twelve”) and non-mathematical (e.g., “an ant is a black insect”) sentences evolve upon school entry.

We first confirm that, before starting formal mathematics education, preschoolers already engage an adult-like cortical network for mathematics, involving bilateral intraparietal sulci, inferior frontal gyri, and inferior temporal gyri, with a partial specialization for geometry in posterior inferolateral occipito-temporal cortex.

We then present a multi-level description of how this network is transformed during this developmental period. We first observed a pronounced increase in activations to math sentences, particularly in the left inferior frontal gyrus and bilateral intraparietal sulcus, driven primarily by enhanced responses in already engaged voxels, but also by the recruitment of new ones. Moreover, in comparison to age and school exposure, we found that individual proficiency was often a better predictor of these developmental changes.

Concurrently, examination of brain responses to individual sentences revealed two complementary processes. First, as children better understood a mathematical statement, neural activations decreased, indicating a more efficient processing of mathematical concepts. Second, the

representational space of mathematical concepts became increasingly differentiated with age, suggesting the gradual neuronal separation of previously overlapping mathematical ideas. By confronting these developmental data with several theoretical models—such as recruitment of new cortical areas vs. pruning of existing ones—we offer a more comprehensive and exhaustive portrait of how young minds begin to think mathematically—and how the brain is transformed in the process.

PA-08 When Do Human Infants and Pet Dogs Expect Contact in Transport Events? The Role of Animacy in Causal Expectations

Beyza Gokcen Ciftci¹, Gergely Csibra¹, Christoph Völter², Jonathan F. Kominsky¹

¹Central European University, Austria; ²University of Veterinary Medicine Vienna, Austria

Infants do not have uniform expectations for different types of causal events. For physical state-change events, they expect animate agents (like a human hand), but not inanimate ones (like a toy train), to act as causal agents. However, for transport events, infants infer the event is caused by physical contact regardless of the animacy status of the agent (Muentener & Carey, 2010; Adibpour & Hochmann, 2023).

In an attempt to replicate this finding, we presented 8-month-old infants ($n = 40$, after exclusions) with transport events where the potential causal agent was either a human hand or a toy train. Infants were familiarized with occluded events. In the test, the agent either contacted or did not contact (gap) the transported patient. We predicted greater pupil dilation in the gap event compared to the contact event, independent of agent type. Contrary to our hypothesis, infants showed greater pupil dilation in the contact event compared to the gap event both with a human hand (GAM, $t = -11.971$, $p < .001$) and with a toy train ($t = -12.913$, $p < .001$).

One potential explanation of these results is that unlike past work the causal patient in our stimuli stopped on its own, which may have led participants to perceive it as an animate agent. Previous literature shows that 7-month-old infants expect contact when one object causes another to move, but not when the interaction involves two people (Woodward et al., 1993). Moreover, when an object is self-propelled, 10- and 12-month-old infants do not infer a hidden agent causing its movement (Saxe et al., 2005). In a follow-up experiment, we included an obstacle that made the causal patient stop after moving. This version is tested with both pet dogs and human infants (data collection is ongoing). Results from the three experiments will be discussed together at the conference.

PA-09 Eurasian jays adjust their search behavior to sure versus merely possible outcomes

Isabelle Hawkins¹, Michael Huemer², Robin Murphy³, Ria Genrich⁴, Nicola Clayton⁵, Brian Leahy⁶, Susan Carey⁷

¹University of Oxford, United Kingdom; ²United Kingdom; ³University of Oxford, United Kingdom; ⁴Germany; ⁵University of Cambridge, United Kingdom; ⁶Massachusetts Institute of Technology, United States; ⁷New York University, United States

Darwin (1871) argued that human and nonhuman minds differ in degree rather than kind, a claim that frames debates about reasoning. A central question is whether animals without language can make logical inferences (e.g., Bermúdez, 2003; Carruthers, 2002; Descartes, 1649) and distinguish sure from possible outcomes. We tested Eurasian jays (*Garrulus glandarius*) using a 3-cup logical reasoning task (Mody & Carey, 2016). One reward is hidden in a singleton cup and another in one of two cups. If given a chance to choose one cup, choosing the singleton is wise as this holds a reward for sure, while each member of the pair might be empty. In Study 1 (N = 9), Eurasian jays chose the singleton above chance (61% vs. 50%). In Study 2 (N = 6), with cups filled with sand to prevent manipulation, performance remained similar (59% vs. 50%). Although explicit choices were above chance, this may not reflect deploying a concept of possibility that allows entertaining a thought that one reward is in the right cup or in the left cup of the pair. Instead, it might reflect associative learning that choosing the singleton provides a reward every time, whereas choosing a member of the pair is rewarded only half the time.

To move beyond these limitations, we next asked whether Eurasian jays reveal sensitivity to alternative possibilities through other behaviours. Study 3 (N = 5) measured search time and exploratory actions with sand-filled cups, where in half the trials no reward was hidden. Eurasian jays searched longer in singleton cups and attempted to tip them over more often than pairs. Although explicit choices were above chance and may reflect reward learning, converging search measures suggest that Eurasian jays implicitly distinguished sure from possible outcomes. These findings provide preliminary evidence for a basic sensitivity to possibility.

PA-10 The role of conflicting cues in children's partner selection

Fatma Sila Cakmak¹, Azzurra Ruggeri²

¹CEU, Austria; ²CEU & Technical University of Munich, Germany

Much of what we learn and do, especially as children, relies on others, making it essential to be selective and efficient when deciding whom to cooperate with and learn from. Even preschoolers can recognize domain-specific competencies and prefer partners whose knowledge and skills are most relevant to the task at hand (Hermes et al., 2016). Previous literature also shows that children adjust their reliance on different agents depending on their goals (Grüneisen et al., 2024). However, the mechanisms that support children's partner preferences and selective learning are still unclear.

The current study examines whether and to what extent children adapt their partner selection based on agent characteristics and task relevance across two experiments. The study included two groups of children: 3- to 7-year-olds (N = 123; 70 female) in Experiment 1a, and 8- to 9-year-olds (N = 24; 17 female) in Experiment 1b. In a within-subjects design, children completed two phases.

In the Baseline phase, they encountered two agents: one knowledgeable and the other not. In the Information condition, children were asked to choose an agent to obtain information from. This included (1) a competence-relevant trial and (2) a competence-irrelevant trial. In the Partner condition, children were asked with which agent they would like to be partners for (1) a competence-relevant trial and (2) a competence-irrelevant trial.

In the Contrast phase, children were introduced to a second characteristic, helpfulness, with the knowledgeable agent being unhelpful and the unknowledgeable agent being helpful.

Results indicate that by age 5, children start to consider multiple agent characteristics; however, the ability to apply this information effectively in a relevant context appears to develop later, around age 7. When age groups were combined, results revealed a significant interaction between age and task relevance, and between age and phase, suggesting increased flexibility with development.

Currently, we are examining adults' partner choice using the same procedure as a follow-up study; data collection is ongoing.

PA-11 Navigating Rules with Flexibility: Developmental Insights into Adaptive Rule Understanding

Daniil Serko Daniil Serko¹, Paula Fischer¹, Azzurra Ruggeri²

¹Technical University of Munich, Germany; ²Central European University Vienna; Technical University of Munich, Germany

Successfully navigating the social world requires balancing strict adherence to social norms with their flexible interpretation. This poses a particularly interesting problem for early development: learning when to strictly follow rules and when not.

Across two preregistered experiments, we examined how 6- to 11-year-old children evaluate agents who follow different rule strategies: adaptive (adapting to context), rigid (strict adherence), or noncompliant (knowingly neglecting the rule). Children rated the agents and chose one to guide them on an unknown planet.

Study 1 (n = 162) presented a safety-relevant rule scenario: agents crossed a street with a traffic light at either a busy or an empty road. The adaptive agent crossed only when the road was empty, the rigid agent always waited for green, and the noncompliant agent always crossed, regardless of the light. Younger children's ratings were more favorable of the rigid agent, while older children increasingly favored the adaptive one, suggesting a developmental shift in rule evaluation. We found no age-related differences in children's choices of a guide for the unknown planet.

To test whether children's flexibility depends on the type of rule, Study 2 (ongoing, n = 99) uses an arbitrary social rule: wearing a hat to avoid upsetting locals on a new planet. Agents followed

adaptive, rigid, or noncompliant strategies. Preliminary results suggest that with age, children's ratings of the adaptive agent increased relative to the rigid agent. Children's likelihood of selecting the adaptive agent as their guide showed a positive trend with age, though the effect did not reach conventional levels of significance.

To further explore these developmental patterns, we plan to collect additional data for both studies, extending the samples to adolescents and adults.

PA-12 Studying Development in the Real World: An Automated Analysis of Children's Naturalistic Home Experiences

Nele-Pauline Suffo¹, Anas Suffo¹, Pierre-Etienne Martin², Anam Zahra², Daniel Haun², Manuel Bohn³

¹Leuphana University, Germany; ²Max Planck Institute for Evolutionary Anthropology, Germany;

³Leuphana University, Max Planck Institute for Evolutionary Anthropology, Germany

Children's everyday experiences at home are central to early development, yet most existing research relies on parental reports or lab observations. We present a large-scale, data-driven analysis of children's naturalistic home environments, based on 273 hours of egocentric video and audio recordings from 109 children aged 3–5 years.

We developed a scalable multimodal analytical pipeline to integrate visual and auditory information using machine learning models fine-tuned to our dataset. From these recordings, we extracted key indicators of social interaction: (a) whether others were present (adults vs. children), (b) the proximity of visible faces, and (c) speech presence with speaker identity (key child vs. others).

Preliminary analyses of 81 hours from 34 children reveal an important developmental trajectory: the percentage of time spent alone steadily increases with age, while time spent interacting with others decreases. Language production also follows a developmental trajectory; as children get older, the amount of speech decreases. This decline is significantly steeper in situations when the child is alone compared to the more gradual decrease observed when they are interacting with others.

These findings show that as children get older, they spend more time in independent play but also engage less frequently in self-talk when alone. This integration of egocentric recordings and machine learning provides a novel framework for examining the real-world dynamics of children's experiences in their naturalistic developmental environment.

POSTER SESSION A
THURSDAY

PA-14 Thinking About Others First: How Children's Perceptions of Peer Generosity Influence Their Own Sharing

Tehila Kogut, Bar Levy Friedman

Ben Gurion University, Israel

Children's self-perception develops through social comparisons, though their assessments of others may be biased. In prosocial contexts, these relative evaluations are especially important, shaping

expectations and influencing social acceptance. Research on adults suggests that they tend to see themselves as more prosocial than average, demonstrating the better-than-average effect (BTAE). Research suggests children show similar biases in hypothetical scenarios. However, in actual resource-sharing tasks, the BTAE was evident only among older children (8+), while younger children—who find sharing more challenging—expected peers to be more generous than themselves, demonstrating a worse-than-average effect (WTA).

The present study examined whether these biases are affected by the order in which children evaluate their own and others' behavior, and whether such evaluations influence actual prosocial behavior. In a study with 200 children aged 6–12, we asked children to share ten candies with another child and varied whether they did this before or after evaluating how much an average peer would share. Results showed that sharing increased with age, and the BTAE was found overall. However, the effect of evaluation order differed by age. Six-year-olds, who typically do not show the BTAE, shared more when they evaluated peers first, suggesting they were encouraged by others' perceived generosity. In contrast, eight-year-olds, who exhibited the BTAE, shared less when evaluating the peer first. These children appeared motivated to preserve their better-than-average self-view, sharing just enough to exceed their estimate of the peer's behavior. Among ten-year-olds and older, the BTAE remained stable, and the order of evaluation had no significant effect, suggesting more consistent prosocial behavior that is less influenced by considerations of others' actions.

We discuss developmental and cognitive mechanisms and consider their implications for promoting prosocial behavior in children.

PA-15 Cross-cultural variability of the development of the Liking Gap in childhood and adolescence

Xiaohuan Li, Sander Thomaes, Wouter Wolf

Utrecht University, Netherlands

People often underestimate how much others like them after initial conversations, a phenomenon known as the liking gap. This social illusion might reduce individuals' well-being and cause a more negative evaluation of their relationships. Previous research has shown that the liking gap is not only found in adults but also emerges in children around 5 years of age. Yet the question remains whether children's liking gaps are limited to individuals they interact with (specific liking gap), or if they also experience more general liking gaps towards groups such as their classmates (general liking gap). Moreover, all research on the development of the liking gap has been done in a relatively small US sample, making it difficult to generalize these findings.

In the current study we therefore collected data on the Liking Gap in Chinese and Dutch children and adolescents (4–17 years old): Two unfamiliar participants interacted with each other in a cooperative task, after which they reported (1) how much they liked their partner, (2) how much they believed their partner liked them, (3) how much they liked their classmates, and (4) how much they believed their classmates liked them.

Although the Dutch sample is currently still being finalized, the Chinese sample (1231 children and 817 adolescents) already shows a specific liking gap emerging later than in the previous US sample, at 7 years instead of 5. Similarly, a general liking gap seemed to emerge at a similar age, around 7 years of age (although, surprisingly, the data suggests that 4-year-olds already show a similar liking gap). Finally, correlation analysis showed that the two liking gaps are correlated, albeit stronger in adolescence than in childhood.

These (preliminary) findings provide evidence that both specific and general liking gaps emerge in early childhood, but that there is more variability in the age of emergence than previously thought.

PA-16 Rational acquaintanceship: Children select informative observations to test hypotheses about agents

Laura Schlingloff-Nemecz, Georgina Török, Azzurra Ruggeri

Technical University of Munich, Germany

Research shows that children are “naive psychologists”, adept at understanding and navigating the social world from early in life. However, much of this work portrays them as passive recipients of information about others. When such information is not immediately available, children may use their skills for active learning, exploration, and hypothesis-testing to acquire it.

In this study, we test whether 3- to 7-year-old children can identify informative observations about novel agents. Children are introduced to animated alien characters, and asked to answer questions about their goals (e.g., food preference) and traits (e.g., climbing ability, fairness). To help them answer, children can choose to watch one of two video clips: one likely to yield relevant information, the other underinformative or confounded. When choosing, children only see the initial still frames and must predict the agents’ actions in the depicted scenarios to evaluate which event is likely more informative.

We assess whether children, across 8 trials, select the more informative video; for a preliminary analysis, we conducted Bayesian mixed-effects logistic regressions. With $n = 63$ participants (37 girls; mean age: 5.4 years, target $n = 80$), children overall choose the better evidence 67.5% of the time (OR: 2.24, 95% CI: 1.08, 4.64). We also find an effect of age (BF: 32): choices of the more informative video increase from 55.8% at age 3 to 76.8% at age 7.

Moreover, we find that while children generally express high confidence in their responses, the proportion of children indicating that they are only somewhat or not at all certain is higher after watching a less informative (39.6%) compared to a more informative video (20%).

Overall, these results indicate that young children can leverage their scientific reasoning skills in the social domain to reveal invisible features of agents.

POSTER SESSION A
THURSDAY

PA-17 Reconciling two competing views on the process of generating explanations: Rational inference vs. intuitive biases

Mert Kobas, Andrei Cimpian

New York University, United States

Explanations help us make sense of the world. Previous studies point out two approaches to explanation generation. One view argues that explanations are generated from rational, Bayesian inferences (Gopnik & Bonawitz, 2015), while the other points to a reliance on cognitive shortcuts, such as the inference bias, a tendency to favor explanations based on inherent features over external factors (Cimpian & Salomon, 2014). This study investigates whether these approaches can be reconciled.

We expected participants to show an inference bias when the evidence is ambiguous. The extra complexity involved in arriving at an inference in this case might prompt reliance on shortcuts, such as using easily accessible information. However, explanations might approximate rational inference when evidence unambiguously identifies a particular cause (inherent or extrinsic) because unambiguous evidence reduces the complexity of the problem space, allowing use of more optimal inferential strategies.

In Study 1, we presented 105 adults and 210 children (4–12 years) with evidence pointing to an inherent cause (unambiguous-inherent), an extrinsic cause (unambiguous-extrinsic), or both causes (ambiguous) (see Figure 1 for the details of demonstrations). In the ambiguous condition, participants' explanations exhibited the inference bias, generating more inherent than extrinsic explanations ($p_s < .05$), despite the evidence being equally consistent with both. Conversely, in unambiguous conditions, participants' explanations approximated rational inference, aligning with the evidence whether it supported an inherent or extrinsic cause ($p_s < .001$, Figure 2).

Study 2 successfully replicated this pattern in adults using a different phenomenon and inherent property, confirming the generalizability of these findings ($p_s < .05$, Figure 3). Both in Study 1 and 2, the demonstrations suggested a one-to-one mapping between cause and effect (deterministic evidence). However, prior studies about rational inference (e.g., Frosch & Johnson-Laird, 2011) have emphasized that effects may occur only some of the time, even when the relevant cause is present (probabilistic evidence). Study 3, with ongoing data collection, extends this investigation to probabilistic evidence to evaluate the robustness of our findings beyond deterministic scenarios.

Our results demonstrate how the two approaches to explanation generation can be reconciled. In the ambiguous condition, participants generated more inherent explanations because ambiguity makes drawing inferences more challenging, thereby promoting reliance on the most accessible information (a shortcut). However, when the evidence was unambiguous, participants' explanations approximated rational inference.

PA-18 Compositional Thought Before Compositional Language: Evidence from 9-11-Month-Olds

Lily Zihui Zhu, Elika Bergelson, Jesse Snedeker

Harvard University, United States

Language combines words into phrases to express complex thoughts. Does compositional thought require composing linguistic units (e.g., Spelke & Tsivkin, 2001) or reflect a more general language-of-thought (Fodor, 1975)? We investigate compositional thought in infants too young to understand compositional language, which emerges around 12–16 months (Hirsh-Pasek & Golinkoff, 1996; Pomiechowska et al., 2024). Specifically, we test infants' ability to compose nonlinguistic functions by applying two familiar physical functions to a single object in different orders to produce distinct outcomes. In Experiment 1, 9–11-month-olds ($n = 16$) learn two physical functions from four training events. For pushing, they see a broom both move an object across the display and move alone. For smashing, they see a hammer both lower and smash an object, and lower beside an intact object. Participants then complete two test trials in one of two conditions. In each, the same function-composition sequence occurs behind an occluder. Afterward, the occluder lifts to reveal either an expected or unexpected outcome.

In the Push-First condition, the broom pushes the object towards the hammer, which then falls where the object should now be, and should therefore smash it. In the Smash-First condition, the hammer falls before the object is pushed underneath, so the object should remain intact.

A repeated-measures ANOVA on looking times revealed a significant condition \times outcome interaction, $F(1,14) = 6.39$, $p = .02$, suggesting that infants in both conditions looked longer at the unexpected outcome (Push-First: intact > smashed; Smash-First: smashed > intact). We replicated this effect in Experiment 2 ($n = 32$, preregistered), $F(1,30) = 4.61$, $p = .04$.

Taken together, this suggests that at 9–11 months, before they can compose linguistic units, infants can compose physical functions and anticipate different outcomes depending on the order of function application. These findings suggest that compositional thought does not require learning an external compositional language but instead reflects a more general cognitive capacity (e.g., a language-of-thought).

PA-19 Enhancing Social Curiosity Drives Prosociality in Young Children

Nayen Lee, Kelsey Lucca

Arizona State University, United States

Starting in childhood, much of human thinking is devoted to understanding how others think, feel, and behave – a phenomenon known as “social curiosity”. Yet, we still know little about what motivational factors drive social curiosity and how it influences children’s interpersonal behaviors. We addressed these questions with two experiments with children in the United States ($N = 192$, Mage = 7 years, Predominantly White and English-speaking).

Study 1 tested whether providing incomplete information about unfamiliar people would heighten social curiosity. Children were randomly assigned to one of three conditions: Social Curiosity (SC), Object Curiosity (OC), or No Curiosity (NC). They were given 10 opportunities to learn about a new person (Sam) and a new object (Apple House). To elicit social curiosity, the conditions varied in the amount of information provided about Sam: children in the SC condition received the least, those in the OC condition the most, and those in the NC condition an intermediate amount. Next, children chose which topic they wanted to learn more about and rated how much they wanted to learn about each topic on a 5-point scale (Fig. 1). Children in the SC condition reported the highest social curiosity across both tasks ($p_s < .01$, Fig. 2).

In Study 2, we tested whether social curiosity predicts children's sharing. The procedure closely followed that of Study 1, except children additionally completed five rounds of a sharing game (Fig. 3). In each round, two pre-allocated distributions of stickers were presented: one maximizing the child's gain (non-sharing) and one giving some to Sam (sharing). Results replicated Study 1 and additionally showed that boosting social curiosity increased sharing among children low in dispositional social curiosity, suggesting that situational curiosity can compensate for lower baseline levels (Fig. 4). Together, this work provides new insights into ways to support curiosity-driven social engagement in childhood.

PA-20 How long is a moment? Acceleration of visual experience from infancy to adulthood

Sara Dochez¹, Flavia MENGARELLI², Marie-Maude GEOFFRAY-CASSAR², Jean-Remy HOCHMANN³

¹Institut des Sciences Cognitives, CNRS - Le Vinatier Psychiatrie Universitaire Lyon Métropole, France; ²Le Vinatier Psychiatrie Universitaire Lyon Métropole, France; ³Institut des Sciences Cognitives, CNRS, France

While our experience of the world appears continuous, perception actually involves discrete sampling of the environment into successive moments (or time integration window; TIW). When successive stimuli are presented closely in time, within a single TIW, they are integrated into a single coherent percept; but if the stimuli are separated by longer delays, they give rise to two distinct percepts. We evaluated the duration of the TIW from infancy to adulthood ($N = 288$). Participants viewed two alternating displays separated by variable inter-stimulus intervals (ISI). In integration trials, only half-faces were presented in each display, but if the two displays were integrated into one percept, a unique emergent complete face would attract attention among half-faces. In segmentation trials, the integration of the two displays lead to the perception of multiple complete faces, even though only one complete face was actually drawn on the screen in one display only. Longer cumulative looking time towards the target than the distractors indicated target detection. Target detection should decrease in integration trials and increase in segmentation trials for ISIs longer than the TIW. In Experiment 1 (ISI = 16, 32, 83 or 116 ms), results revealed TIWs between 32–83 ms in adults ($N = 24$) and 5-year-olds ($N = 24$), and a longer TIW of about 100 ms in 3-year-olds ($N = 24$). In infants (5, 8, and

18 months; N = 24/group), no interaction with ISI was found, but a main effect of trial type indicated persistent integration and TIWs > 116 ms. In Experiment 2 (ISI = 100, 150, 200, 250 or 400 ms; N = 48/group), TIWs were estimated around 200 ms at 8 and 18 months, and around 400 ms at 5 months. Together, these results highlight an acceleration of perception in the course of development and suggest major differences in the first-person visual experience of young infants, older children and adults.

PA-21 Children's Attention to a Speaker's Face During a Live Interaction in Native and Non-Native Language

Monica Leris¹, Joan Birulés²

¹Universitat Autònoma de Barcelona, Spain; ²University of Barcelona, Spain

Previous research has examined how infants, children, and adults direct their visual attention to different parts of a speaker's face to support social and language development. However, most studies have relied on static, screen-based paradigms, which may not fully capture the dynamic and interactive nature of real-life communication. This study is the first in a broader collaborative project aimed at investigating naturalistic visual attention to faces across development and diverse linguistic and cultural contexts.

We examined how children (N=21; 4–8yo, native Catalan/Spanish speakers learning English) allocate gaze to a speaker's eyes and mouth during live face-to-face interactions in a native and a non-native language (English), using a head-mounted eye tracker. Results revealed that children adjusted their attention depending on the language ($F(1, 20) = 7.60, p = .012, \eta^2 = .28$); they focused more on the eyes in native conversations but distributed attention more evenly between eyes and mouth in non-native conversations (see Figure 1).

These findings mirror previous evidence from children and adults' screen-based paradigms and demonstrate that in naturalistic interactions, children adapt visual attention based on linguistic familiarity. More broadly, this work provides an early step toward understanding the role of faces in real-life contexts, contributing to an ongoing project examining how naturalistic visual attention develops across ages, languages and cultures.

PA-22 Short-Form Video Consumption and Cognitive Function in Children

Ebru Ger, Claudia M. Roebers

University of Bern, Switzerland

Short-form video consumption on platforms such as TikTok, Instagram Reels, and YouTube Shorts is increasingly common among children worldwide. Early studies suggest a potential link between such consumption and attention problems, yet the prevalence and patterns of use remain largely unknown. This study aimed to provide first descriptive insights into short-form video use among children aged

POSTER SESSION A
THURSDAY

8 and 10 in Switzerland and examine associations with parent-reported ADHD symptoms, children's executive function (EF), and academic performance in math and reading.

Data were collected from 382 parents in Bern, a mid-sized Swiss city, who reported on their children's frequency and duration of short-form video use and ADHD-related behaviors (Conners-3 Short Parent Form). Children completed digitalized tasks assessing EF, math, and reading skills. Results indicated that 13% of 8-year-olds and 15% of 10-year-olds watched short videos daily, and 45% of 8-year-olds and 56% of 10-year-olds watched one or more times per week. On average, parents estimated that their children watched 7 and 9 minutes per day, respectively, for 8- and 10-year-olds. Consumption was higher in children with lower parental education ($r = -.20, p < .001$).

No significant correlations emerged between the duration of short-form video consumption and children's EF, math, reading performance, or parent-reported ADHD symptoms (all $ps > .05$). These findings may suggest that, at current average levels, short-form video use is not associated with measurable cognitive or behavioral difficulties. However, given increasing trends in global short-form video consumption, the higher usage in families with lower parental education, and limitations of parent-report measures, continued monitoring is warranted. Future research should explore whether longer durations, different contexts, certain child characteristics, or less-developed regions show distinct patterns or effects.

PA-23 Young preschoolers from Germany and China fail at a low-demand false belief task when alternative strategies are controlled for

Chen Yang¹, Josef Perner², Charlotte Grosse Wiesmann¹

¹Max Planck Institute for Human Cognitive and Brain Sciences, Germany; ²Department of Psychology, University of Salzburg, Austria

Previous research has shown that 2.5-year-olds succeed at an explicit false belief (FB) task when response-generation and inhibitory-control demands were reduced (Setoh et al., 2016). Given better inhibitory abilities in Chinese compared to Western children (Sabbagh et al., 2006), we aimed at comparing the development in this low-inhibition FB task between cultures. However, the low-inhibition FB task has been criticized for allowing for the lower-level strategy of looking at the last object location, which would not require false belief attribution (Rubio-Fernandez et al., 2017). To rule out this alternative explanation, we added an FB=first control condition to the original FB=last condition – where the agent believes the object to be in the first location. If young preschoolers genuinely reason about beliefs, they should succeed in both conditions and not just in the FB=last condition.

We tested 53 German and 45 Chinese 3- to 5-year-olds with the modified Setoh-task, a standard FB task, and an inhibitory control task. In both cultures, 3-year-olds performed above chance in the FB=last condition (original Setoh-condition) but not in the FB=first condition (controlling for the lower-level strategy). Children showed significant age-related improvement in the FB=first condition but not in the FB=last condition. Further, while the FB=first condition was related to performance in a standard

FB task and in an inhibitory control task, the FB=last condition was not. Across both cultures, our findings show a consistent pattern, suggesting that children may employ a non-mentalistic strategy in the original Setoh-task– (i.e., gazing at the last object location rather than attributing false beliefs). This suggests that, in line with previous theory, explicit false belief reasoning emerges around age 4 in both Western and Chinese cultures, independently of the executive demands of the task.

PA-24 Early Motor Activity Levels and Their Association with Later ADHD: A Systematic Review

Hattie Ruffer, Emma Meaburn
Birkbeck, United Kingdom

Background: Attention-deficit hyperactivity disorder (ADHD) is increasingly recognised as a condition with early developmental origins. Motor activity is one of the earliest observable behaviours in infancy, yet its role as an antecedent of ADHD remains underexplored.

Methods: We conducted a systematic review of 17 longitudinal studies examining early motor activity in relation to later ADHD symptomology and diagnosis. Studies included objective measures (actigraphy, accelerometry, video-coded behaviour), parent and multi-informant reports, and combined designs. Data extraction followed PRISMA 2020 guidelines, and methodological quality was assessed using a modified checklist adapted from previously published tools (Ronald et al., 2021; Meerman et al. 2022).

Results: Across methodologies, heightened or poorly regulated activity in infancy and early childhood was consistently associated with later phenotypic ADHD. Objective measures revealed stable, heritable patterns of overactivity, with predictive signals emerging as early as 18 months. Parent-reported activity levels also associated with ADHD outcomes, providing evidence for ADHD-specificity in large cohort samples. Associations across studies seemed most robust when activity measurements were multi-modally combined (e.g. with temperament or executive function indices), as well as developmentally timed and contextualised appropriately. A subset of studies suggested that motor delays or dyscoordination, not only hyperactivity, may also confer ADHD risk.

Discussion: Beyond empirical findings, one critical insight is the dominance of a medical-model framing, which often pathologises early behavioural variation and positions diagnosis as the ultimate endpoint. While this supports clinical utility, it risks narrowing interpretive space. More dimensional, neurodiversity-informed approaches may enrich our understanding of how early motor behaviours interact with developmental systems.

Conclusion: Early motor activity represents a promising, multifaceted marker of ADHD propensity. Broadening the phenotype to include related factors like motor dyscoordination will be key to enhancing conceptual models of ADHD. Future research integrating objective, informant, and genetic data is needed to advance these developmental frameworks.

POSTER SESSION A
THURSDAY

PA-25 Secret, Equal, and Free – Preschool Children’s Evaluation of Democratic Electoral Principles

Norbert Zmyj, Marie Schröter, Lukas Ullmann, Uwe Winkler, Thomas Goll
TU Dortmund University, Germany

The understanding of democratic principles might begin to develop as early as preschool age. While democracy education programs in early childhood settings are becoming increasingly popular, there are still only a few empirical studies on how children in this age group understand democratic and constitutional principles. The present study examined the extent to which preschool children are able to recognize and endorse the electoral principles of free, equal, and secret voting. It was hypothesized that children would evaluate adherence to these principles more positively than their violation, and that this differentiation would increase with age. It was further assumed that this differentiation would be interrelated across the different electoral principles. To test these assumptions, 55 preschool children aged between 3 and 6 years were interviewed. They were presented with videos of voting situations that either adhered to or violated one of the electoral principles. Afterwards, the children evaluated the videos using a rating scale. The results showed that preschool children generally evaluated violations of electoral principles more negatively than their adherence. However, an age-related increase in rejection was observed only for the principles of equal and secret voting. These findings suggest that preschool children already possess a basic understanding of democratic principles in the form of electoral principles. The study emphasizes the need for an empirical foundation for democracy learning in preschool settings.

PA-26 Replicating the Logarithmic-to-Linear Shift in Number Line Estimation at Scale

Eudald Correig-Fraga
Innovamat Education, Spain

Classic work by the team of Booth and Siegler (2004, 2006) demonstrated a developmental shift in children’s number line estimation, from a logarithmic to a linear representation of numerical magnitude. This shift has been proposed as a cornerstone of symbolic number understanding and a strong predictor of later mathematical achievement.

In the present study, we replicated these findings at unprecedented scale using data from Innovamat, an EdTech platform providing research-based mathematics curricula. We analysed number line estimations from more than 64,000 children in Grades 1 and 2 (ages 6–7), assessed both at the beginning and at the end of the academic year. Children also completed an arithmetic fluency task, allowing us to examine how estimation patterns vary with maths competence.

Our results closely mirror the original studies. At the start of the year, younger and lower-fluency children tended to produce estimates following a logarithmic compression, while older and higher-fluency children’s estimates were predominantly linear. By the end of the year, the majority of children

showed estimation patterns best fit by linear functions. Model-fitting analyses confirmed that the lowest-fluency quartiles in Grade 1 were better explained by logarithmic models, while most other groups were best explained by linear ones.

These findings provide robust evidence—based on a sample size orders of magnitude larger than the original studies—that the logarithmic-to-linear shift in number representation is a reliable developmental phenomenon strongly associated with arithmetic skills. Embedding such tasks into large-scale classroom practice validates foundational results in numerical cognition and highlights the potential of number line estimation as a diagnostic and instructional tool.

PA-27 Neural oscillatory dynamics of building novel visual object representations from infancy to adulthood

Marlena Baldauf¹, Stefanie Höhl², Radoslaw Cichy³, Siying Xie³, Christina Maria Schätz², Moritz Köster¹

¹University of Regensburg, Germany; ²University of Vienna, Austria; ³Freie Universität Berlin, Germany

Neural rhythms coordinate activity across distributed brain networks. In the adult visual system, oscillations in the 3–8 Hz theta and 8–14 Hz alpha ranges have been studied extensively: theta is proposed to support perceptual binding and the formation of novel representations, while alpha is thought to gate information in perceptual networks. Emerging evidence suggests that theta and alpha also play a role in infancy and childhood, yet a systematic investigation of their functional properties across development is missing.

We investigated the functional properties of theta and alpha across development by combining high-density EEG and a large sample spanning seven age groups (N = 44 six-month-olds, N = 43 12-month-olds, N = 40 4-year-olds, N = 40 6-year-olds and N = 20 adults; data collection ongoing for 8 and 13-year olds). Participants viewed familiar and novel images, allowing us to probe oscillatory dynamics associated with novelty processing and learning over time by leveraging time-frequency and representational similarity analyses.

Preliminary results reveal similar functional patterns across age groups. Image onset elicited an early increase in theta power, followed by a later decrease in alpha power, providing the first evidence of alpha suppression in infancy. However, developmental changes are evident in both peak frequency, which increases with age, and topography, with theta activity becoming more frontal in older children. Results from all seven age groups and their evolution throughout the familiarization phase will be presented at the conference.

This study constitutes the largest developmental dataset to date examining neural responses to novel versus familiar visual information, offering valuable insights into the functional properties of theta and alpha rhythms throughout development.

PA-28 The impact of very premature birth and the role of statistical learning in reading skills

Lauréline Fourdin¹, Florence Christiaens², Dominique Grossman³, Marie Tackoen⁴, Aline Vuckovic², Annick Lebrun², Xavier De Tiège¹, Julie Bertels¹

¹Université Libre de Bruxelles (ULB), Belgium; ²Hôpital Universitaire de Bruxelles (HUB), Belgium;

³Hôpital CHIREC (Delta), Belgium; ⁴CHU Saint-Pierre, Belgium

Very preterm birth (VPB) abruptly alters brain development, increasing the risk of complications and potential abnormalities. Although many preterm children achieve developmental outcomes similar to those of term-born peers, VPB is often linked to long-term cognitive and academic challenges, especially in reading. Statistical learning (SL) is thought to support reading development by enabling the recognition of probabilistic patterns in language input. Moreover, the brain regions most impacted by VPB are those involved in SL. This raises questions about whether SL is affected by VPB and if it influences reading outcomes.

We have tested 34 children aged 8–12 years so far: 25 born at term (>36 weeks gestation) and 8 born very preterm (28–32 weeks gestation). Participants were exposed to nine cartoon aliens presented in fixed triplets. Learning of these triplets was then evaluated through a rapid serial visual presentation (RSVP) detection task and a three-alternative forced-choice (3AFC) completion task. Reading ability was assessed using the standardized French test Alouette-R.

Preliminary results suggest that both groups could learn the patterns: reaction times tended to decrease for aliens in the third compared to the first triplet position in the RSVP task, and average accuracy in the 3AFC task was above chance. No significant differences in SL were observed between the groups. Similarly, no differences in reading ability emerged between groups. Regression analyses showed a link between SL performance and reading efficiency, regardless of birth status.

These findings should be interpreted cautiously due to the small sample size, which limits statistical power. Nonetheless, emerging trends suggest that SL may be a mechanism contributing to individual differences in reading outcomes, supporting previous research. They also imply that VPB has a minimal impact on reading and SL performance. These findings will need to be confirmed in a larger sample, which is expected to be available in the coming months.

POSTER SESSION A
THURSDAY

PA-30 The emergence of language-specific rhythmic processing in Moroccan Arabic monolingual 6-month-olds

Marielle Hababou-Bernson¹, Victor Jose Lopez-Madrona², Clément François³, Isabelle Dautriche¹

¹Centre de recherche en Psychologie et Neurosciences, France; ²Institut de Neurosciences des Systèmes, France; ³Laboratoire Parole et Langage, France

We examined neural tracking of speech in Moroccan Arabic monolingual 6-month-olds and adults using EEG and TRF modeling. We compared the encoding of acoustic and linguistic features in native and non native language while they listened to stories in Moroccan Arabic and French. Infants

showed a native-language advantage without feature-specific tracking, while adults were selectively sensitive to stressed syllables.

PA-31 When and how do infants represent abstract relations in dynamic events?

Ana Martin-Salguero, François Leroy, Ghislaine Dehaene-Lambertz

NeuroSpin (Cognitive Neuroimage Unit, Paris), France

Theories of conceptual development generally assume that young infants create perceptual-like representation driven by attentional biases or representations generated by modular structures. By contrast, the presence and role of abstract representations are poorly attested, and often controversial. One reason for this is that they require symbolic capacities, which are typically associated with frontal brain regions, known to have a relatively late maturation process. However, recent evidence suggest that an adult-like brain architecture and functional networks are already present in infants, with prefrontal regions involved in higher-level cognition — such as memory, or familiar stimuli recognition — active within the first semester of life (Dehaene-Lambertz et al., 2010; Dehaene-Lambertz et al., 2002). Furthermore, before their first birthday, infants show frontal brain signatures during symbolic labelling and logical reasoning (Kabdebon & Dehaene-Lambertz, 2019; Martin-Salguero., 2021), as well as oculomotor markers of abstract thematic role representation (Papeo et al., 2024). Since the compatible brain architecture is already in place, it is plausible that even younger infants learn, at least in part, by exploiting their capacity to symbolically represent situations, events, and state of affairs. Here we explore whether 4-month-olds can encode simple events at an abstract level by leveraging the predicative argument structure of an event. We thus introduce infants to animals of two different kinds, engaged in a chase ending with one flattening the other. In subsequent test scenes, new animals are introduced, either preserving this relational structure (A flattens B) or reversing it (B flattens A). We are currently running pilots using EEG and oculomotor recordings. If infants can represent the abstract structure of events, they should generalize the event mappings to object-kinds and found the reversal relation surprising. It will be revealed by a late EEG response and increased pupil dilation, indicating top-down processing at this early age.

PA-32 Change is a core concept

Peter Mazalik¹, Justin Halberda²

¹Johns Hopkins University, Romania; ²Johns Hopkins University, United States

“One can never step in the same river twice, for it is not the same river and he is not the same man.” This ancient puzzle by Heraclitus highlights that the world, and ourselves, are constantly changing. Philosophers have long debated how identities can persist through change, or what the true nature of a continuously changing entity is (e.g., Neurath’s boat). To raise these puzzles, one must engage the concept of CHANGE. Some of the most striking findings in psychology in the past decades have

shown that infants represent some of the most abstract notions humans are endowed with; notions such as objects and agents, cause, and number. Here we show that infants possess an additional abstract representation of CHANGE.

To test this, we adapted the individuation paradigm pioneered by Xu and Carey (1996), in which two objects emerge sequentially from behind an occluder, preventing spatiotemporal cues about object number. Infants must instead rely on contrastive features/kind information. Prior work shows that before 12 months, infants fail to individuate objects differing by basic-level category (e.g., duck vs. truck), but succeed with broader distinctions (e.g., object vs. agent).

Our stimuli were cubes with either a static color or continuously changing color. At test, the occluder was removed to reveal a single cube. Trials were either consistent or inconsistent with there being only one object behind the occluder. Infants looked reliably longer at inconsistent trials, $t(15) = 1.97$, $p < .05$. This is striking in light of reports that infants at this age fail to individuate objects by color alone (Leslie, 1998).

Individuation studies reveal the earliest concepts infants use to track identity: OBJECT, AGENT, HUMAN, ARTIFACT, and now CHANGE. Representing change opens a new avenue for research: What types of change are automatically encoded? Over what timescales? Embedded in which cognitive systems? By 8 months, infants already appreciate change as a core property of the world.

PA-33 Effects of Direct and Indirect Reciprocity on Children's Third-Party Norm Enforcement

Louisa Huff, Sebastian Grueneisen

Leipzig University, Germany

Reciprocity is an evolutionarily ancient cornerstone of human cooperation. However, when a personal benefactor commits a transgression, the drive to reciprocate favors can come into conflict with the imperative for impartial norm enforcement. In a prior experiment, we investigated whether direct reciprocity has the potential to obstruct impartial norm enforcement even in young children. We found that, contrary to their deontic judgments, 5- to 7-year-old German children were less likely to enforce a norm against cheating on transgressors who had previously done them a favor compared to transgressors who had not. In the current study, we investigated whether this effect was driven specifically by children's motive to protect their benefactor or by a more general inclination to protect prosocial others. Five- to 7-year-old Germans witnessed a play partner cheat in a guessing game. Prior to the norm breach, the partner benefited either children themselves (direct reciprocity condition) or an absent peer (indirect reciprocity condition). Children had the opportunity to police, tattletale, and withhold resources from the transgressor. While spontaneous tattletaling was generally rare and children policed the transgression at comparable rates in both conditions, children across ages were less likely to withhold a prize from a transgressor who had done them versus the peer a favor. Further, when prompted to tattletale in the transgressor's absence, 6- and 7-year-olds were more likely to lie on behalf of a transgressor who had benefited them versus a peer, whereas 5-year-olds covered at

equally high rates for both. The findings speak to how young children resolve obligational conflicts and indicate that obligations emanating from direct reciprocity play a unique role in compromising consistent norm enforcement.

PA-34 The Role of Parental Cultural Values in Children's Over-Imitation

Esmee M. Aalders, Joanna M. Rutkowska, Moritz M. Daum

Universität Zürich, Switzerland

Children often imitate unnecessary actions, a behaviour known as over-imitation (Hoehl et al., 2019). This study investigates how children's over-imitation is influenced by their parents' cultural values. Research shows that parental institutional collectivism and performance orientation modulate bilingual children's responses to norm violations (Gampe & Daum, 2018). Building on this, we hypothesise that children are likely to imitate redundant actions when they perceive them as normative.

In an ongoing study, we test 120 children aged 3.5-4.5 years, equally divided among monolinguals, bidialectals (two German varieties), and bilinguals (two distinct languages). Each child observes an adult perform a novel multi-step action on a toy box, including both instrumental and causally irrelevant actions (adapted from Schleihauß et al., 2018) to retrieve an object. Irrelevant actions are categorised as pseudo-instrumental (contact with the box) or noncontact (no physical interaction). Noncontact actions are more likely to be perceived as normative (Schleihauß & Hoehl, 2020). Children then interact with the toy box, and their imitation of each step is measured. Caregivers complete questionnaires assessing children's Theory of Mind (CSUS; Tahiroglu et al., 2014) and their cultural values (GLOBE; House et al., 2004). We use Bayesian generalised linear mixed models to test whether parental values (institutional collectivism, performance orientation) and action type influence children's over-imitation, controlling for ToM and age. We expect parental values to predict children's noncontact, but not pseudo-instrumental, over-imitation.

Preliminary results ($n = 105$) show that children copy on average 1.3 of two pseudo-instrumental and 0.6 of two noncontact actions ($SD = 0.8, 0.7$ respectively), consistent with Hoehl et al. (2014). Moreover, parental values deviate from Swiss norms (e.g., performance orientation: our sample $M = 2.63$ vs. Swiss $M = 5.82$), indicating variance and cultural differences. These findings shed light on how multicultural development interacts with cognitive and social factors in shaping early social learning.

PA-35 Development of mind perception

Ayaka Ikeda¹, Yuko Okumura²

¹Senshu University, Japan; ²NTT Communication Science Laboratories, Japan

A question that how people perceive the mind for agents and objects (hereafter characters) has been shed light on for recent decades (e.g., Gray et al., 2007; Weisman et al., 2017). A prevailing idea is that people perceive the mind using the agency-experience framework proposed by Gray

et al. (2007). They suggest that adults perceive the mind through two dimensions: agency (the perceived capacity for intend to act) and experience (the perceived capacity for sensation and feelings). One important question regarding mind perception is whether it differs in children and adults and how it changes developmentally. This study investigated such developmental changes using the agency-experience framework from two perspectives: specialization of mind perception for nine characters and their categorization. We asked 3–10-year-old Japanese children and adults (N=378) how they perceived the minds of each character, including an adult human, an infant, a dog, an ant, God, a social robot, a nonsocial robot, a ball, and a stuffed animal. To assess their perceptions, we asked four questions each on agency and experience (e.g., “Can X [characters] feel hungry?” “Can X [characters] communicate its thoughts or feelings to others?”). We calculated agency and experience scores by averaging each question. The results of convex analysis, which examined the spread of mind perception of the nine characters, revealed that in younger children, especially 3- and 4-year-olds, mind perception was gathered in small areas, whereas older children and adults had larger areas. Additionally, cluster analysis showed that younger children grouped living and non-living things. Notably, while children perceived the minds of social robots as belonging to living agents, adults perceived them as similar to non-living things. These findings suggest that children’s mind perception develops from an undifferentiated to a differentiated structure, in the uniqueness attributed to individual characters and the mind’s categorizations.

PA-36 When Wrong Feels Right: The Developmental Origins of Suboptimal Guess Revision

Munther Ahmed, Erno Teglas

CEU, Austria

How do we learn to abandon our incorrect predictions? While young preschoolers are thought to confuse guesses with reality (Leahy & Carey, 2020), the ability to revise hypotheses in light of new evidence is critical for reasoning. This project examines the developmental origins of this ability by comparing guess revision in adults and preschoolers.

In a novel touchscreen paradigm, participants had to guess the final location of a target object relative to a non-target. The key manipulation was the revelation of the non-target object’s location, which provided probabilistic evidence that either supported, remained neutral, or contradicted the initial guess. After revealing the non-target object, participants were allowed to search for the target object. While adults (N=20) revised their own contradicted guesses significantly more often in incongruent cases than in neutral or congruent cases, their performance remained suboptimal compared to a rational benchmark, and remained below the performance of a no-guess group (N=20). Crucially, this impairment was not due to owning the initial guess, as revision rates were similarly suboptimal even when the guesses were generated by a third person (N=20). Together, these findings demonstrate that the mere presence of an initial hypothesis impairs optimal decision-making.

To explore the developmental origin of this bias, data from a group of five-year-olds (N=20) making

self-generated guesses revealed that this suboptimal revision pattern emerges early in development; these children, like adults, revised their guesses significantly more often in incongruent cases but remained well below optimal performance, demonstrating a similar persistent commitment to initial guesses. Data acquisition for the remaining experimental groups (no-guess and other-generated guess) is currently ongoing and is expected to be completed before the conference.

This work provides a new window into the development of the processes shaping decision-making under uncertainty.

PA-37 Is language needed for constructing two-place predicates: event imitation in toddlers

Canudas-Grabolosa Irene, Snedeker Jesse

Harvard University, United States

A central question in cognitive science is whether language merely expresses pre-existing event concepts or provides new cognitive tools for encoding them. Hinzen and DeVilliers(1,2) argue that language is necessary to represent abstract transitive relations that generalize across kinds (e.g., cats push chickens). Supporting evidence shows that 12-24 month olds fail predictive-looking tasks requiring role differentiation,(2) and three-year-olds struggle to imitate transitive (but not intransitive) actions without verbal labels.(3) This view has been challenged by studies of homesigners—deaf adults who didn't have access to conventional language when growing up4—who nevertheless can imitate transitive actions.(5) Yet homesigners create structured communication systems,(6) raising the possibility that their own language supports mastery of transitive relations.

To address this possibility, we tested 17-21 month toddlers (n=23; mage=20;01) using an imitation paradigm modeled on prior studies.3,7 Toddlers were randomly assigned to one of two conditions: a one-participant event (e.g., a cat jumping while a chicken stood nearby) or a two-participant event (e.g., a cat pushing a chicken). On each trial, the experimenter enacted an event with two figurines. The parent then reproduced the event with new exemplars of the same kinds, after which the toddler was given a third pair of figurines and encouraged to act.

The task proved doable for toddlers, who produced the observed action (e.g. hitting) on 50% of the trials.. Regarding role assignment, accuracy was marginally above chance in the two-participant condition (mean=72%, $\beta=4.9$, $p=.06$, log-regression), but not the one-participant condition (mean=58%, $\beta=-.53$, $p=.7$). The difference between the two conditions was not reliable ($\beta=.73$, $p=.3$). These findings provide preliminary evidence that toddlers represent transitive actions before they talk about them and suggest that transitive actions do not pose a greater representational challenge than one-participant events, undermining the claim that the production of transitive sentences is necessary for building these concepts.

PA-38 Resilience in Early Communicative Development: A Comparison of Preterm and Full-Term Children

Miriam T. Loeffler¹, Lisa Wagner¹, Xin Tong², Tabea Stähli³, Giancarlo Natalucci⁴, Moritz M. Daum¹

¹Department of Psychology and Jacobs Center for Productive Youth Development, University of Zurich, Switzerland; ²University of Virginia, United States; ³Department of Psychology, University of Zurich, Switzerland; ⁴Larsson-Rosenquist Foundation Center for Neurodevelopment, Growth and Nutrition of the Newborn, Department of Neonatology, University of Zurich, Switzerland

Children born preterm (<37 weeks of gestation) are at increased risk of delays in early communicative development. However, previous studies have often focused on vulnerable subgroups with very low gestational ages. This raises the question: Do delays persist in samples reflecting the population's gestational age distribution? To address this, we assessed 14 communicative milestones using the Pebbles App, a smartphone-based development diary for caregivers (<https://www.psychology.uzh.ch/en/areas/dev/devpsy/weltentdecker-app.html>). The analyses included $n = 335$ preterm (age-corrected) and $n = 4,563$ full-term children (0-2 years). Descriptively, preterm infants reached 11 out of 14 milestones earlier on average compared to full-term children. In most cases, these effects were not considered meaningful (i.e., they did not exceed our predefined smallest effect size of interest, $r = .10$), except for the milestones combining two or more words and marginal babbling. We also assessed milestone attainment for each month of age from 0 to 24 months and coded whether a child had already reached each milestone or not. In total, 136 models were fitted, and no meaningful effect was detected in 99 of these. However, being born preterm was associated with a higher likelihood of having reached a milestone in 30 models and a lower likelihood in 7 models. One explanation for our results is the longer period of exposure to communicative input that preterm children experience after birth. Our analyses further suggest that early-term children (37 to <39 weeks of gestation) reach milestones later than their peers. In sum, these findings challenge traditional assumptions about language delays in preterm children.

POSTER SESSION A
THURSDAY

PA-39 Infants in Control: How Predictability Shapes Looking Preferences

Tal Ravid-Roth¹, Livne Romi², Berlinger Ariel¹, Kunde Wilfried³, Eitam Baruch¹, Jaffe-Dax Sagi²

¹University of Haifa, Israel; ²Tel-Aviv University, Israel; ³University of Würzburg, Germany

Although infants often prefer novel or surprising stimuli, recent research suggests that predictability arising from their own actions (sensorimotor predictability) may also be a powerful motivator. Across two gaze-contingent eye-tracking experiments, we investigated whether infants prefer to look at stimuli whose movements are triggered by their own gaze, or at stimuli that move independently. In Experiment 1 ($n = 21$, $M = 10.11$ months), we compared a stimulus whose movement was fully gaze-contingent with a stimulus whose movement pattern was identical to the target, but with a randomly timed onset. In Experiment 2 ($n = 22$, $M = 8.24$ months), we tightly controlled the properties of the movement of the non-contingent stimulus, resulting in the presentation of a gaze-contingent

stimulus alongside a non-contingent stimulus that was moderately predictable, but not under the infant's control. In both experiments, infants consistently preferred the gaze-contingent target. This preference was especially pronounced in younger infants and diminished with age, suggesting that the ability to generate predictable outcomes may be particularly important early in development, before more abstract and externally driven motivations emerge alongside more complex learning abilities. Pupil size analyses supported this interpretation. In Experiment 1, contingent stimuli elicited lower arousal than the non-contingent stimulus, which is consistent with learned predictability, whereas in Experiment 2, pupil responses were similarly low for both stimuli, indicating that their predictability was indeed matched and that contingency itself drove the preference.

Overall, these findings suggest that infants are not only attuned to the structure of their environment, but to their own causal powers within it. These findings are congruent with the Reinforcement from Sensorimotor Predictability (RSP) framework, which posits that predictable outcomes of self-initiated actions are intrinsically rewarding. Thus, from the earliest months of life, infants appear not only to seek stimulation, but evidence of their own effectiveness.

PA-40 Maternal Pointing and Infant Vocabulary: Role of Infant Point-Following

Sura Ertaş¹, Ebru Ger², Sümeyye Koşukulu-Sancar³, Aylin C. Küntay⁴

¹Acibadem University, Turkey; ²Bern University, Switzerland; ³Utrecht University, Netherlands; ⁴Koç University, Turkey

Parents' pointing may be related to infants' language development. There remains a question whether maternal pointing predicts later vocabulary, depending on infants' point-following skills. Infants follow points to targets within their visual fields by 9 months and beyond their visual fields by 12 months. We examined whether (1) mothers' pointing and (2) its interaction with infants' point-following predict subsequent vocabulary.

Fifty-six infants (30 girls) and their mothers with varying levels of maternal education participated in monthly lab observations from 8 to 12 months of age, and follow-ups at 14 and 18 months. Mothers' and infants' pointing and infants' point-following were assessed at each month from 8 to 12. Mothers' and infants' pointing frequencies were obtained using the decorated room paradigm, where the dyads took a 5-minute walk in a room with 21 objects on four walls. With infants, we used a point-following paradigm, in which an experimenter pointed to four pictures located at the front left, front right, behind left, and behind right of the infants. Receptive and expressive vocabulary were measured using the Turkish Communicative Development Inventory at 14 and 18 months, respectively.

We categorized the infants as "point-non-followers" if they did not follow any points during the front and the behind trials, as "visual-field point-followers" if they could follow at least one of the points in the front trials, but not the behind trials, and as "advanced point-followers" if they could follow at least one of the behind trials.

We applied multiple linear regressions for each time point from 8 to 12 months to test our research questions. At 11 months, maternal pointing did not predict receptive vocabulary, but infants' point-

following skills did: point-non-followers had significantly lower subsequent receptive vocabulary size compared to visual-field point-followers, $p_{\text{bonferroni}} < .001$, and advanced point-followers, $p_{\text{bonferroni}} = .041$. At 12 months, an interaction emerged: maternal pointing predicted subsequent receptive vocabulary only for advanced point-followers, $p = .035$. No significant associations were found with expressive vocabulary. These findings suggest that infants' point-following skills may influence whether they can translate their mothers' pointing into words.

PA-41 The role of follow-in naming and sustained attention in vocabulary growth

Elena Luchkina¹, Fei Xu²

¹The University of Texas at Dallas, United States; ²University of California, Berkeley, United States

Parent speech that follows infants' attentional shifts ("follow-in speech") is known to predict vocabulary size, but the mechanisms remain unclear. One possibility is that follow-in speech supports word learning by providing relevant input, such as object labels ("follow-in naming"). Another possibility is that follow-in naming boosts vocabulary by prolonging infants' attention to objects and strengthening word-object mappings. To disambiguate between them, we examined naturalistic parent-infant interactions using the Rollins Corpus when infants were 9- (N=22) and 12-months-old (N=19). Each recording was annotated frame-by-frame.

Follow-in speech episodes were identified based on temporal (within 2s of an attentional shift) and semantic contiguity (parent speaks about the object in infant's focus). Sustained attention episodes were defined as infants' looks to objects that lasted longer than average (7.8s at 9 months, 8.0s at 12 months). To account for variation in the number of infants' attentional shifts, these measures were calculated per attentional shift. Overall language input and complexity were also measured. Vocabulary outcomes (MCDI) were assessed at 12 (receptive M=78.35; productive M=7.94) and 18 months (M=232.39; M=98.74).

We predicted that if follow-in naming directly supports vocabulary, the number of such episodes would predict outcomes regardless of sustained attention. If its effect is via extending attention, only episodes followed by sustained attention should predict vocabulary. We also expected effects to emerge in the first year (9–12 months), but not the second (12–18 months), when children employ more word-learning strategies.

Consistent with the first possibility, the number of follow-in naming episodes at 9 months predicted receptive (but not productive) vocabulary at 12 months (Tables 1-3). This held regardless of sustained attention (Tables 4-6), although naming did extend infants' looking to the objects on average (7.3 s without and 8.7 s with naming, $t=3.2$, $p<.01$). As expected, these effects only held in the first year.

PA-42 Infants assign more value to objects that others have cued

Velisar Manea, Helle Lukowski, Dora Kampis, Katarina Begus, Victoria Southgate
University of Copenhagen, Denmark

From early in life, human infants learn more about objects when they are the targets of others' attention. Recent work suggests that young infants may have an altercentric bias which is proposed to facilitate learning by curating the environment according to items that more knowledgeable others deem relevant. The current study aims to test this proposal by asking whether 8-month-old infants not only encode more about objects when they are the target of others' attention at the moment of encoding, but whether they assign greater value to objects that they could only infer as targets of others' attention. Infants saw an agent gaze behind one of two occluders. The agent then disappeared and either the occluder towards which the agent had gazed, or the other occluder, was lowered to reveal a novel object. We predicted that infants would assign greater value to the object that they could infer was the target of the agent's attention.

We tested this hypothesis by measuring theta-band activity in the EEG, a neural signature of information expectation, during the object reveal. In the second part of the study, infants took part in a memory test in which we sought evidence that they better remembered the object that was hidden behind the gazed-at occluder. Our results suggest indeed that infants exhibit greater theta band activity over occipital channels when presented with the object hidden behind the gazed-at occluder. Greater theta was predictive of a familiarity preference for the cued object, suggesting that infants may have assigned more value to this object.

PA-43 Phenomenological Characteristics and Themes of the Cultural Life Scenarios of Mother-Father-Child Triads

Tugce Tiftik¹, Fehime Suheda Kurt², Sibel Kazak Berument¹, Deniz Tahiroglu³, Aysun Dogan⁴, Basak Sahin Acar¹

¹Middle East Technical University, Turkey; ²Ataturk University, Turkey; ³Bogazici University, Turkey; ⁴Ege University, Turkey

The cultural life script is a cognitive schema shaped by semantic knowledge and cultural norms, obtained by asking participants to identify the seven most important events a person might experience over the course of their life. In this study, as part of a nation-wide project conducted with the support of TÜBİTAK, parents and their middle or high school-aged children were administered the Life Script Questionnaire. They were asked to list important life events and rate these events in terms of their importance and emotional characteristics.

In total, 143 families, consisting of mother-father-child triads, were asked to evaluate the importance and emotional tone of the event they listed. The responses were analyzed using repeated measures ANOVA. A significant difference was found within the family regarding the perceived importance of the event. Further analysis revealed that mothers rated the importance of the event higher than

both fathers and children. No significant difference was found between fathers and children. When examining how the event was evaluated emotionally, a significant difference was found within the family. Children evaluated the event they listed more negatively than both parents, while no significant difference was found between mothers and fathers in terms of the emotional tone of the event. Coding the themes of scripts is still an ongoing process that will be investigated exploratorily.

These findings are considered highly valuable for understanding how the phenomenological characteristics of the cultural life script are shaped within the family unit consisting of a mother, father, and child. The fact that the study was conducted using a nationally representative sample from across Turkey also provides valuable data in terms of sample diversity. The findings will be discussed in relation to both the broader autobiographical memory literature and the specific concept of cultural life scripts, with suggestions for future research.

PA-44 Understanding the ironical attitude: A developmental perspective

Giulia Giunta¹, Noémie Treichel¹, Nausicaa Pouscoulous², Diana Mazzarella¹

¹Université de Neuchâtel, Switzerland; ²UCL, United Kingdom

Verbal irony is a particularly complex form of non-literal language, as it requires recognizing not only a meaning beyond the literal, but also a dissociative attitude such as skepticism, mockery, or rejection. Post-Gricean accounts, such as the echoic theory and pretence theory, emphasize that irony relies on implicitly conveyed attitudes, often communicated through prosody or facial expressions (Clark & Gerrit, 1984; Wilson & Sperber, 2012). While preschool children can interpret several non-literal forms of language (e.g., metaphor, hyperbole, humour), irony typically eludes them until around the age of six (Fuchs, 2023; Matthews, 2014; Pouscoulous, 2023). What makes irony so cognitively and pragmatically complex for young learners? We hypothesise that the answer to this question lies, in part at least, in the development of children's attitude recognition.

Therefore, the present study investigates how children develop sensitivity to implicit attitudes—positive, questioning, and dissociative/ironical—communicated via prosody in mother–child interaction scenarios. A total of 155 children aged 4–8 years, divided into four groups (4–5 y, N=36; 5–6 y, N=38; 6–7 y, N=40; 7–8 y, N=41), and a control group of 37 adults, were administered an attitude comprehension task. In 12 short, illustrated stories, a mother responds to her child's statement with an utterance expressing one of the three target attitudes. During the induction phase, the attitude was made explicit, while in the test phase it was conveyed implicitly through prosodic variation. After each story, participants were asked to identify the mother's belief by choosing the picture that best matched her thoughts.

Our results indicate a developmental progression in the comprehension of implicit ironical attitudes, with younger children exhibiting limited understanding and performance improving steadily from childhood to adulthood.

PA-45 Infants reason logically about categories: preliminary resultsDaniel Diaz-Fernandez¹, Ana Martin-Salguero², Luca Lorenzo Bonatti¹, Michael Huemer³¹Universitat Pompeu Fabra, Spain; ²NeuroSpin, France; ³University of Salzburg, Austria

The origin of the human ability to construct scenarios to formulate and test hypotheses remains unknown. Some research suggests that elementary forms of logical reasoning are available in preverbal infants (Cesana-Arlotti et al. 2018; 2022, Ekramnia et al. 2021). Alternative interpretations propose that such results need not assume logical reasoning or representations of multiple possibilities: infants might solve tasks apparently involving such resources by recourse to a minimal possibility concept not requiring the construction of alternatives (Leahy & Carey, 2020; Leahy et al. 2022), or even simpler perceptual systems for tracking objects (Jasbi et al. 2019). Here, we present an eye-tracker paradigm meant to test whether infants' representation of ambiguous scenes, where the identity of objects may be determined by disjunctive reasoning (A or B; not A, therefore B), can be explained by such less committing accounts. In it, participants have to make an inference about object categories rather than single objects, because the disambiguation requires them to reason not on the animals presented in the scene but on the categories to which these animals belong to. Thus, in this paradigm, tracking of the singletons presented in the scene, or constructing minimal scenario involving only these objects, cannot help solving the task. We present preliminary data from two versions of such design. Pupil dilation and oculomotor behavior analyses suggest that as of 18 months, infants can reason disjunctively on object categories: pupil dilated more at the moment of the potential inference, and crucially, infants looked more at the location of another object belonging to the same category of the inferred object. These results suggest that at least as of that age, perceptual-based or minimal representation accounts do not capture the representations infants spontaneously generate when facing ambiguous situations, although it is possible that younger infants may use such strategies.

PA-46 Democrat or autocrat: Context sensitivity in children's voting behaviorOhan Hominis¹, Francesca Bonalumi², Alexander Bor³, Azzurra Ruggeri⁴¹Central European University, Austria; ²Technical University of Munich, Germany; ³Central European University, Hungary; ⁴Central European University; Technical University of Munich, Germany

When faced with the choice of an imperfect democrat or an autocrat offering material incentives or symbolic victories, voters around the world are increasingly opting for the latter. We investigate the conditions under which children between the ages of 5 and 14 are willing to compromise their democratic rights for material gain, particularly in how they vote to entrust leaders with decisionmaking for the group. Across three studies, we vary the contexts within which children vote by manipulating the material incentives offered by each leader, the number of rounds for which the winning leader will make decisions, and the narratives leaders use to justify their decision-making rules. We find that children are willing to jeopardize their democratic rights when material interests are on the line, that

this willingness is mitigated by increased term lengths for the leaders, and that children are sensitive to appeals that protect vulnerable minorities.

PA-47 When Someone's Watching: Experimenter Presence and Children's Executive Function

Aurelien Frick¹, Chris Jarrold², Amanda Seed¹

¹University of St Andrews, United Kingdom; ²University of Bristol, United Kingdom

In many daily life situations, children are frequently required to regulate their thoughts and actions in order to achieve goals. For example, when working on a school assignment, they may need to ignore noises (i.e., discussions between other children) which are irrelevant to the task. This efficient use of executive functions (EF) has been linked to important outcomes, including academic achievement. As a result, EF has become a central focus of research in cognitive development, leading to significant advances in understanding its underlying neurocognitive mechanisms. More recently, attention has increasingly turned to the influence of social context on children's EF engagement and performance. In particular, during EF assessments, the experimenter remains present in the same room as the child. Yet, little is known about whether this presence affects children's EF performance. In the present study, we tested 54 French children aged 4 to 9 years on a Go/No-Go task that varied the level of working memory load. Each child completed the task on two occasions: once in the presence of the experimenter (who observed them intermittently for about 60% of the session) and once while alone (with the experimenter absent from the room). Results revealed strong evidence that children were slower, but also made fewer errors, when the experimenter was present compared to when they were absent. However, there was no strong evidence that these effects varied by age or by the working memory demands of the task. These findings demonstrate that the presence of an experimenter influences children's EF performance. Future research should investigate whether these effects differ depending on the executive demands of the task or on individual differences among children.

POSTER SESSION A
THURSDAY

PA-48 Can infants track multiple perspectives in an object search task?

Bartug Celik, Agnes Melinda Kovacs

Central European University, Austria

Understanding that others may hold conflicting perspectives is an important developmental ability in social reasoning (Southgate, 2013; Tomasello, 2018). In the present study, we asked (1) whether infants can track multiple altercentric perspectives (i.e., Experimenter 1 holds a true belief while Experimenter 2 holds a false belief) in an object-search task, and (2) whether infants' understanding of others' perspectives is influenced by self-awareness, as measured by the Mirror Self-Recognition (MSR) task. In the search task, adapted from Celik and Kovács (in review), infants were presented with a false-belief scenario in which E1 hid a toy in one of two locations while E2 was present, and E1 later moved

the toy to the other location while E2 was absent (FB trials) or present (TB trials). In the test phase, after E2 returned to the room, either E1 (E1-asks condition) or E2 (E2-asks condition) asked the infant about the current location of the object.

The GLMM analyses revealed that infants ($N = 96$; 15- to 18-month-olds) searched for the object in the current location differently in the FB and TB trials in the E2-asks condition, $p = .002$, but not in the E1-asks condition, $p = .778$. Planned post-hoc analyses showed that infants searched above chance in the E1-asks condition for both FB, $p = .016$, and TB trials, $p = .043$. In contrast, in the E2-asks condition, infants searched above chance only in the TB trials, $p = .001$, but not in the FB trials, $p = .858$. The difficulty observed in the FB trials was also evident in infants' latency to choose and their looking toward the unchosen cup and the Bystander.

These findings suggest that infants can track multiple, conflicting altercentric perspectives in an object-search task, and that this ability appears to be independent of their MSR performance. We discuss these results in relation to altercentricism in early childhood.

PA-49 Factive vs. non-factive Theory of Mind: Which is primary?

Saba Amirhaftehran, Marina Proft, Hannes Rakoczy

George August Universität Göttingen, Germany

In our folk psychology, what is the primary cognitive attitude we ascribe? Traditionally, belief–desire accounts assume that belief ascription is primary; knowledge is secondary, reducible to justified true belief (JTB) (Fodor, 1990). More recent Factive Theory of Mind accounts, in contrast, assume that knowledge ascription is primary, basic, and primitive (Phillips et al., 2021).

In a series of studies, we tested these accounts against each other. Knowledge–First accounts make three specific predictions: If the concept of “knowledge” is primitive and not reducible to “justified true belief”, then:

1. Knowledge ascription should be robustly faster than belief ascription.
2. Adults, and even children, should share so-called “Gettier case” intuitions (JTB does not necessarily amount to knowledge).
3. Knowledge ascription should have priority over belief ascription when subjects are to predict how an agent will act.

We tested and found clear evidence for the first prediction in three large-scale studies with adults ($N > 5000$). Independently of the forms of knowledge and belief involved, participants were consistently faster in ascribing knowledge than in attributing belief. The second and third predictions were tested in two studies with 5–8-year-old children (knowledge/action prediction tested between-subject, each $N = 88$) and adults (within-subject, $N = 102$) in which subjects were confronted with so-called “Gettier cases” scenario (Gettier, 1963): an agent has a JTB (e.g., by looking at a broken clock that, by coincidence, shows the current time) yet it is doubtful whether the agent thus knows the relevant facts (what time it is). There was clear evidence for the second prediction: Results revealed consistent Gettier intuitions (agent believes but does not know the relevant facts) in adults (replicating and

extending previous findings) and children (novel findings). Findings regarding the third prediction were complex and mixed.

Taken together, these findings speak more in favour of Knowledge First accounts of our folk psychology.

PA-50 Do capuchin monkeys use metacognitive judgements in virtual environments?

Andreea Miscov, Emma McEwen, Amanda Seed, Justin Ales

University of St Andrews, United Kingdom

Computerised technology is increasingly used in animal cognition research to tightly control stimuli presentation and response recording. Recent non-human primate studies have highlighted how virtual environment (VE) software facilitates studying phenomena in naturalistic contexts, unrestricted by real-world space, enabling natural behaviours with minimal training. We studied memory in capuchin monkeys in a VE delayed-response task. On a touchscreen, subjects view three hedge rectangles from a virtual hilltop, one containing grapes. While walking down the hill, the hedges obscure the grapes, so their location must be remembered. By varying the distance from the hill to the grapes we created delays of approximately 0s, 15s and 30s. We compared ten capuchins' short-term memory performance in the VE task in 12 trials of each delay, and an equivalent physical task using three cups. We found the predicted main effect of delay in the VE task ($p < .001$), with a similar pattern of results as in the physical task. Monkeys displayed a spontaneous behaviour in the VE task: they abandoned some trials and returned to the start. Interestingly, this happened most in long-delay trials, where forgetting is more likely. Was this learned over trials or an indication of metacognitive awareness of memory ability by monkeys? In study two, we will explore this using an opting-out paradigm to disentangle metacognitive judgements from learned associative rules. Here, monkeys will receive two options: attempt a memory task for a high-value reward (obscured by hedge rectangles) or "opt-out" by walking to a low-value reward. We will orthogonally vary delay, number of hedges, and contextual cues to create unique trials. We predict that, if monkeys make metacognitive judgements, their opting-out rates will increase with task difficulty. The comparable performance of monkeys in virtual and real environments, presents VEs as an exciting new tool for comparative memory research.

POSTER SESSION A
THURSDAY

PA-51 Anticipatory looking, pupil dilation, and looking times as indices of spatio-temporal expectations in 12-month-old infants

Paul Gallenkemper, Nina-Alisa Kollakowski, Ulf Liszkowski

University of Hamburg, Germany

During repeated presentation, infants build spatial expectations of stimulus locations by anticipating appearances with their gaze (Romberg & Saffran, 2013). When this expectation is violated by showing

the stimulus in a different location, infants show longer looking times (Haith et al., 1988). However, it is unknown whether the amplitude of infants' surprise reactions depends on the degree of spatial deviation (Preuschoff et al., 2011; Tamási et al., 2017; Poli et al., 2024), especially regarding pupil dilation. Expectation building itself could also affect pupil dynamics (Polzer et al., 2023; Ghilardi et al., 2024).

We presented 12-month-old infants with learning sequences, in which a stimulus appeared at a location repeatedly. After each learning sequence, infants saw one test trial, in which a stimulus either appeared at the expected location or 90° / 180° away. We measured looking times, pupil dilation responses (PDR) and anticipatory looking. We expected larger signs of surprise (longer looking time; larger PDR) to further spatial deviations and a decrease in PDR across learning. We expected an increase in anticipatory looking across learning trials and increased anticipation of expected events compared to 90° and 180° deviation trials at test.

In Experiment 1 (4 learning trials; N = 53), infants anticipated the expected outcome significantly more often than deviant test events (OR₁₈₀ = 0.34, p = .043; OR₉₀ = 0.31, p = .030). There were no significant effects of surprise in their looking times or PDR, nor effects of learning in their PDR. In Experiment 2 (8 learning trials; N = 50), infants significantly increased their anticipatory looking across learning trials (OR = 1.13; p < 0.001). However, no significant effects of learning or VoE were found in PDR and looking times. Future analyses will focus on relations between successful anticipation trials and PDR and looking time effects.

PA-52 Do 18-month-olds understand novel iconic gestures spontaneously?

Eulalie PEQUAY¹, Shreejata Gupta², Isabelle Dautriche³

¹Aix-Marseille University, France; ²France; ³CNRS, France

Two studies investigated 18-month-olds' understanding of iconic signals, which resemble their referents and facilitate communication. Language development theories suggest that iconic signals play a crucial role in language emergence and acquisition. However, previous studies have failed to show that children under 2 years old understand iconic gestures. The current studies used implicit measurement paradigms (looking-time and violation-of-expectation) to assess French-learning 18-month-olds' comprehension of iconic signals. Study 1 (n=40) found no evidence of target image preference, while Study 2 (n=22, ongoing) showed a non-significant trend towards longer looking times during incongruent trials. The null findings suggest that even implicit measures may not reveal 18-month-olds' understanding of iconic signals, challenging language development theories that emphasize iconicity.

PA-53 Does naming support 12-month-olds' individuation of faces?

Aslı Bursalıoğlu¹, Sophia Jaurigüe², Sandra Waxman²

¹Northwestern University, Turkey; ²Northwestern University, United States

By 12 months, infants' representations of objects are influenced by how they are named. Prior work shows that applying distinct labels, even within the same category, supports object individuation. This raises the question of whether naming also influences infants' representations of people. Although 3-month-olds can discriminate both own- and other-race faces, by 12 months, they typically lose the ability to recognize other-race faces while maintaining recognition of own-race faces. While language supports object processing, less is known about its role in infants' representations of people, particularly in the context of race. This study addresses two questions: Does naming shape 12-month-olds' representations of people as distinct individuals? Are infants more likely to individuate faces of the majority-race than minority-race when provided with distinct names?

We hypothesized that naming would support individuation, with stronger effects for majority-race than for minority-race faces. Twelve-month-old infants (N = 47; N_{White} = 30) were randomly assigned to view either White or Black faces. During learning phase, infants viewed four faces from a single racial group, each paired with a distinct name. At test, infants saw a familiar face, paired with a novel face from the same racial group (Fig. 1). Recognition was assessed using novelty preference scores. Racial diversity exposure was measured through caregiver-reported contact with other-race individuals, and community-level diversity calculated from zip-codes.

Results showed that naming supports individuation. In the White condition, infants showed a novelty preference on the first test trial ($p < .05$), suggesting recognition. In the Black condition, novelty preference emerged later, on the second trial ($p < .05$) (Fig. 2). Infants with higher diversity exposure showed stronger novelty preferences for Black faces. These findings highlight that naming and experience shape infants' representations of majority- and minority-race faces. Data collection is ongoing, and future work will expand the sample to include more racially diverse infants.

POSTER SESSION A
THURSDAY

PA-54 Exploring the Better-Than-Average Effect in a Better-Than-Average Environment: Gender Differences and Long-Term Dynamics

Noy Hammer Ashkenazi, Tehila Kogut

Ben-Gurion University of the Negev, Israel

Distinguishing oneself from others is a core aspect of social cognition, shaping self-perception, adaptation, and well-being. When objective information is limited, individuals rely on subjective assessments of their peers, often leading to systematic biases. The Better-Than-Average Effect (BTA) reflects the tendency to view oneself as superior to peers, a bias associated with increased well-being. Little is known about how BTA patterns change over time in environments of excellence, where the comparison group is itself objectively exceptional.

This study examines how social comparison evolves during adolescents' transition into a selective

high school for gifted students. Students rated their academic abilities and the abilities of a peer from their previous, standard school, and from their current excellent school (6 items, 1-7 scale). Using a mixed-method longitudinal design, we followed students across three grade levels (N = 234), including repeated measures for newly admitted 10th graders. We also included a comparison group of 10th grade students from a standard school (N = 80), to assess whether observed effects are unique to the environment of excellence.

Results indicate that in the environment of excellence, students showed BTA effect when comparing themselves to their former, non-excellent peers. However, this effect was significantly reduced when they compared themselves to their current high-achieving classmates, especially among girls, who exhibited a Worse-Than-Average (WTA) effect, which diminished only partially over time. In contrast, students in the standard school consistently exhibited BTA effects, both regarding their current peer and regarding their previous peer. Mediation analyses further revealed that students' perceived difficulty, both for themselves and for others, significantly shaped their comparative self-evaluations. These findings highlight the role of the environment in shaping relative self-evaluations and suggest that transitioning into a high-performance environment may challenge students' academic self-perceptions, particularly among girls.

PA-55 Strategic Ignorance in Early Childhood: Turning a Blind Eye to a Partner's Cheating

Tindaya Déniz, Sebastian Grueneisen
Leipzig University, Germany

Numerous situations in our lives elicit tension between our self-interest, concern for others, or adherence to other social norms we ought to consider. Ignorance can provide a way out of these dilemmas by making the relationship between our actions and their outcomes unclear and creating a moral "wiggle room" to act selfishly (Dana et al., 2007). Strategic ignorance refers to situations where individuals deliberately avoid information that would compel them not to pursue their self-interest. The current experimental study investigates if children aged 5 to 8 years engage in strategic ignorance by deliberately avoiding information about whether another person committed a transgression. Children played a bingo game with a partner who repeatedly reported unrealistically high success rates. Children had the opportunity to surreptitiously check whether the partner cheated (and to subsequently tattle on them) or to remain ignorant. Participants were randomly assigned to one of two conditions: a collaborative condition, in which children and their partner collected coins together and children thus benefited from the partner's successes, and a solo condition, in which they each collected coins independently. We hypothesized that children in the collaborative condition would be more likely to remain ignorant than children in the solo condition. The results indicated an interaction between age and condition with older children being more likely to remain ignorant in the collaborative than the solo condition. With age, children were also less likely to tattle in the collaboration than in the solo condition. An ongoing follow-up study currently explores the same question with 7- to

10-year-olds. Data collection is expected to be completed in December 2025. Together, the studies have the potential to reveal whether young children avoid finding out about the transgressions of their collaborative partners and when they stand to benefit personally.

PA-56 Exploring the associations between cognitive-behavioral tasks and questionnaire-based measures of attention at different stages of development

Cintia Bali, András Norbert Zsidó

University of Pécs, Department of Cognitive and Evolutionary Psychology, Hungary

In developmental research, attentional mechanisms such as sustained and executive attention are extensively studied to understand cognitive growth from early childhood to adulthood. A wide range of measurement tools is available for researchers, including both questionnaires and cognitive-behavioral tasks, to assess various aspects of attentional mechanisms. While questionnaires offer valuable insights, it is important to recognize their limitations in measurement. There is an ongoing challenge regarding what other- and self-reported tools actually measure and how closely behavioral assessments align with questionnaire-based tools in assessing similar constructs. Therefore, this study aims to investigate the relationship between other- and self-reported questionnaire results and behavioral cognitive tests measuring sustained attention and executive attention across a broad developmental span. Our sample included preschoolers (N=32), elementary school students (N=238), secondary school students (N=260), and adults (N=399). Participants of all age groups completed a cognitive behavioral task appropriate for their age. We conducted two types of tasks: a cancellation tasks and a flanker tasks. Additionally, caregivers and teachers filled out the questionnaire for the younger age groups, while participants 14 years onward completed a self-reported questionnaire measuring inattention. Our results show that caregiver ratings indicated low to moderate associations with the results of the cancellation test. However, in other age groups, we found no associations between questionnaire responses and behavioral data, regardless of whether the questionnaire was completed by a teacher or the participants themselves. These results suggest that the alignment between cognitive-behavioral tests based on actual performance and other or self-reported questionnaires is weak or non-existent. From a developmental and methodological perspective, this highlights the importance of reconsidering how attention is assessed in different age groups and indicates that behavioral tasks may offer a more direct insight into attentional functioning than questionnaires.

PA-57 Caregivers' perceptions of preschoolers' screen time: Associations with screen time duration, sleep, and language development

Madeleine Gale, Alyssa Quinn, Samantha Playford, Ami Eidels, Emma Axelsson

University of Newcastle, Australia

As caregivers influence their child's activities, their perceptions of screen time may impact their child's screen time engagement types and duration. Screen time is linked with mixed sleep and language outcomes in preschool-aged children (two to six years). However, more clarity regarding the links between perceptions, screen time, sleep, and development is needed. Thus, this study assesses caregivers' perceptions of their child's screen time, screen content duration (educational and entertaining), sleep, and language development in children aged three to five years. To assess caregivers' perceptions of their child's screen time, an adapted screen time questionnaire (Klakk et al., 2020) was used, and caregivers noted their level of agreement to statements such as '... screen media...helps the child learn about letters...'. Over three days, children's educational and entertaining screen time was recorded, and children wore an actigraphy watch to measure sleep. The communication subscale of the Ages and Stages-3 (Squires et al., 2019) questionnaire, and the 'Expressive Vocabulary' task from the Early Years Toolbox (Howard & Melhuish, 2015) were used to assess language development. So far, 177 caregiver-child dyads have completed the study. Using path analysis, relationships between caregivers' perceptions, screen time, sleep and language development will be assessed. This approach extends on extant literature by providing a more complete overview. An understanding of the complete path from caregivers' influence (perceptions of screen time) linked to the child's screen time duration and then to the outcome (language development) will provide a nuanced understanding of how much a modifiable factor (caregiver perceptions) is associated with screen time and language development. Sleep will also be incorporated, due to its importance for language development. This study has implications for caregivers, healthcare workers, and educators, as it highlights how screen time perceptions link to screen time and development outcomes, and the importance of providing awareness.

POSTER SESSION A
THURSDAY

PA-58 Label Retention in Preschoolers and Dogs with a Vocabulary of Object Labels: Similarities and Differences

Shany Dror¹, Dorottya Júlia Ujfalussy², Abigél Májér², Írisz Legény², Ádám Miklósi², József Topál³,

Claudia Fugazza²

¹Comparative Cognition, MESSERLI Research Institute, University of Veterinary Medicine Vienna, Austria;

²Department of Ethology, Eötvös Loránd University, Budapest, Hungary; ³MTA-ELTE Comparative Ethology Research Group, Budapest, Hungary

The ability to remember words is a key component of language processing, relying on both short-term and working memory. Some dogs show a rare capacity to learn object labels. These Gifted Vocabulary Learning (GVL) dogs provide a unique opportunity to study memory for labels in a

nonhuman species. In this study, we tested GVL dogs (N = 15), 3-year-old preschoolers (N = 12), and 4-year-old preschoolers (N = 12) in two tasks. In the first, participants were tested on their ability to remember a list of two labels. Dogs were asked to go to a different room and retrieve from there one toy at a time, while preschoolers used a magnetic wand to pick up pictures corresponding to a label, one at a time. In the second task, participants were tested on their ability to retain a single object label over short delays. They were told which object to retrieve and had to wait 1–5 minutes before completing the task. All groups succeeded in both tasks. Children performed better at list memorization than at the delayed retention task, whereas dogs showed the opposite pattern with a relatively high performance in delayed retention but low performance in list memorization. We suggest that the species differences in the retention task may reflect constraints related to executive functions, which in GVL dogs could be less affected by factors such as boredom or frustration. Conversely, the dogs' poor list performance may reflect a lack of understanding of the task, rather than limitations of working memory. Overall, our findings demonstrate that the cognitive mechanisms supporting label retention are domain-general and likely predate the evolution of human language.

PA-59 Investigating word segmentation in infant-robot interaction: the impact of robot-provided social cues

Lara Hamburger, David Schlangen, Natalie Boll-Avetisyan

University of Potsdam, Germany

Infants develop the ability to segment words from speech during their first year of life. While much research has focused on acoustic cues that facilitate this development, little is known about the contribution of social cues. Social robots, which can display social cues consistently, offer a promising tool for studying this. Therefore, we investigate whether infants process speech provided by a robot, and whether robot-provided social cues enhance their attention and speech processing performance. Specifically, we tested 8- to 13-month-old German-learning infants (32 n). We used a classical speech segmentation paradigm, modified such that a Furhat robot spoke the text. There were two familiarization conditions: one in which the Furhat recited text passages containing two target words while maintaining “eye contact” with the infants, and one in which the Furhat did not express any social cues. Afterwards, infants were tested for their recognition of target words vs. novel words. Linear mixed-effects models revealed a marginal interaction between social cue condition and word type ($p = 0.09$). Results of a nested model indicated a marginal preference ($p = 0.08$) in the condition without social cues, with longer looking times to the novel than to familiar words, but no preference ($p = 0.5$) in the condition with social cues. Pearson correlations revealed no relationship between attention to the robot during the familiarization and speech segmentation performance. The marginal segmentation effect in the control condition suggests feasibility of using social robots in language acquisition research, providing a promising foundation for future application. The unexpected finding that infants in the control condition outperformed infants in the social cue condition raises questions about the effectiveness and naturalness of the provided cues, suggesting

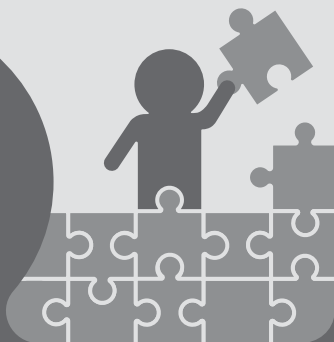
that with the current Furhat implementation it remains difficult to systematically investigate which aspects of social cues actually support learning.

PA-60 The dentate gyrus of the hippocampus contributes to recall of specific event details in preschool children

Zsófia Glavák-Berke¹, Boróka Ferencz², Hunor Kis³, Ildikó Király⁴, Attila Keresztes⁵

¹1. HUN-REN Research Centre for Natural Sciences, Brain Imaging Centre; 2. Eötvös Loránd University, Faculty of Education and Psychology, Hungary; ²1. Doctoral School of Psychology, ELTE Eötvös Loránd University; 2. HUN-REN Research Centre for Natural Sciences, Brain Imaging Centre, Hungary; ³1. Doctoral School of Psychology, ELTE Eötvös Loránd University; 2. HUN-REN Research Centre for Natural Sciences, Brain Imaging Centre, Hungary; ⁴1. Eötvös Loránd University, Faculty of Education and Psychology, Hungary; ⁵ 1. HUN-REN Research Centre for Natural Sciences, Brain Imaging Centre; 2. Eötvös Loránd University, Faculty of Education and Psychology, Hungary

Children gain vast amounts of knowledge every day, yet often cannot recall specific experiences, such as what they ate on a given day. Research indicates that this apparent discrepancy reflects differential maturation of distinct memory processes. Generalization, allowing children to learn and transfer knowledge across contexts, matures earlier than the ability to encode and retrieve specific episodic memories. This difference in developmental trajectories is closely tied to the heterogeneous maturation of subfields within the hippocampus, a brain structure in the medial temporal lobe. In particular, the delayed maturation of the dentate gyrus (DG) subregion has been hypothesized to drive the late maturation of memory specificity in early childhood. However, extant studies provide scarce data on the association between hippocampal subfield volumetry and recall of specific events in preschool-aged children. Furthermore, it remains an open question how delay between encoding and recall affects these associations. Here, in a sample of 130 children aged 4–5 y (data collection ongoing, current n=57; M age = 4.48 y), we assess hippocampal subfield volumes via semi-automatic segmentation of high-resolution (0.4 x 0.4 x 2mm) magnetic resonance scans and measured specificity of event memories with an experimental task in which children watched short stories and recalled them both immediately and after a delay (M = 17 days, SD = 9.58). We hypothesized that memory specificity is specifically associated with DG volumes, and that this association is stronger at immediate than delayed recall. Preliminary results showed that specificity was positively associated with a volumetric measure of DG at immediate but not delayed recall, supporting the role of the DG in memory specificity in early childhood. Clarifying these associations will advance our understanding of the role of hippocampal subfield maturation in shaping the developmental trajectory of memory specificity.



PB-01 Promoting Growth Mindset and Reducing Math Anxiety in Elementary School

Marc Colomer Canyelles¹, Eudald Correig Fraga¹, Maria Isabel Nuñez Peña²

¹Innovamat Education, Spain; ²Universitat de Barcelona, Spain

Positive attitudes towards mathematics are crucial for academic success, with math anxiety being a strong predictor of later achievement, even when foundational skills are controlled for. Motivational frameworks like growth mindset—believing abilities are malleable vs. fixed—are linked to math anxiety and academic performance. While growth-mindset interventions have shown promise in older students, their efficacy in younger children remains underexplored. To date, only one study from Lee et al. (2021) has implemented a growth mindset intervention—combined with a focus on gender stereotypes—in elementary school, with positive results. A critical limitation, however, was that the program was implemented in a single, highly controlled school setting, with trained facilitators. While such settings ensure fidelity, they limit generalizability. The current study re-adapted the intervention from Lee et al. (2021) and tested its effectiveness in a less controlled, more diverse context. The study was conducted with 620 Grade 3 and Grade 4 students across 20 schools in Spain, using pre- and post-tests to measure math anxiety, attitudes (self-concept and intrinsic motivation), mindset, gender stereotypes, and math achievement. Two hundred fifty-nine students participated in a 5-session growth mindset program led by their teachers. The control group continued with business-as-usual instruction. Results showed that the intervention significantly improved children’s growth mindset ($F(1,1829) = 8.43, p = 0.003, d = 0.14$) and reduced their math anxiety ($F(1,1224) = 6.15, p = 0.013, d = -0.16$), but did not significantly affect students’ self-concept, intrinsic motivation, or math achievement (all $p > 0.1$). Additionally, while students held stronger associations between mathematics and males than females ($t(1,1709.8) = -5.15, p < 0.001$), the intervention did not reduce gender stereotypes. We discuss potential mechanisms underlying these findings, along with the study’s limitations.

PB-02 The missing link: Is infant reasoning a precursor of the logic of natural language?

Chiara Saponaro¹, Mahham Fayyaz², Nicolò Cesana-Arlotti²

¹University of Milano - Bicocca, Italy; ²Yale University, United States

What is the relationship between logical reasoning and language? Recent research suggests that core logical capacities may already be present in preverbal infants, enabling them to make disjunctive inferences while processing visual events ($A \vee B; \neg A \rightarrow B$; Cesana-Arlotti et al., 2018; 2020). In contrast, children begin to produce the connective “or” only around age three (Morris, 2008) and fully master its logical meaning around age seven (Chierchia et al., 2001; Singh et al., 2016). In two preregistered experiments, we explore the link between preverbal logical inferences and natural language logical words, by asking whether “or” conveys disjunctive reasoning from its onset (Experiment 1), and

whether preverbal disjunctive inferences can prime preschoolers' understanding of the logical meaning of "or" (Experiment 2).

In Experiment 1, we tested the ability to reason deductively based on visual and linguistic information in three-year-old English-speaking children ($N = 23$; age $M = 39;05$ months; range: 36;12–42;22). They completed a non-verbal cognitive inference task followed by a linguistic inference task, where they had to infer the identity of a hidden object. In the cognitive task, they received only visual input (Figure 1a). In the linguistic task, they had to integrate a disjunctive statement (e.g., "the object is the car OR the ball") with visual information (Figure 1b). We found that preschoolers robustly succeed in both tasks (Figure 2). This result suggests that "or" can readily support disjunctive inferences from the attested onset of its production.

In Experiment 2 (in progress), another group of children complete the same linguistic task but preceded by a non-inferential control task. We predict that, if preverbal disjunctive inferences are linked to the semantic representation of linguistic disjunction, children's performance in the linguistic task may improve after practicing the non-verbal disjunctive inference in Experiment 1 compared to Experiment 2, suggesting that preverbal logic can scaffold the acquisition of linguistic disjunction.

PB-03 Relationships between preterm vs full-term born children's math skills, parental math anxiety, home math activities, and math input

Sultan Karakaş¹, Begüm Yılmaz¹, Tilbe Göksun¹, Ece Demir Lira²

¹Koç University, Turkey; ²The University of Iowa, United States

Preschool-aged children exhibit varying levels of early math performance, which is related to their later academic success and SES. Despite 15 million preterm births annually, less is known about how preterm-born (PTB) children differ from their full-term born (TB) peers in early math skills. We investigated how children's neonatal status (PTB vs TB) and home math environment (i.e., parental math anxiety, home math activities, and math input) might be related to children's math skills (i.e., verbal counting, cardinality, and arithmetic). Participants included 216 English-speaking children (100 PTB, Mage = 4 years 10 months, SD = 0.60) and their parents.

Results showed that PTB children's counting and cardinality scores were significantly lower than their TB peers ($p < .05$). PTB children also tended to have lower scores in arithmetic, but this difference did not reach significance ($p = .053$). Beyond that, parents of PTB children reported higher math anxiety ($p = .027$), but this effect was not significant, controlling for parental education. In the overall group, parental math anxiety was negatively related to parents' engagement in math activities ($p < .001$). Additionally, parents of PTB children reported significantly less frequent home math activities ($p < .05$), which was not related to children's math skills ($p > .05$). Contrary to activities, parents of PTB children provided more math input during free play ($p < .05$), however, it was not related to children's any math skills, either ($p > .05$).

These findings suggest that PTB preschool-aged children have difficulties in math tasks compared to their TB peers. The lack of associations between the home math environment and children's math

skills suggests that neurocognitive processes linked to preterm birth may exert a more influential impact on math skills at ages 4–5.

PB-04 Examining the different uses of normative language during caregiver-child interactions in China and the US

Jiayi Song, Jinming Chen

Harvard Graduate School of Education, United States

Social interactions with caregivers support children’s moral development, with normative language playing a central role in transmitting value judgments about right and wrong in accordance with social conventions or formalized rules (Mammen & Paulus, 2023; Paulus, 2020). The use of normative language may differ across cultures due to variations in the cultivation of filial obedience versus autonomy, the endorsement of the collectivistic versus individualistic cultural emphasis, and the interdependent versus independent perceptions of self (Li, 2005; Pomerantz et al., 2014). The current study focuses on two distinct cultures, China and the United States, to probe how differences in normative language uses between caregivers and children may be attributed to aforementioned cultural factors. The three dimensions of analysis include (1) tracing the frequency of showing politeness through expressing gratitude, demanding respect, or using greetings; (2) exploring the inclination to make explicit judgements of others’ utterances and behaviors; and (3) contrasting directive language, or the use of declarative sentences in an imperative mood to give commands, with elaboration, which usually involves using questions to inspire deeper thoughts of an inquiry and elicit detailed explanations. This study hypothesizes that Chinese dyads use more expressions of politeness, more explicit judgements, and more directive languages than American dyads within the scope of normative language usage. Specifically, we analyzed naturalistic caregiver–child interactions from Chinese and American families involving children aged 4 to 6 years, drawing data from established CHILDES corpora in both cultures (e.g. Luo et al., 2012; MacWhinney, 2000; Warren-Leubecker & Bohannon, 1984). The descriptive comparisons suggest that Chinese dyads show a tendency toward more politeness and explicit judgments but fewer elaborations than American dyads. These findings are preliminary and require further statistical verification. This study contributes to research on distinct features of caregiver-child naturalistic communications to inform quality childrearing practices.

PB-05 The changing demands of communication: Children’s interpretation of quotative ‘be like’

Rasmus Overmark, Derek Ball, Amanda Seed

University of St Andrews, United Kingdom

We constantly invent new linguistic devices. If such devices make specific cognitive demands of their users, it means that the cognitive demands of communication are in flux. The emergence of

quotative 'be like' (QBL) can yield insight into these changing demands. QBL uses like to quote, as in "I was like, 'that's so weird!'". QBL is extremely popular and unusually flexible (Barbieri, 2009). It can quote both utterances and thoughts. It is therefore non-specific in a way that typical thought verbs ('thinks') and utterance verbs ('says') are not. QBL could therefore raise specific cognitive demands, with cognitive consequences for its users (Overmark, 2025; Rubio-Fernandez, 2024).

In earlier work, we found that adults rely on information about mental states to interpret QBL. We do not currently understand how children interpret this new verb and what cues they rely on to reduce uncertainty in conversation. We present new work using an interpretation task where English speaking children (6-9 years) are presented with 10 short stories containing QBL (see supplementary materials). Participants indicated whether they thought QBL was said or thought by matching pictures to stories. We perform a within-subject manipulation of three contextual cues. Goal cues involve a character goal that favoured either a 'said' or 'thought' interpretation. Norm stories involved a social norm which one interpretation would violate. No-cue stories used neither goals nor norms to favour an interpretation. If participants interpret QBL in line with the cues, it means that they engaged mentalizing to interpret QBL. QBL has therefore introduced a change in cognitive demands. Children have a capacity to attribute both goals and norms to understand behaviour, so we expect them to use these cues. We also collect data from the children's parents on the same task. This allows us to investigate sources of individual differences in QBL interpretation.

PB-06 Nine-month-olds anticipate communicative correction of false beliefs

Alice Guerrini¹, Tibor Tausin², Giulia Mazzi¹, Eugenio Parise¹

¹Centro Interdipartimentale Mente e Cervello (CIMeC) - University of Trento, Italy; ²Department of Linguistics - University of Vienna, Austria

Infants represent others' mental states and can retrospectively infer whether communication served to update an agent's false belief in third-party interactions. In this study, we investigated whether 9-month-olds make anticipatory inferences about the aim of communication—specifically, whether they expect agents to communicate to correct a partner's false belief.

In our EEG paradigm, infants were familiarized with videos of two non-human agents, one of which aimed to retrieve a target object hidden in one of two containers. At test, the protagonist held either a false belief (FB) or a true belief (TB) about the object's location, while the other agent always had the correct information. Before the protagonist approached the baited container, the agents oriented toward each other and exchanged variable non-speech sound sequences, allowing communicative information transfer in both conditions.

We predicted that infants would expect communicative information transfer in the FB trials, where correcting the protagonist's incorrect belief about the target object's location is necessary for the agent to achieve its goal. Since the expectation of relevant information elicits synchronization of EEG theta rhythm, we hypothesized to find an increase in the theta-band brain oscillations in the FB condition in contrast to the TB condition before communication took place.

Our preliminary results ($N = 17$) show an increased theta-band activity in the FB condition in frontal ($FB \neq 0$: $BF10 = 40.86$; $TB \neq 0$: $BF10 = 2.26$) and bilateral temporal (Left: $FB \neq 0$: $BF10 = 28.23$, $TB \neq 0$: $BF10 = 0.40$; Right: $FB \neq 0$: $BF10 = 6.96$, $TB \neq 0$: $BF10 = 0.41$) areas, suggesting that infants expected the exchange of communicative signals only when it was necessary to update the protagonist's incorrect belief. These results indicate that 9-month-olds form anticipatory inferences about the aim of communication when mental states require updating.

PB-07 What is uncertainty and Surprise to Exploration in infants?

Romain di Stasi¹, Claire Kabdebon², Quentin Delhay³, Adélaïde de Heering¹

¹Unité de Recherche en Neurosciences Cognitives (UNESCOG), Center for Research in Cognition & Neuroscience (CRCN), Université libre de Bruxelles (ULB), Belgium; ²Centre de Recherche en Psychologie et Neurosciences (CRPN, UMR 7077), Aix-Marseille Université, France; ³École Centrale des Arts et Métiers de Bruxelles (ECAM), Belgium

How do uncertainty and surprise shape curiosity in infants? Pioneering studies showed that 8-month-old infants are more curious about information that is neither too certain nor too uncertain, an adaptive phenomenon known as the “Goldilocks effect” that maximizes the cost-to-benefit ratio in information acquisition (Kidd et al., 2012, 2014). However, several questions remain. First, since these studies indexed curiosity via infants' gaze, it remains unclear whether the Goldilocks effect generalizes to engaging contexts such as problem-solving tasks in which curiosity is central (Modirshanechi et al., 2023). Second, while surprise is known to influence curiosity (Murayama et al., 2019), it is unknown whether moderate surprise elicits the strongest curiosity in infants, as does moderate uncertainty. We thus tested 60 infants aged 18–24 months in a task where an experimenter pressed the top button of a demonstration cube eight times, triggering a sequence of sounds. The cube was then handed back to the infant, now silent. This procedure was repeated with four cubes, each emitting the sequence of sounds with varying probabilities (0, 1, 4, or 8 out of 8 presses) to manipulate uncertainty. We assessed curiosity via exploratory (e.g., varied button presses) and exploitative behaviors (e.g., repeated pressing) (Berlyne, 1966). Additionally, we developed an algorithm to detect the facial expression of surprise in infants (i.e., raised eyebrows, open eyes, open mouth; Camras et al., 2002). In line with the Goldilocks effect, we predicted that infants would show greater exploration - and hence greater curiosity - when interacting with the cube of intermediate uncertainty than with the cubes producing certain or uncertain outcomes. Furthermore, since Berlyne (1972) speculated that excessive surprise is aversive, we predicted that the most curious infants would exhibit a moderate expression of surprise. Behavioral and statistical analyses are on their way, with half of the infants tested.

PB-08 Infants preferentially encode spatial relations in depictions

Mariem Diané, Jonathan Kominsky, Gergely Csibra

Central European University, Austria

Abstract relations (e.g., hierarchies, causal connections) are often depicted by spatial arrangements of symbols. This study tested the hypothesis that infants are more likely to encode spatial relations among objects when they are interpreted as elements of a symbolic display. We posited that infants were more likely to take objects as symbols if someone was displaying ostensive communicative signals while manipulating them.

We tested 10-month-old infants using a within-subjects design where each trial consisted of a familiarization and a test phase. During familiarization, infants watched videos of actresses manipulating three identical, unfamiliar objects arranged in various spatial configurations (e.g., an equilateral triangle, a horizontal line) in blocks of two conditions. In the communicative condition, the actress displayed ostensive communicative signals while arranging the objects: she waved at the infant and established eye-contact at the beginning of each trial, before placing each object on a table. In the non-communicative condition, the actress stroke her hair instead of waving and arranged the objects on the table without any communicative cues.

At test, we presented infants with an array of objects which was either identical to the one that had been shown before (Match), or the positions of the objects changed relative to one another (Configuration change), or the whole arrangement shifted to a new location (Location change). Our dependent variable was looking time to each of these outcomes.

We expected infants to look more toward changes of configuration in the communicative condition than in the non-communicative condition, indicating preferential encoding of spatial arrangements when the objects are encoded as potential symbols. In contrast, we expected that looking times to Location change would be shorter and would not be modulated by communicative cues despite it represented a larger visual change than Configuration change. Our results are in line with this prediction.

PB-09 Fine-Tuning Perception? Exploring Vernier Acuity and Cognitive Control in Preschool Children Aged 5-6 Years

Anna Bánki, Katharina Limbach, Sarah Weigelt

Technical University of Dortmund, Germany

Vernier acuity is a visual hyperacuity that allows to detect subtle positional differences, such as small misalignments between lines. Vernier acuity develops throughout childhood and shows a significant increase from age 6, reaching 10-25 arc seconds, comparable to adult levels (3-8 arc seconds). The rapid maturation of Vernier acuity around school age suggests its co-development with reading acquisition. Yet, it remains to be established whether learning to read plays a pivotal role in Vernier acuity development, as measuring it in children is challenging. As a prerequisite to investigate this co-development, here we tested if behavioural and neural Vernier acuity thresholds correlate in

preschool children, and whether Vernier acuity assessment is influenced by children's cognitive control, another important ability for reading. We assessed behavioural and neural Vernier acuity thresholds in 5-6-year-old preschool children (N = 88, 43 girls) by using the computerised Freiburg Vision Task, and by recording steady-state visually evoked potentials with electroencephalography. Behavioural thresholds were obtained from the hyperacuity subtest (with 3 lines). Neural thresholds were calculated based on signal-to-noise ratios of visually evoked potentials elicited by Vernier acuity stimuli: 10 square-wave grating images flickering at 5 Hz, with decreasing offset/gap sizes (147-4 arc seconds). Children's cognitive control was assessed with the Hearts and Flowers task. Our preliminary findings show that children's valid behavioural Vernier acuity thresholds varied between 5.9-29.1 arc seconds (mean: 18.2, N = 50), while neural thresholds ranged between 4.32-50.4 arc seconds (mean: 14.1, N = 19). The two threshold measures did not show a significant correlation. Behavioural thresholds were influenced by cognitive control in the case of the full sample, including children also with invalid behavioural thresholds. Our findings suggest that cognitive control should be accounted for when assessing children's Vernier acuity, and the link between behavioural and neural thresholds needs to be further explored.

PB-10 German-speaking preschoolers' representations of weak syllables

Stefanie Radetzky¹, Anna Schirmeisen¹, Christina Kauschke², Nicole Altvater-Mackensen¹

¹University of Mannheim, Germany; ²University of Marburg, Germany

Many disyllabic German words follow a trochaic structure with a reduced vowel in the unstressed syllable (e.g., ['ha:zə] – rabbit), while trochaic structures with full vowels in the weak syllable (e.g., ['ki:no] – cinema) are less common. Research suggests that weak syllables might have an important function in segmentation (Bartels et al., 2009). However, to date, young children's representation of weak syllables is largely unexplored. While production studies often report truncation of weak syllables (e.g., Gerken, 1996), most perception studies focus on strong syllables in disyllabic or monosyllabic words (cf., Von Holzen & Bergmann, 2021). The current study therefore investigates German-learning preschoolers' perception of trochees with and without reduced vowels and asks if they categorize them as prosodically distinct structures.

Adapting the anticipatory looking paradigm introduced by Ngon & Peperkamp (2016), we test preschoolers (current N = 32) on their categorization of trochees with full vs. reduced final syllables. In each trial, participants listen to disyllabic words while they look at a computer screen displaying two empty squares. Depending on the type of vocalic information encoded in each word's weak syllable (reduced vs. full vowel), a video begins to play either within the square on the left or the right side of the screen. If preschoolers represent and categorize reduced and full vowels in weak syllables as distinct prosodic structures, we expect them to anticipate the location of the video, gazing at the respective square prior to video onset. This observation would corroborate previous findings of nuanced phonological representations in children, and moreover, highlight the use of information encoded in weak syllables to distinguish prosodically distinct elements.

PB-12 Children's Selective Learning: Exploring Children Trust in Explanation about Social Inequality and the Role of Social Status

Norwood Glaspie¹, Charisse Pickron², Melissa Koeing²

¹University of Minnesota Institute of Child Development, United States; ²University of Minnesota Institute of Child Development, United States

Psychology identifies individualistic and structural explanations as primary ways of discussing social inequality. Individualistic explanations attribute inequality to internal factors like one's ability, work ethic, or personality traits (Klugel & Smith, 1986; Cimpian & Salomon, 2014). These beliefs, rooted in essentialism, often lead to racial prejudice, support for social hierarchies, and stereotype endorsement in both children and adults (Hussak & Cimpian, 2015; Bastian & Haslam, 2006). Structural explanations, in contrast, focus on systemic factors like historical disparities, socioeconomic conditions, and institutional practices (Haslanger, 2016; Kneeskern & Ellenbas, 2023). This preliminary study examines 51 children between the ages of 5-12, in a within-subjects design. All children were introduced to two novel groups, Manus and Tomas, who varied in social status. In the Selective Learning Phase, children went through 3 Ask trials in each Condition Block (CB1 and 2). In CB1 the disadvantaged group offers structural explanations while the advantage group offers internal explanations and vice versa in CB2. After receiving both explanations in each Condition Block, children rated their trust in the Manus and Tomas's statements on a 5-point Likert scale. On a series of Ask trials, children were asked whom they would approach (a Manus or a Tomas) to learn more about social inequality. The aim of this study was to examine whether some children might be more likely to trust structural over internal explanations for inequality, and investigate what role an informant's status influences their selective learning decisions. We will use linear regression models to examine children's selective trust rating (structural/internal) across condition order (Disadvantaged vs Advantage), age and its interactions. Findings from this study will potentially lay the groundwork for future research examining who children trust to learn about an abstract concept such as social inequality and the role social status may have in this learning process.

PB-13 The heart of the argument: The influence of emotional appeals on rational judgements

Jiatian Zhang, Keith Jensen, Belen Lopez-Perez, Bahar Koymen

University of Manchester, United Kingdom

Adults and children attend to the quality of arguments, favouring strong, well-supported arguments over weak ones. However, emotional appeals can also sway judgement. In two studies, we examined how Chinese children aged 5 to 7 evaluated conflicting arguments that differed in both argument quality and emotional tone, particularly when the two dimensions were pitted against each other. In Study 1, 180 children (60 in each age group, 90 girls) were presented with pairs of conflicting arguments that varied in quality (strong: "I saw" vs weak: "I heard") and emotional tone (neutral vs

passionate). Children showed a marginal preference for strong arguments over weak arguments, but no preferences for either passionate or neutral tone.

In Study 2, the arguments were simplified and emotional valence was emphasized. The same sample were presented with pairs of conflicting arguments that varied in both quality (strong: helpful vs weak: unrelated) and emotional tone (happy vs worried). From age 5, children favoured strong arguments over weak arguments. By age 7, however, children also showed a negativity bias, favouring strong arguments with a worried tone over those with happy tone. Moreover, all the children referred to rational appeals when making justifications, while older children generated more advanced justifications for their choices.

These findings highlight developmental changes in how children integrate rational and emotional cues when reasoning. While children's sensitivity to argument quality emerges early, emotional tone increasingly influences their reasoning as they grow older.

PB-14 The motivation to compete in chimpanzees

Charlotte Savill¹, Josep Call², Amanda Seed², Keith Jensen¹

¹University of Manchester, United Kingdom; ²University of St Andrews, United Kingdom

Humans have been called ultra-social and hyper-cooperative, and as a result, considerable effort has gone into searching for the evolutionary foundations of cooperation. Humans, however, are also hyper-competitive. Our research will examine the roots of human hyper-competitiveness by looking at the competitive motivation of chimpanzees.

Chimpanzees at Edinburgh Zoo are being presented with the option to either co-feed with a conspecific or to compete with them. Co-feeding provides each subject with single reward (a frozen juice cube). Competing gives one of them the chance to get both rewards. Co-feeding, therefore, is safe, but competing is risky. Unlike other studies on risk preferences, this is the first study to look at social risk. If chimpanzees are competitively motivated – competing for the sake of competing – they should prefer this to co-feeding.

To test this, chimpanzee dyads are presented with a novel button-pressing task. In the co-feed game, pressing a button repeatedly causes a food tray to move toward the subject. Across a booth from the actor, the partner can do the same. In the compete game, both chimpanzees can move a single food tray toward themselves and away from the other subject. This “digital tug-o-war” does not advantage stronger or more dominant individuals but gives everyone a chance of winning.

The results from this ongoing study will help us understand more about the nature of human hyper-competitiveness.

PB-15 Friendship status and recipient's emotions both affect children's sharing behavior

Martina Vogelsang, Annika Schäfer, Alina Ehrenreich, Mirjam Ebersbach
University of Kassel, Germany

Studies on the development of sharing resources as one aspect of prosocial behavior revealed that single recipient characteristics affect preschoolers' sharing decisions. In the present study, we investigated (1) whether preschoolers also take multiple recipient characteristics simultaneously into account, and (2) whether preschoolers' general prosocial behavior affects their sharing decisions. A 2 (friendship status: friend vs. non-friend) x 2 (emotional state of the recipient: sad vs. happy) within-subjects design was used. In the context of a dictator game, German preschoolers (N = 82; age range: 4.5-7 years) were provided with six stickers per trial, which they could share with another, fictitious child. The other child was introduced either as a friend or a non-friend, who was either sad or happy. Results showed that preschoolers shared more stickers with friends than with non-friends and more with sad than with happy recipients. There was no significant interaction between these factors. Furthermore, preschoolers' general prosocial behavior did not predict their sharing decisions. This study suggests that preschoolers take multiple recipient characteristics simultaneously into account when sharing resources and that sharing resources might differ from other aspects of prosocial behavior.

PB-16 Abstract: The Fantasy Planet Task: Introducing a New Measure to Study Children's Creativity

Sayyeda Ume Rubab¹, Bruce Rawlings², Patricia Kanngiesser¹

¹University of Plymouth, United Kingdom; ²University of Durham, United Kingdom

Creative development is an important part of childhood and is interlinked with children's cognitive, social, and emotional development. Measuring creativity is notoriously difficult, and many existing tasks rely on tightly structured assessments (e.g., Alternative Uses Task), which may constrain children's creative expression. This study aimed to explore children's creativity through a more open-ended approach by developing and implementing a novel task, the Fantasy Planet Task. Children (aged 5 to 8 years, N=80, UK) were given a blank piece of paper and arts and crafts materials (pens, stickers, etc) and asked to come up with creatures that lived on a fantasy planet. Once finished, we prompted them to describe their creatures (e.g., what do they eat). They also completed an Alternative Uses Task for comparison (order of tasks counterbalanced). Creativity across both tasks was evaluated using four measures: fluency (number of valid ideas/creatures), flexibility (types of ideas/creatures), originality (uniqueness within the sample), and elaboration (number of features and diversity of materials incorporated). We coded 235 different categories of creatures for the Fantasy Planet Task and are currently undertaking analyses. We anticipate that children will demonstrate higher creativity scores in the Fantasy Planet Task compared to the

structured Alternative Uses Task. We will discuss implications for measuring creativity in childhood and creative development broadly.

PB-17 Can illusive realm distort pain perception? – A systematic review and meta-analysis of virtual reality in pediatric postoperative pain

Kevin Efrain Tololiu¹, Ferenc Kocsor¹, Krisztina Csokasi²

¹University of Pécs, Hungary; ²University of Pécs, Hungary

Background: Current paediatric postoperative pain management relies on pharmaceutical therapies, haunted by unfavourable side effects. As a nonpharmacological intervention, virtual reality stands out due to its novelty, flexibility and safety. The efficacy consistency and mechanism of virtual reality in altering children postoperative pain demands further investigation.

Method: A systematic search was conducted in PubMed, Cochrane Library, MEDLINE (OVID), Embase, and EBSCO until January 2025. Randomized controlled trials (RCTs) of Intervention-related virtual reality in pediatric postoperative pain reduction were included. A classical meta-analysis using a random effect maximum likelihood model (REML) was deployed to summarize standardized mean difference (SMD) in 95% Confidence interval (CI). Sensitivity analysis was performed by excluding outliers and studies with a high risk of bias.

Result: 9 of 458 RCTs highlighted a large effect of pain reduction with virtual reality (SMD = -1.98, 95% CI: - 2.58, -1.39, I² = 97.1 %, P<0.001). A sensitivity analysis showed exponential reduction in heterogeneity and size effect (SMD = -0.29, 95% CI, - 0.48, 0.10, I² = 34.8 %, P=0.003). The virtual reality mediated nature-based, game, video animation, and surgical layout with varying immersion and interactivity.

Conclusion: While virtual reality yields an overall clinical benefit in reducing children's pain intensity, the immersion, presence, and agency level in RCTs requires more attention. Active engagement in distraction, multisensory stimuli in relaxation, and memory re-framing in conditioning play considerable roles in altering children's pain perception after operation.

PB-18 The effect of maternal odor on social face perception in 7-month-old infants

Robin Nehler, Sarah Jessen

University of Lübeck, Germany

Recent studies suggest that the mother's odor facilitates face processing (Durand, 2013), identity processing (Durand, 2020), and has an impact on emotion processing (Jessen, 2020). However, it is unclear how the impact of maternal odor on these sociocognitive processes changes across the first year of life. We use both, eye-tracking and EEG, to investigate the impact of maternal odor on the processing of emotional as well as identity information in infants longitudinally at 4, 7 and 11 months

of age. Here, we present first data from a group of 7-month-old infants (at time of submission: N=67). We employed a worn t-shirt paradigm where, during the experiment, the infants were exposed to a t-shirt previously worn by either their mother or a different infant's mother. During the EEG experiment, infants were presented with pictures of their mother and a stranger showing a happy or fearful expression. Key dependent measurements for the EEG part are ERP amplitudes, focusing on the attention-related Nc component as well as the N290 and N400 components, related to face-processing. During eyetracking, infants saw two pictures side by side (again of their mother or a stranger with a happy or fearful expression), presented for 15 seconds in a preferential looking paradigm.

Previous work by Jessen (2020) with 7-month-old infants indicated a reduced Nc response towards fearful faces when infants smelled their mother. Preliminary results (N after preprocessing = 52) indicate no clear effect for the Nc, N290 and P400 component, and we discuss possibly implications of these results in the context of the longitudinal sample.

PB-19 The Impact of Audiovisual Synchrony on Neural Correlates of Infant Face Recognition

Aslı Bursalioglu¹, Cidnee Hall², Maya Martin², Owen Caldwell², Maggie Guy²

¹Northwestern University, Turkey; ²Loyola University Chicago, United States

Background: Infant social interactions occur in multimodal contexts where social partners are both seen and heard. Synchronous audiovisual stimulation provides intersensory redundancy (IR), which captures attention and promotes processing of information presented across modalities (Bahrick & Lickliter, 2000). Event-related potentials (ERPs) offer insight into the role of IR in infant face processing. The N290 and P400 reflect developing face specialization (e.g., Guy et al., 2016; Conte et al., 2020), while the Negative central (Nc) indexes attention allocation and stimulus salience (Guy et al., 2016). **Objective:** This study examines how IR influences neural responses to faces in 12-month-old infants. **Method:** Infants complete a familiarization phase with two actors reciting children's stories: one synchronous audiovisual (IR) and one asynchronous audiovisual (no-IR). During the test phase, ERPs are recorded in response to 500 ms presentations of the synchronous-familiar, asynchronous-familiar, and a novel face. EEG is recorded using a Magstim EGI 128-channel system. Data collection is ongoing (16 participants to date), with a goal of 20 usable datasets.

Analysis: ERPs will be segmented from 100 ms pre-stimulus to 1,000 ms post-stimulus. Peak amplitudes of the N290 and P400 and mean amplitude of the Nc will be analyzed following prior methods (Guy et al., 2016, 2021). Within-subjects factors include stimulus type (synchronous-familiar, asynchronous-familiar, novel) and electrode location. Repeated-measures ANOVAs, one-way ANOVAs, paired t-tests, and least squares means with Bonferroni corrections will be conducted.

Hypotheses: Synchrony is expected to increase attention during familiarization. However, IR may inhibit visual-specific face processing. Thus, infants should process the asynchronous-familiar face more deeply, reflected in a smaller Nc compared to the synchronous-familiar condition. Nc responses to synchronous-

familiar and novel faces are expected to be similar. An N290 is anticipated but not differentiated by condition; P400 effects will be explored given prior mixed findings (de Haan et al., 2002).

PB-20 Active Experience Induces the A-not-B Error through Observing Others' Novel Tool-Use Acts: A Test of the Covert Imitation Hypothesis

Chi-Tai Huang

Dept. of Psychology, National Chengchi University, Taiwan

The covert imitation hypothesis proposes that the classic A-not-B error reflects infants' covert simulation of others' goal-directed actions. To test this account, we developed a novel observational version of the A-not-B paradigm. Nine-month-old infants ($N = 72$) were first familiarized with unfamiliar actions performed with a claw-like tool and then observed an experimenter use these actions to hide and retrieve a toy during the A-trials. Infants did not search on the A-trials themselves; their own search behavior was assessed only on the subsequent B-trial.

Three experimental groups were included (Fig. 1). In the action-observation group, infants observed 12 familiarization events in which the experimenter used the claw to grasp six different toys, each presented twice. In the action-comparison group, after grasping the toy with the claw, the experimenter handed it to the infant and then retrieved it, providing an opportunity to contrast a familiar manual action with novel tool-use. In the action-control group, infants directly observed the experimenter use the claw to search for the hidden toy during the A-trials.

Analyses focused on infants' first reach on the B-trial. The proportions of infants first reaching location A were .42 in the action-control group, .46 in the action-observation group, and .58 in the action-comparison group. A chi-square test indicated no reliable group differences. In contrast, Bayesian estimation with a Beta(2,2) prior yielded more fine-grained evidence (Fig. 2). Posterior comparisons indicated that the comparison group was more likely to exceed the control ($P = .86$) and the observation groups ($P = .79$), while the latter two were nearly indistinguishable ($P = .61$).

Although the Bayesian evidence was of moderate strength, these findings support the covert imitation hypothesis by suggesting that active experience during observation facilitates infants' understanding of a novel tool's goal, thereby biasing their subsequent search toward the experimenter's prior search location in the A-not-B task.

PB-21 A novel experimenting behavior in mirror self-recognizers when they view video self-image

Lira Yu¹, Kazuo Hiraki²

¹Rikkyo University, Japan; ²The University of Tokyo, Japan

Recognizing oneself in live videos develops later in children than mirror self-recognition (Suddendorf et al., 2007). A potential learning mechanism underlying both mirror and video self-recognition is

contingency perception—the ability to understand the relationship between one’s own movement and visual feedback from self-image (Kärtner et al., 2012; Miyazaki & Hiraki, 2006). However, it remains unclear how infants who begin to recognize themselves in mirrors perceive their video self-image and whether they actively engage in contingency checking behaviors (i.e., experimenting behavior). In this study, infants aged 18 months ($n = 64$) participated in one of three conditions: mirror, monitor-live, or monitor-1s delay condition. We introduced a novel “mark-offering” phase after the mark test to observe a wider range of infants’ experimenting behaviors. The test included four phases: 1) first exposure to the self-image, 2) covert application of a Post-it mark on the infant’s forehead, 3) a second exposure to the self-image, and 4) the mark-offering phase to observe additional experimenting behaviors. Our results confirmed that the proportion of successful mark-test performance (i.e., touching or removing the mark) was significantly lower in the two monitor conditions compared to the mirror condition. Interestingly, experimenting behaviors, such as placing the mark on their forehead or other areas they explored, were observed only in the monitor conditions. The proportion of infants who showed no mark-related behaviors was not significantly different between three conditions. This suggests that mirror self-recognizers actively engage in contingency checking when viewing their video self-image. Based on these findings, we will discuss how mirror self-recognizers might perceive and process their video reflections.

PB-22 Epistemic and Interpersonal Aspects of Parenting: Development of a Scaffolding Scale

Gokce Sahin¹, Jedediah Wilfred Papas Allen²

¹Technical University of Munich, Germany; ²Bilkent University, Turkey

The objectives of the current study were twofold. The first aim was to examine the relationships between parenting styles and the epistemic and interpersonal aspects of parenting, the last two of which were operationalized as scaffolding and parenting by lying practices, respectively. Since there was no measurement tool to assess parental scaffolding functions quantitatively, the second aim was to develop a self-report scaffolding scale to address this limitation in the literature.

In Study 1, parents of preschool-aged children ($N = 258$) were recruited to determine the factor structure of the Parental Scaffolding within Cultural Learning scale (PSCL), which was developed within the scope of the current research. The four-factor a priori structure of the 42 items was developed as a synthesis of the predominant conceptualizations of scaffolding means in the literature: cognitive, emotional and sensitive scaffolding, and autonomy support.

In Study 2, the relationships between parenting styles and the epistemic and interpersonal aspects of parenting were investigated in a second independent sample ($N = 153$), and the validation of the 22-item PSCL was statistically confirmed. The four-factor structure was conserved, forming new conceptually related factors: task persistence (Cronbach’s alpha value = .747), responsive teaching (.704), reducing difficulty (.740), and autonomy for learning (.393). The findings from Study 2 also showed that authoritative parenting style significantly predicted task persistence, responsive teaching,

and autonomy for learning, and overprotective parenting attitudes predicted task persistence and reducing difficulty. Furthermore, overprotective parenting behaviors were associated with the use of positive affect lies. And the use of threat lies was predicted by overprotective parenting and authoritarian parenting practices.

Overall, the current study demonstrated notable relationships between parenting styles and epistemic and interpersonal practices. Furthermore, this research contributed to the literature by developing a valid and reliable measurement tool for assessing parental scaffolding in everyday life instances.

PB-23 The Ecology of Human Vocal Learning: A Child Network Approach

Alexandra Bogoyavlenskaya, Natalia Kartushina, Luca Onnis

University of Oslo, Norway

Vocal learning is a steppingstone in the development of language via the progressive acquisition and mastery of language-specific speech sounds from exposure to ambient speech. Children's language development is significantly influenced by their social environments, yet research primarily emphasizes the role of individual caregivers rather than broader social networks (Goldstein, King & West, 2003; Athari et al., 2021). Variability in a child's social network, such as the number of close relationships and the diversity of speakers, may impact their speech perception and production, hinting at a complex relationship between social interaction and vocal learning (Okocha et al., 2024, Casillas et al., 2020). Current evidence is inconclusive, indicating that while some studies suggest benefits from speaker variability, others show no correlation with language outcomes, highlighting the necessity for further investigations to clarify how diverse social networks contribute to infants' language acquisition (Estes & Lew-Williams, 2015; Bulgarelli & Bergelson, 2023).

We hypothesize that individual differences in the social diversity of interactions of 11-month-old infants relate to their maturity of early vocalizations, i.e. proportion of canonical babbling, as measured during naturalistic parent-child play interactions. We thus predict that a larger speaker variability (different unique speakers regularly speaking to the child and in the presence of the child, weighted by their frequency of interactions) should be associated with more mature vocalizations at the same age.

We recruit families with monolingual Norwegian infants. Data collection involves online parental interviews about the child's social network and audio recordings of play interactions, with analyses focusing on vocalization types and speaker diversity measured through Shannon's entropy, using mixed-effects regression models to assess the relationship between social network diversity and vocalization maturity.

This study contributes to a better understanding of the role of the child social network in the emergence of human speech, and the trajectories of speech development.

PB-24 Early Compositionality: Investigating Adjective–Noun Understanding in Infants

Eulalie Pequay¹, Anne Christophe², Isabelle Dautriche²

¹Aix-Marseille University, France; ²France

This study investigates infants' understanding of adjective–noun combinations before age two. Linguistic compositionality allows infinite meanings from a limited set of elements. Previous research shows children aged 3–5 understand subjective adjectives, but it is unclear when this ability first emerges. The study tested 14- to 19-month-olds using size adjectives (“big,” “small”) paired with familiar body-part nouns, employing a visual preference paradigm. Infants viewed image pairs while hearing target phrases (e.g., “Look at the one with big eyes!”). Preliminary results show no significant preference for the target image so far. Data collection is ongoing to examine age-related developmental trends.

PB-25 Different developmental patterns of pragmatic skills in ASD, ADHD, and typically developing children

Veronika Svindt

ELTE Research Centre for Linguistics, Hungary

Pragmatic ability is often delayed or impaired in neurodevelopmental disorders such as ASD and ADHD, yet no comprehensive Hungarian test battery has been available to measure this skill. The aim of this study is to fill this gap by examining pragmatic abilities and their development in ASD and ADHD relative to typical development.

Methods: The pragmatic test protocol includes subtests assessing the semantic–pragmatic interface, speech acts, figurative language, and prosodic cues. Receptive grammar was measured with the TROG-H test. Participants were 131 children: ASD (n=22), ADHD (n=34), ASD+ADHD (n=15), and typically developing peers (TD, n=60).

Results: All clinical groups performed significantly below TDs, but did not differ from each other. Normal-range pragmatic performance was found in 80% of TD children, compared to ~37% in ASD and ADHD, and 20% in ASD+ADHD. Severe impairment ($\geq 2SD$ below the TD's average) was observed in 50% of ASD, 60% of ASD+ADHD, and 38% of ADHD participants. GLM analysis revealed age-related improvement in pragmatic ability in TD and ADHD groups, but not in ASD or ASD+ADHD. Pragmatic performance strongly correlated with TROG-H scores in all groups. Moreover, pragmatic ability was a better predictor of grammar performance than vice versa: good pragmatic skills implied adequate grammar, but strong grammar did not guarantee pragmatic competence.

Conclusion: Pragmatic difficulties were milder in ADHD than in ASD, though still significant compared to TDs. In ASD and ASD+ADHD, deficits were more severe and did not improve with age, suggesting a permanent impairment rather than a developmental delay. These findings highlight the value of the new test battery in detecting pragmatic difficulties and differentiating developmental trajectories across clinical groups.

PB-26 Emerging intention in 3-month-olds: simultaneous pupillometry and EMG during the mobile paradigm

Ryo Fujihira¹, Yuta Shinya², Hama Watanabe², Gentaro Taga²

¹National Institute for Physiological Sciences, Japan; ²The University of Tokyo, Japan

Intention lies at the core of human behavior, allowing flexible and goal-directed interaction with the environment. However, how it emerges in infancy is still not well understood. In recent years, the mobile paradigm has attracted renewed interest as a setting for examining the emergence of intention (Kelso 2016, Sen and Gredebäck 2021). We investigated whether 3-month-old infants can initiate intentional actions by simultaneously recording electromyogram, eye gaze, and pupil diameter while they interact with a suspended mobile toy. Twenty infants (12 girls and 8 boys, mean age 110.9±7.1 days) completed the experimental procedures (2-min baseline, 10-min interaction, 2-min extinction, and 2-min reinteraction). We focused on the pupil dilation time-locked to movement onsets which reflects internal decision making or emerging intention similar to readiness potential in adults (De Gee et al. 2014, Gavenas et al. 2024). Movement onset was detected using electromyographic signals from the arm connected to the mobile. Pupil dilation was then analyzed for a time window from 2 seconds before to 4 seconds after the movement onsets, including only movements performed while the infants were looking at the toy. We found that, at the early stage of mobile interaction, pupil dilation appeared after movement onset. The pupil dilation gradually shifted to precede movement onset during the interaction phase. This shift implies that infants begin to anticipate the timing of their forthcoming movements. Pupil dilation was continued at the extinction phase. Furthermore, the antecedent pupil dilation occurred only with efficient movements characterized by reduced muscle co-contractions. These findings suggest that infants learn to predict outcomes of their own actions and initiate particular movements at self-determined timings, marking the emergence of intentional action. Our study also contributes to establish a new experimental setup that simultaneously measures behavior and pupil dynamics while infants actively interacting with their environment.

PB-27 Curious Choices: How explore-exploit trade-offs shape preschoolers' decision-making

Marlene M. Meyer, Lorna Schlüter, Marina Proft, Hannes Rakoczy

University of Göttingen, Germany

Prior research suggests that full-fledged modal thought emerges surprisingly late, not before age four. For instance, when confronted with one certain and two uncertain options (in the so-called "3-cups-task"), preschoolers choose randomly (e.g., Mody & Carey, 2016; Leahy & Carey, 2020). Apparently, they fail to represent mutually exclusive possibilities and do not consider their uncertainty. This contrasts with findings that in other tasks, already 3-year-olds provide accurate metacognitive judgments about their own (un-)certainty (e.g., Hembacher & Ghetti, 2014; Meyer et al., under review). Given this divergence, the current study investigates whether poor performance in the 3-cups-task

indeed reflects immature modal cognition or whether other factors mask children modal competence in making decisions under uncertainty. In particular, curiosity, conceptualized as a metacognitive feeling (Goupil & Proust, 2023), may lead children to explore uncertain options rather than exploit the certain ones in situations like the 3-cups-task. Poor performance in the 3-cups-task may thus reflect performance rather than competence limitations. Ironically, these performance limitations in modal cognition would be due to competence in metacognition (curiosity-based exploration). To test this possibility, the current study aims to resolve the potential explore-exploit trade-off with a modified version of the 3-cups-task. The original version cannot distinguish explore and exploit choices since children only give one response (search under the certain or under one of the uncertain cups). In our modified version, therefore, children (3- and 4-year-olds, N=68) could make two choices, one for exploration (“where do you want to search to gather information?”) and one for exploitation (“which cup would you choose?”). Currently, data collection is still ongoing, but will be completed by the time of the conference. Altogether, this project highlights the complicated role of curiosity in children’s sophisticated decision-making and raises broader questions for the development of modal thought and metacognition.

PB-28 Strategies to encode environmental sounds into language with developmental change

KAEDE HATTORI¹, Shoko Miyauchi², Kazuhide Hashiya³

¹Graduate School of Human-Environment Studies, Kyushu University, Japan; ²Faculty of Information Science and Electrical Engineering, Kyushu University, Japan; ³Faculty of Human-Environment Studies, Kyushu University, Japan

Infants gradually attune to the phonological system of their native language, establishing perceptual categories that shape both speech perception and production. This developmental process results in warped perceptual spaces, in which native language prototypes function as “perceptual magnets” that alter the perceived similarity among sounds (Kuhl, 1991; Kuhl et al., 1992; Kuhl et al., 2008). While these perceptual anchors are reinforced by exposure to conventional phonological input, non-speech sounds provide opportunities for novel spoken representations. Onomatopoeia illustrates this interplay: each language develops conventional sound-symbolic forms (e.g., “meow” in English), yet speakers also invent representations when no conventional form exists. Such cases offer a unique window into phonological adaptation across development.

The present exploratory study investigated how children construct spoken representations of environmental sounds and whether these vocalizations show developmental convergence toward adult forms. Audio data were collected from children aged 3–10 years and adults, each producing spontaneous vocalizations after listening to target sounds without visual cues. Recordings were converted into mel-spectrogram images and analyzed with and without temporal alignment using Dynamic Time Warping (DTW) and its derivative (DDTW). Dissimilarity measures were visualized through hierarchical clustering in two- and three-dimensional spaces.

Preliminary observations suggested that children's spoken representations tended to spread broadly than adults'. That temporal normalization via DDTW provided useful insights into developmental convergence; other factors would contribute to the phonological adaptational change since the rhythmic factor afforded similar contribution in both adults' and children's representations. However, given the exploratory nature of this work, these findings should be interpreted cautiously. Further analysis is being conducted on a Convolutional Neural Network to extract features that contribute to the clustering. The findings of this study will directly explain how humans undergo the phonological adaptation process.

PB-29 Mutual Exclusivity Across Word Classes

Chiara Carraro, Manuel Bohn

Leuphana Universität Lüneburg, Germany

Mutual Exclusivity (ME), the tendency to map novel words onto novel rather than familiar referents, is an important word learning mechanism (Markman, 1991). While extensively studied for nouns, less is known about ME in adjective (Yoshida & Hanania, 2013) and verb learning (Merriman et al., 1993), especially in relation to one another.

This preregistered study investigates whether ME guides novel adjective and verb learning, as it does for nouns. On each trial, children see a character and three pictures, always consisting of two familiar objects (noun condition), features (adjective condition), or actions (verb condition), and one novel object, feature, or action (respectively). In experimental trials, the character asks the child to click on a picture using an unknown word, hence the target is always the novel picture; In filler trials, a familiar word is used to refer to one of the two familiar pictures. Each child completes 6 items per condition plus 12 fillers.

Although adjectives are acquired later than verbs (Tribushinina, 2018), their defining function is to highlight contrasts between opposing qualities of the same item. Therefore, we predicted ME would be used less for adjectives than nouns, but more for adjectives than verbs. Preliminary results on 74 children (preregistered N=100; (mean age=5.25; range: 3.05-6.84) show that children get better with age ($\beta=0.68$, 95%CrI [0.23, 1.14]), a greater accuracy for nouns compared to adjectives ($\beta=-1.15$, [-2.26, -0.04]) and verbs ($\beta=-2.50$, [-3.62, -1.41]); On an individual level, there was a moderate correlation between adjective and noun accuracy ($r=.35$, $p=.002$) and a weak correlation between noun and verb accuracy ($r=.28$, $p=.018$).

These findings suggest that ME most strongly supports novel noun learning but may also facilitate novel adjective interpretation in comparison to verbs, supporting a pragmatic interpretation of ME as a flexible word learning mechanism.

PB-30 Epistemic Vigilance in Early Childhood: Predicting Children's Acceptance and Rejection of Informational Suggestions

Isaac Bisla, Natalie Worzalla, Rose Kindred, Natalia Jahnke, Melissa Koenig
University of Minnesota, Twin Cities, United States

Researchers and legal professionals express growing concern for children's abilities to provide accurate eyewitness accounts due to their susceptibility to suggestion (Klemfuss & Olaguez, 2020). Prior work has suggested that children's ability to attribute remembered information to its correct origin (e.g. "did you hear it or see it?") is associated with decreased susceptibility to misinformation (Giles, Gopnik, & Heyman, 2002). However, little research has explored how children's epistemic vigilance, the ability to monitor the reliability of sources, may support children in resisting misinformation in suggestive contexts. This study investigates various forms of epistemic vigilance in children aged 3-6 years ($N = 225$) as an early capacity that could aid their ability to identify and resist misinformation in suggestive contexts. Children were presented with a 1-minute silent video depicting a petty theft followed by a 1-minute narration of the same event. Afterwards, they were randomly assigned to either an epistemic vigilance condition (statement evaluation or informant evaluation condition) or a control group. Findings revealed children from our control group showed greater acceptance of misleading suggestions ($M = 4.24$, $SD = 3.18$) than children from the informant evaluation ($M = 3.09$, $SD = 2.98$) and statement evaluation conditions ($M = 3.20$, $SD = 3.12$). Follow up analyses showed no significant differences between the 2 epistemic vigilance conditions, $t(148) = -0.21$, $p = .83$. However, both epistemic vigilance conditions showed significantly lower acceptance to misleading suggestions compared to children in the control group. This highlights that task-based support through evaluating informational statements or evaluating the reliability of a speaker, improves children's ability to reject misleading suggestions. Overall, this study carries important implications in applied settings such as forensic contexts and emphasizes the importance of incorporating developmentally informed interviewing strategies that consider a child's ability to also critically evaluate information prior to being questioned.

PB-31 "What did I see on the video?" – Exploring preschoolers' episodic memory development

Krisztina Andrásí, Réka Schvajda, Kinga Saly, András Sziklai, Ildikó Király
Eötvös Loránd University, Hungary

The aim of the current study is to explore whether 4- and 5-year-old children (and as a control, adults) are able to recall the order in which certain events happened to them in order to solve a task (find a hidden object). We believe this is an important milestone in episodic memory development. During the experiment, participants are first involved in two tasks: in a coloring task and in a box exploration task. In the latter, they explore the contents of three colourful boxes together with an experimenter, and change the location of a red puzzle piece. Importantly, there are two conditions

based on the order of these tasks: participants either partake in the box exploration or the colouring task first.

Following a 10 minute break, children watch a short video, during which they learn that while they were engaged in the colouring task, an experimenter changed the location of the puzzle piece in secret. In the test phase, children are instructed to uncover the current location of the piece (experimental design inspired by Povinelli et al., 1999). We measure which box children choose upon this request (correct, wrong or irrelevant location). Importantly, the relevance of the content of the video differs in the two conditions: when children did the colouring task first, the content of the video is irrelevant (video irrelevant condition), while if they viewed the boxes first, they should update their knowledge about the location of the puzzle piece based on the video (video relevant condition).

Data collection is ongoing in all age groups. In the 4-year-old group (current sample size = 28), children perform better in the video irrelevant condition (proportion of correct first choice: 50%), compared to the other condition (proportion of correct first choice: 21%). In the case of the 5-year-old group, data collection has just started. In the adult sample (current sample size = 10), participants were similarly successful in the two conditions (proportion of first choices being correct: 90%).

PB-32 A Developmental Shift in the Relation Between Maternal Depression and Child Inhibitory Control from Infancy to Early Childhood

Bethany Biggs¹, Abigail Fiske², Arielle Bonneville-Roussy³

¹University of Bristol/Macquarie University, Australia; ²Lancaster University, United Kingdom; ³Université du Québec à Montréal, Canada

Study 1: This study assessed the relation between maternal depression and child inhibitory control (IC) in a sample of 187 mostly White (79.6%), high SES mothers (mean age = 33.89 years) and their children between 10 and 42 months postpartum. Correlational analyses demonstrated associations between higher levels of maternal depression and lower child IC from 36 months. Infants of mothers with chronically high but decreasing levels of depression across the testing period were found to score higher on the lab-based IC task at 10 months, compared to infants of mothers with consistently low levels of depression. Taken together, the effect of maternal depression on child IC is initially positive in infancy, and switches to a negative association in early childhood. Study 2: We will also present the results of a second study aiming to replicate the novel finding in a new sample of infants and their mothers, and to examine whether this effect generalises to other infant measures of IC. Infants have completed the same lab-based IC task as employed in study 1, as well as three prohibition tasks, at 10 and 16 months of age. We will employ factor analyses, path analyses and multilevel modelling to examine 1) the relationship between chronic maternal depression and distinct components of infant IC and 2) reciprocal relationships over time, in order to establish the direction of causality. Data for study 2 has been collected, coded, and is ready for analysis once the plan has been pre-registered. Findings will inform theories of IC development, and will help in understanding the unstable nature

of inhibitory control between infancy and childhood. In the case that the findings replicate and generalise across tasks, practitioners should be aware of the need for age specific strategies in supporting the healthy development of inhibitory control.

PB-33 Why Do Some Children Say Yes? Investigating Individual Differences in Suggestibility

Rose Kindred, Isaac Bisla, Melissa Koenig

University of Minnesota - Twin Cities, United States

Children often serve as eyewitnesses in legal cases, yet their vulnerability to suggestion raises concerns about the reliability of their testimony. Individual differences in children's suggestibility have previously demonstrated mixed findings in relation to executive function (EF; Klemfuss & Olaguez, 2020), with most studies focused on inhibitory control, overlooking EF as a multidimensional construct. This study investigates whether executive function, assessed through a composite of working memory, response inhibition, and cognitive flexibility is associated with children's susceptibility to suggestion. A sample of 225 3- to 6-year-olds ($M_{age} = 54.08$; $SD_{age} = 9.9$) completed a suggestibility task following exposure to a laboratory video. Children also completed a multi-dimensional EF task using the Minnesota Executive Function Scale (MEFS; Carlson & Zelazo, 2014) and a theory of mind task. Parents answered questions about their children's language ability and their own parenting characteristics (e.g., authoritarianism and social conformity). Preliminary results demonstrated that after controlling for age, theory of mind, and language ability, higher scores on the MEFS was associated with lower acceptance of misleading suggestions ($B = -0.024$, $\beta = -.145$, $p = .030$), highlighting the role of EF as a protective factor against children's acceptance of misleading suggestions. The MEFS assessment captured multiple components of EF, suggesting that broad EF abilities (e.g., working memory, inhibitory control, and cognitive flexibility) collectively contribute to children's resistance to misinformation in suggestive contexts. Ongoing data analysis will further explore children's susceptibility to misleading suggestions by examining additional individual differences, including parenting characteristics such as authoritarianism and social conformity. Individual differences in children's susceptibility to suggestion are critical to understand, particularly in forensic contexts where their testimony may carry significant legal consequences. This study aims to identify key sociocognitive predictors of vulnerability, informing more developmentally appropriate and protective interviewing practices.

PB-34 Plan Chunking Benefits Memory-Guided Multi Step Planning in Preschoolers

Jade Zack¹, Chen Cheng², Tashauna Blankenship¹

¹University of Massachusetts Boston, United States; ²Hong Kong University of Science and Technology, China

Episodic future thinking (EFT) involves using episodic memories to simulate a possible future, often in service of a goal (Atance & O’Neill, 2001). Our study examined children’s use of EFT during multi-step plans while using a strategy called Plan Chunking, which eases working memory (WM) load. When steps of a sequence are perceptually grouped together (i.e., Plan Chunking), 3-year-olds can complete multi-step plans (Blankenship & Kibbe, 2023). In this follow-up study, we explore how 3- and 4-year-olds use Plan Chunking, when WM is taxed and not, to complete temporally ordered multi-step plans.

Overall, 115 children, 61 3-year-olds (M= 43m, 30 girls) and 54 4-year-olds (M= 55m, 24 girls) participated in this study; 66 were from China and 49 were from Boston, US. We found significant main effects, but no interaction effects, for age ($F(1, 107) = 28.6, p < 0.01$), condition ($F(1, 107) = 5.36, p < 0.05$), location ($F(1, 107) = 10.78, p < 0.01$), steps ($F(1, 111) = 9.92, p < 0.01$), and feedback given ($F(1, 111) = 6.45, p < 0.05$). Overall, four-year-olds (M= 0.81) performed better in all conditions than three-year-olds (M= 0.54); participants in China (M= 0.68) performed better than those tested in the US (M= 0.47); participants performed better in trials with 3-step (M= 0.63) than 4-step plans (M= 0.56), trials where they received feedback after each step (M= 0.68) than no feedback (M= 0.51), and trials with Plan Chunking sequences (M= 0.62) than alternating sequences (M= 0.57).

Our results suggest that 3-year-olds can successfully use Plan Chunking to complete plans with multiple steps, even when working memory is not under heavy load, and their planning abilities improve as they get older. Future research should explore the factors influencing the difference found between locations.

PB-35 Pointing gestures in children with Developmental Language Disorder

Daniela Bühler¹, Alexandra Perovic², Nausicaa Pouscoulous²

¹HfH, Switzerland; ²University College London, United Kingdom

Pointing gestures play a central role in early communication and language development. Yet, little is known about how they are used by children with Developmental Language Disorder (DLD). This study examined index-finger pointing gestures in 42–49-month-old children with DLD and their caregivers using a function-based and dyadic approach. Pointing behaviour was observed in a communicative setting designed to elicit spontaneous gestures. In this task, the child interacted with their caregiver in a “decorated room” filled with colourful objects and pictures (adapted from Liszkowski, Carpenter, & Tomasello, 2004; Liszkowski et al., 2012). We compared pointing in 14 children with DLD to two control groups: 13 age-matched and 12 language-matched neurotypical peers. Pointing frequency

and communicative functions – including imperative and responsive gestures – were coded from five-minute caregiver–child interactions.

Results showed that children with DLD used significantly more gestures with clear functional communicative intent than their language-matched peers, but, contrary to expectations, did not differ from age-matched peers, suggesting preserved gesture use despite language difficulties. Their pointing behaviour was qualitatively different from that of neurotypical peers: they produced a higher proportion of imperative gestures and showed a tendency toward more responsive gestures. This suggests that pointing may serve a compensatory function in DLD, while remaining a stable communicative resource in neurotypical preschoolers. Caregivers of children with DLD also differed from caregivers of neurotypical children, exhibiting significantly more gestures, and greater variety, particularly multimodal ones (gestures accompanied by speech). However, no participant group displayed coordinated gesture use between child and caregiver, indicating a lack of dyadic synchrony. These findings establish pointing as a flexible and adaptive modality in DLD, shaped by both communicative needs and caregiver input. The study underscores the potential of gesture-based interventions fostering multimodal, interactive scaffolding in early development.

PB-36 Training Children’s Understanding of Numbers Using Compositional Cues

Lucia Vilches¹, Akshita Srinivasan², Jiaxin Liu¹, Elizabeth Spelke¹

¹Harvard University, United States; ²Stanford University, United States

Human infants form exact representations of small quantities (1,2, and 3) but not larger quantities (e.g., 5). How do children in numerate cultures acquire exact large-number concepts?

Here we test whether children can acquire exact large-number concepts from natural language expressions using small numbers: e.g., “I have five pets: three dogs and two cats” (Spelke, 2017; Dehaene et al., 2025). We compared a training using such expressions along with visual displays of sets (eg., of five pets) made up of subsets (eg., three cats and two dogs) to a control training with similar displays but no words for subsets.

Participants (n=92, 2.5-4.5 years) completed a point-to-N task (adapted from Wynn, 1992) to assess baseline number-word knowledge, then received either compositional or control training on either “five” or “six”. Across the full sample, compositional training did not improve performance, likely because children at the highest knower levels performed at ceiling on the post-test, and children at the lowest knower levels failed to understand the number words used in compositional training. Accordingly, a further analysis included only children who demonstrated knowledge of number words up to, and not beyond, “three”, before training (three-knowers, n=19). These children were significantly more likely to learn the meanings of “five” and “six” in the compositional condition than in the control condition (OR=2.48, 95% CI [1.40,4.38], p=.002).

These results reveal that children can benefit from cues that show how sets of large numbers are composed of sets of smaller numbers, providing preliminary evidence that compositionality plays

a role in the acquisition of exact large-number concepts. This accords with recent arguments that compositionality is central to integer concepts in all languages at all ages (Dehaene et al., 2025).

PB-37 How does cross-modal information influence category-selective responses to faces and birds in infants?

Laura Bourgaux¹, Adélaïde de Heering¹, Genevieve Quek²

¹Université libre de Bruxelles (ULB), Belgium; ²Western Sydney University, Australia

Faces hold a unique status in human perception, naturally capturing infants' attention (Gliga et al., 2009; Reynolds & Roth, 2018). However, the role of attentional processes in shaping visual perception during early development remains unclear. Using a frequency-tagging approach combined with electroencephalography (Quek & de Heering, 2024), the present study investigates whether and how cross-modal cues dynamically modulate infants' attention toward or away from distinct visual categories, including highly salient stimuli such as faces. To this end, 6- to 9-month-old infants viewed rapid streams of images presented at a rate of 6 Hz (6 images/second), with faces and birds interlaced at distinct periodic intervals within each 30-second trial: a bird every 5 images (i.e., 1.2 Hz); a face every 4 images (i.e., 1.5 Hz). Each trial also contained neutral sounds, human voices or bird vocalizations presented at non-periodic intervals. Of key interest was whether this auditory information would modulate the strength of the face- and bird- selective signals. Given that infants' face categorization is less robust than in adults (de Heering & Rossion, 2015), we hypothesized that human vocalizations would drive infants' attention towards the face stimuli, thus enhancing the face-selective response. We also expected the bird-selective response to be enhanced due to a general attentional engagement induced by human voices (Stavropoulos & Carver, 2016). In the bird vocalization trials, based on the adult study (Quek & de Heering, 2024), we expected to find attentional suppression for faces and attentional enhancement for birds, because the infants have to inhibit their natural attraction for the former in order to pay attention to the latter. Preliminary results suggest human vocalizations may have served to suppress both category-selective responses, while bird vocalizations suppressed the face-selective response while enhancing the bird-selective response, but more power is needed. Overall, this work will shed light on the plasticity of early attentional biases and explore whether and how infants disengage and redirect their attention from highly salient toward less salient visual categories.

PB-38 Characterizing 2- to 5-Year-Old Children's Exploration Behavior in Free Play

Yibiao Liang, Bastian Rothenburger, Timothy Schaumlöffel, Gemma Roig, Yee Lee Shing
Goethe-Universität Frankfurt, Germany

Children's exploration behavior has been mostly studied using games with explicit, external goals and/or rewards. However, in young children's everyday play, their exploration behavior is driven by

more intrinsic features, such as novelty and joy. In our current study, we aim to characterize 2- 5-year-old children's exploration behavior in semi-structured free play.

We set up a playroom with several toys. Each toy is put in a storage box with the lid closed and spread out so that we can observe how children explore. 2- to 5-year-old children are instructed to freely explore and play with all the toys for 15 minutes, wearing a head-mounted eye-tracker. Children visit the lab twice. In the first visit, there are 6 toys in the room. In the second visit, 2 new toys (8 toys in total) are added to the room. The combination of box-toy and the location of the box in the room stays the same across participants. The room is equipped with surveillance cameras. In addition, the parent will fill out questionnaires regarding their child's curiosity.

Data collection is currently ongoing. With data from the head-mounted eye-tracker and the surveillance cameras, we will derive several measures to characterize children's exploration behavior, including the number of toys they inspect and play with, the time spent playing with each toy per instance, and the order of exploration. With these exploration measures, we will use latent profile analysis to identify different types of explorers/exploiters. We will also analyze how these types of explorers/exploiters are different in their curiosity measures. We predict that explorers will explore more toys and, correspondingly, spend less time with each toy on average. In addition, we predict that explorers will have a higher curiosity score, providing empirical evidence for the association between curiosity and children's exploration in free play.

PB-39 Early markers of conscious processing: neural amplification in infants using a rapid visual stream paradigm

Charlotte Mancuso, Marion Losdat, Ghislaine Dehaene-Lambertz

Neurospin, CEA de Saclay, France

While infants were once thought to have little to no mental life, emerging research has begun to uncover early cognitive abilities that challenge this assumption. A powerful framework for understanding the neural basis of these capacities is the Global Neuronal Workspace (GNW) theory, which predicts that conscious access is marked by the selective amplification of neural responses to target stimuli (Dehaene and Naccache, 2001). In a rapid visual stream presentation (RSVP) study, Marti and Dehaene (2017) showed that adult participants exhibit neural amplification only for target images they could later report. This paradigm thus provides a method to probe conscious access. We hypothesize that, even at an early stage, infants may exhibit neural signatures of conscious access, albeit potentially slower than adults.

Here, we study stimulus amplification using an adapted version of Marti and Dehaene's paradigm on 14 to 18-week-old babies in electroencephalography. Images from 5 categories were presented to infants for an extended duration to ensure effective visual processing (localizer task). Then, rapid streams of images were presented with one target image emphasized at the beginning of the trial to orient the infant's attention (RSVP task).

We started by extracting features for each category using MVPA. Preliminary results indicate that

the decoder trained on images from the localizer task successfully distinguishes between image categories and exhibits neural amplification for stimuli. We will then apply this decoder to images from the RSVP task, where we expect to find similar patterns of decoding to the localizers, but only for the target images. In contrast, we expect to be able to decode the non-target images briefly after stimulus onset without the amplification related to conscious processing. If confirmed, this paradigm could provide early neural evidence of conscious access in infancy and contribute to extending GNW models to the first months of life.

PB-40 Active learning: unitary construct or chimera?

Oana Stanciu¹, Costanza De Simone², Azzurra Ruggeri¹

¹Technical University of Munich, Germany; ²Max Planck Institute for Human Development, Germany

There is a growing body of research tracking the developmental trajectory of children's active learning abilities and exploration strategies using an increasing variety of experimental paradigms. However, we know very little about whether these tasks tap into different facets of a unitary construct and are similarly impacted by the cognitive, social, and cultural factors across development. In a first cross-cultural study of active learning, we recruited 311 children aged between 7- and 11-years-old from Germany, Cuba, Egypt, and India. Participants completed a battery of active learning tasks, as well as a battery of contributing factors, including, among others, WISC memory, attention, reasoning, and vocabulary tasks. The active learning battery comprised several app-based tasks: the widely used 20-Questions task measuring the efficiency of question generation during information search (Ruggeri et al., 2016), an active one-dimensional category learning task (Sim et al., 2015), an active linear function learning task (Jones et al., 2018), a spatial exploration task (Schulz et al., 2016), an episodic memory task (Markant et al., 2016), and a question evaluation task (Ruggeri et al., 2017).

Preliminary results indicated absent or weak correlations between most tasks, with considerable variation across countries. Structural equation modeling suggested a limited scope for a shared active learning factor; however, power was too low to allow testing the variance of factor loadings with age. All in all, results suggest a more nuanced discussion of active learning abilities is necessary in the literature, as well as more experimental efforts aimed at understanding the constellation of factors supporting different facets of active learning performance. We conclude by presenting a planned longitudinal cohort study designed to provide more definitive evidence on how different facets of active learning relate to each other and change across development.

PB-41 The acquisition of implicit regularities in music and language domains during toddlerhood

Ilaria Lorenzi, Eloisa Valenza

Padova University, Italy

Introduction: Previous studies have shown that infants can implicitly learn structural regularities from early in development (Bulf et al., 2015; Bettoni et al., 2020, 2021). Building on this evidence, the present study investigates toddlers' sensitivity to harmonic structures and linguistic rules. Specifically, we examined: (1) spontaneous preference for consonant vs. dissonant isolated chords; (2) implicit learning of harmonic regularities; and (3) implicit learning of morphosyntactic regularities. We further tested whether the ability to extract harmonic rules correlates with learning linguistic rules. **Method:** Sixty toddlers (18–36 months) were recruited across two contexts to maximize ecological validity: laboratory (n = 6) and kindergarten (n = 54). In Task 1, children viewed two visually identical stimuli differing only in harmonic vs. disharmonic isolated chords. In Task 2, an audiovisual cue predicted the target location, which produced either a congruent harmonic chord completing the sequence or a disharmonic chord violating it. In Task 3, the cue produced an Italian adjective (bella/bello) followed by a noun that either correctly or incorrectly completed the phrase (bambina/bambino). Ocular behavior (fixations and saccades) was recorded with eye-tracking.

Results: No spontaneous preference emerged for consonant vs. dissonant isolated chords (Task 1). By contrast, toddlers successfully extracted both harmonic rules (Task 2) and morphosyntactic regularities (Task 3). Importantly, correlation analyses revealed that children who learned the musical rule were also more likely to learn the linguistic rule, suggesting a shared mechanism for processing structural regularities across domains.

Conclusion: These findings demonstrate that toddlers' sensitivity to harmonic structure parallels their capacity to process linguistic regularities. The observed correlation supports the hypothesis that music-based learning can scaffold early language development, highlighting its potential for early interventions in children with primary language impairments.

References:

Bulf et al. (2015). *Frontiers in Psychology*, 6, 1595.

Bettoni et al. (2020). *Frontiers in Psychology*, 11, 28.

Bettoni et al. (2021). *Infancy*, 26, 319–326.

PB-42 Temporal Coupling Between Spontaneous Vocalizations and Limb Movements in Early Infancy

Yuta Shinya, Hama Watanabe, Gentaro Taga

The University of Tokyo, Japan

Rhythmic coordination between vocal behavior and body movement is well described from the babbling period (Ejiri & Masataka, 2001; Borjon, Abney, Yu, & Smith, 2024), and early cries show

structured prosody (Wermke & Mende, 2009). It remains unclear whether such coupling is present as early as three months, a period when spontaneous limb activity becomes more organized and goal-directed (Watanabe, Homae, & Taga, 2011). We investigated whether three-month-old infants exhibit time-locked coupling between vocal onsets and limb movements during spontaneous behavior. Forty-five infants (90–117 days) lay supine while bilateral foot acceleration and ECG were recorded for up to 20 min (stopped if crying persisted ≥ 2 min). Behavioral state was defined as: Neutral (quiet/alert without distress), Fussy (intermittent fussing without sustained crying), and Cry (sustained crying bouts). Vocalizations were defined acoustically as voiced segments >0.1 s within one expiration. Limb movement was defined when jerk in either foot exceeded $5\times$ the median. For each vocal onset, we computed time-resolved movement probability within ± 10 s and evaluated departure from chance using percentile envelopes from 1,000 time-shuffled surrogate series (99% confidence bounds).

Across infants, the probability of limb movement showed a sharp elevation centered on vocal onset and exceeded the surrogate envelope, indicating time-locked vocal–motor coupling. Above-chance elevations were concentrated in the window from ~ 2 s before the onset. In state-stratified curves, Neutral and Fussy exceeded the envelope, whereas Cry remained within chance bounds. Peak latency shifted progressively later from Neutral to Fussy to Cry, consistent with weaker and later coordination under higher arousal.

These results indicate that by three months, infants already exhibit spontaneous vocal-motor coupling outside periods of sustained crying. The rise prior to vocal onset suggests that ongoing limb activity may facilitate vocal initiation, consistent with a sensorimotor scaffold for early vocal learning. In the absence of elevated arousal, precise temporal coupling is prominent, underscoring emerging self-regulatory control may be a key modulator of early vocal-motor coordination.

PB-43 Exploring the role of reasoning in knowledge acquisition: How Knowledge of Alternatives Shapes Thinking

Ana Martin-Salguero¹, Carlo Reverberi², Oliver Sussman³, Christophe Pallier¹, Luca Lorenzo Bonatti⁴

¹NeuroSpin (Cognitive Neuroimage Unit, Paris), France; ²University of Milano Bicocca, Italy; ³Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Germany; ⁴ICREA & University Pompeu Fabra, Spain

Our knowledge on the nature and basic processes of reasoning remains limited^{1,2}. One fundamental question concerns how ambiguous information is represented when multiple options are possible³⁻⁶. Here, we investigate disjunction elimination, an essential reasoning process. We designed visual scenes, some of which contained a puzzle solvable through disjunctive inference. In them, two cards with identical backs and distinct faces, were introduced, later shuffled and rotated in turns. We manipulated the cards side orientation at three critical moments evoking mental representations of potential logical value: when cards were introduced (i.e., “A and B on stage” vs “I don’t know any identity”); when the first card rotated and further logical representations could be constructed (i.e., “That’s an A”, vs. “That card may be either A or B”, or “I don’t know the identity”); and when the

second card rotated and an inference could be made (i.e., "One card is A, so the other must be B") . Crossing them allowed us to compare: (1) an unknown representation generated from a restricted domain vs an unspecific unknown 'x'; (2) information derived by inference (Not A, therefore B) vs a perceptually attested fact (B is shown); (3) the strictly inferential process (Not A, therefore B) vs. the process of excluding an option without reaching a conclusion (It's not A). We report two adult studies using oculomotor measures. Pupil responses reliably distinguished logical from perceptual representations and, notably, varied systematically with both the degree and nature of uncertainty, even when the set of alternatives was not known. This suggests that ambiguous identities are spontaneously encoded, and that pupil dynamics can track processes of knowledge acquisition through inference. To further explore the nature of these representations, we are conducting an adult MEG study and adapting the paradigm for preverbal infants.

1. Martín-Salguero, A. et al. Seeing inferences: brain dynamics and oculomotor signatures of non-verbal deduction. *Scientific Reports* 13, 2341 (2023).
2. Cesana-Arlotti, N. et al. Precursors of logical reasoning in preverbal human infants. *Science* 359, 1263-1266 (2018).
3. Cesana-Arlotti, N., Varga, B. & Téglás, E. The pupillometry of the possible: an investigation of infants' representation of alternative possibilities. *Philos Trans R Soc Lond B Biol Sci* 377, 20210343 (2022).
4. Ekramnia, M., Mehler, J. & Dehaene-Lambertz, G. Disjunctive inference in preverbal infants. *iScience* 24, 103203 (2021).
5. Leahy, B. P. & Carey, S. E. The Acquisition of Modal Concepts. *Trends Cogn Sci* 24, 65- 78 (2020).
6. Bohus, K. A., Cesana-Arlotti, N., Martín-Salguero, A. & Bonatti, L. L. The scope and role of deduction in infant cognition. *Current Biology* 33, 4014-4020.e5 (2023).

PB-44 Pupillometric evidence for category and exemplar learning in 14-month-old infants

Paul Gallenkemper, Nina-Alisa Kollakowski, Ulf Liszkowski

University of Hamburg, Germany

Infants are surprised by a novel object after learning about a single object, but not after the presentation of a variety of exemplars from the same category (Quinn, Eimas & Rosenkrantz, 1993). While this effect is established with looking times, less is known about other correlates of violation of expectation (VoE), for example pupil dilation responses (PDR). As in adults, infants' PDR size should be influenced by the learning context and degrees of violation (Preuschhoff et al., 2011; Nassar et al., 2012), with larger pupil dilations caused by events deviating conceptually further from an expectation. Additionally, PDR should reduce during learning itself as an index of expectation building and the speed of the reduction could depend on the type of learning material presented (Polzer et al., 2023; Ghilardi et al., 2024).

To test pupil dynamics of learning and surprise, we showed 14-month-old infants learning phases of either single object repetitions or different objects from the same basic category and tested them

with novel objects from the same and a globally different category in a within-subject design. We expected same category test events to only cause a stronger PDR after object learning phases, but not after category learning. We expected different category test events to cause a larger PDR than same category test events after both learning phases.

PDR did not reduce across leaning in either learning condition. In test events, we found a significant interaction between learning condition and test event ($\beta = 0.12$; $t(551) = 2.60$; $p = 0.009$), indicating VoE effects to different category test events after category learning ($t(219.93) = 2.59$; $p_{adj} = 0.02$), but no VoE effects after object learning. Possible implications of this diverging result pattern between learning conditions will be discussed.

PB-45 Impact of music training on the development of early abstraction abilities

Théo Morfoisse¹, Séverine Becuwe¹, Marie Palu¹, Cassandra Potier-Watkins², Ghislaine Dehaene-Lambertz¹, Stanislas Dehaene¹

¹Cognitive NeuroImaging Unit, CEA, Inserm, Université Paris-Sud, Université Paris-Saclay, NeuroSpin Center, 91191 Gif/Yvette, France, France; ²Collège de France, 11 Place Marcelin Berthelot, 75005 Paris, France, France

Einstein is often portrayed, violin in hand, as if music were the secret key to his genius. This enduring image feeds a widespread belief: musical training sharpens the mind and enhances abilities far beyond music itself. But is this myth true? Can music training really boost children's reasoning in non-musical domains, such as mathematics and logic?

To explore this question, we conducted cross-sectional behavioral experiments with 566 children aged 4 to 8, enrolled in a musical education program, called Un Violon dans dans mon école. In half of the participating schools, children received weekly violin lessons for four years from preschool to second grade. Children in the other half, matched on socio-economic backgrounds, followed the standard curriculum without formal musical instruction. Among the 566 children, 305 attended the violin schools and 261 the control schools, distributed across the four years of the program: 90 preschoolers, 165 kindergarteners, 191 first graders, and 120 second graders.

Two first experiments examined how children encode auditory sequences and visual patterns and how they can compress them into structured data using symbolic rules (Planton et al., 2021), while a third examined their sensitivity to geometric regularities, such as parallelism (Sablé-Meyer et al., 2021). Results revealed that by first grade, children encoded and compressed complex auditory sequences within a Language of Thought (LoT), and that when confronted with quadrilaterals, children showed increasing sensitivity to geometrical regularities. Together, these results suggest a developmental transition from perceptual to symbolic reasoning as early as the start of formal schooling. However, we did not observe significant impact of musical practice on abstraction abilities across any of the domains tested. These findings suggest that the broader cognitive transfer effects of music education to non-musical domains, such as abstraction or mathematics, may be more limited than previously thought.

PB-46 Uncertainty guides learning: How children learn and revise new word meanings in ambiguity

Natalie Bleijlevens, Tanya Behne

University of Göttingen, Germany

When learning novel words, referential ambiguity is a constant part of children's learning environment. Yet it remains unclear if children are aware of the different levels of uncertainty in referent identification, and to what extent they can utilize this information. In three pre-registered studies, we assessed preschoolers' (and adults') ability to monitor their uncertainty during referential ambiguity, actively seek information to inform their word-object-mappings and update words dependent on their initial learning context.

In study 1, we asked 4-5-year-olds ($n=82$) and adults ($n=70$) to find the referents of novel words in contexts with maximal ambiguity (two novel objects), medium ambiguity (one novel and one known object, resolvable via mutual exclusivity), or minimal ambiguity (one novel object). We measured explicit and implicit markers of both uncertainty and information-seeking. Afterwards, participants faced counterevidence to their initial word-object-mappings and chose which mappings (learned in more vs. less ambiguous contexts) to update. Results show that children's (explicit and implicit) uncertainty and information-seeking increased with referential ambiguity. However, while high uncertainty during initial word-object-mappings increased adults' willingness to update, children instead updated words depending on the recency of the initial learning events.

Study 2 tested improvements in preschoolers' ($n=90$) and adults' ($n=90$) updating performance in a task that reduced potential working memory interferences. In the adapted task, children were highly successful: Not only the ambiguity of the learning context, but also children's experienced uncertainty during the initial word-object-mapping predicted later willingness to update a word.

Finally, study 3 uses eyetracking to investigate whether children who struggle with rational updating choices would seek information about the initial learning contexts to inform and potentially improve their updating. Data collection is ongoing. The complete pattern of results will inform discussions about the mental processes and active learning behaviors enabling children to learn words in the face of ambiguity.

PB-47 Egocentric ignorance understanding in children

Anna Kispal, Agnes Melinda Kovacs

Central European University, Austria

Research suggests that children attribute perceptual access based knowledge before belief. If true, they should also succeed in more complex knowledge tasks before false belief tasks. A specific type of knowledge, egocentric ignorance, refers to recognizing that someone knows something they do not. Unlike simple knowledge attribution, this requires maintaining a separate representation of another person's epistemic state, making it more similar to belief attribution. This study introduces a

novel paradigm to examine 4-year-old children's ($n = 48$) understanding of egocentric ignorance and its relationship to belief reasoning. Children participate in a detective game where an experimenter (E1) hides a bunny in one of two boxes. Another experimenter (E2) and the child either witness or do not witness the hiding. Both then place a token to indicate where they think the bunny is, with the child always acting first. E2 then votes for either the opposite box (Experiment 1) or the same box (Experiment 2). The child can revise their vote after seeing E2's choice. In the egocentric ignorance condition, the child cannot see the hiding, while E2 can. If children recognize their own egocentric ignorance, they should revise their random initial choice when E2 votes for the opposite box but not when E2 votes the same. In the false belief condition, the child is initially ignorant of bunny's location, while E2 can see the hiding. Then, E2 leaves and the boxes are swapped which is only witnessed by the child. Here, children should not revise if E2 votes for the opposite box but should revise if E2 votes the same, recognizing that E2 now holds a false belief. Results show that children did not perform better in the egocentric ignorance condition. This suggests that, in situations of egocentric ignorance, children do not attribute knowledge as readily as they do in simpler scenarios where both parties share the same information.

PB-48 To See or to Believe: Where Visual and Epistemic Perspective-Taking Intersect

Koleen McCrink, Lucia Kouri, Lia Brookhart

Barnard College - Columbia University, United States

114 3-6-year-olds were tested on a novel perspective-taking task measuring their ability to infer misunderstandings generated by seeing only one side of a multifaceted object. This multifaceted (MF) task required the child to infer knowledge based on complex visual perspective-taking skills (Level 2 Perspective). It was measured alongside a traditional FB task, wherein knowledge inferences were based on a simpler perspective-taking (Level 1 Perspective). Beyond studying this new type of perspective-taking that, to our knowledge, has not been tested, our primary goal was to see whether visual skills could be distinguished from belief reasoning skills at high and low visual complexity. L1P skills emerged early, with all ages performing above 70%. L2P skills improved later, with a jump in success rates between 3 and 4. 3-year-olds displayed lower performance on L2P compared to L1P, and children performed equally well on L1P and L2P from age 4 onwards. It wasn't until age 5 that children performed above chance FB and at a level comparable to L1P. 4-year-olds showed higher success rates on L2P compared to FB. These findings contrast with theories predicting similar age-related trends for FB and L2P. The MF task was the most difficult and its mastery emerged later than any other task in the study. FB scores being significantly higher than MF supports our hypothesis that inferring belief in complex visual scenarios poses more of a challenge than inferring belief in simpler visual contexts. Tellingly, even though a majority of children in the oldest age group could correctly identify a character's visual experience of the objects as different from their own (L2P), they struggled to use those visual skills to infer differences in knowledge. These results provide

evidence that visual perspective taking skills can be differentiated from belief reasoning skills in both simple and complex visual contexts.

PB-49 Language universals in syllable processing in infancy

Flora Chartier¹, Gonzalo Garcia De Castro¹, Laura S. Piracún-García¹, Nuria Sebastian-Galles², Chiara Santolin¹

¹Institut de Recerca Sant Joan de Deu, Spain; ²Center for Brain and Cognition, Universitat Pompeu Fabra, Spain

Syllables are one of the fundamental units of speech in early language acquisition (e.g., Bijeljac-Babic et al., 1993; Jusczyk & Aslin, 1995). The structure of a syllable such as /lik/ includes a nucleus, typically a vowel (/i/), and onset and coda, optional elements (usually consonants) located at the edges (/l/, /k/). This structure is shared by many languages and is determined by the Maximal Onset Principle (MOP) (e.g., Prince & Smolensky, 2008; Goldsmith, 2011) among other linguistic principles. MOP states that consonants are preferred at the onset of syllable: when consonants appear in the middle of a word, they are parsed with the following syllable. For example, dekli is parsed as de_kli rather than dek_li. Little is known about whether infants rely on MOP when learning language.

Here we investigated whether 6-to-10-month-old infants show spontaneous preferences for words parsed according to MOP. Infants (n=64) were presented with two word-types: MOP-following (e.g., mo_pla, de_kli) and MOP-violating (e.g., mop_la, dek_li; with separated consonants) using the Head-Turn Preference Procedure without prior familiarization. The two parsing options were implemented by a 200ms silence between syllables. Looking times for the two word-types were measured as dependent variable. A linear mixed-effect model showed a significant interaction between word type and trials ($p=.033$). Model-estimated effects revealed significant longer looking times for MOP-violating words during the first half of the experiment, which decreased towards the end (see Figure 1). Results suggest that infants discriminated between MOP-following and violating words, and prefer MOP-violating words at least in the first half of the study. Note that word types differed only acoustically, and minimally (a slight change in position of the 200-ms pause). It is plausible that infants detected such difference early on, then “overregularized” MOP-violating words (e.g., dek_li) into the correct parsing option (e.g., de_kli). This possibility needs further investigation.

PB-50 Detecting syllables at birth: an fNIRs study about the role of the Maximal Onset Principle

Gonzalo Garcia-Castro¹, Laura S. Piracún-García¹, Judit Gervain², Ana Alarcón Allen¹, Chiara Santolin¹

¹Institut de Recerca Sant Joan de Déu, Spain; ²University of Padua, Italy

Newborns preferentially parse the speech signal into syllable-sized units (Bijeljac-Babic et al., 1993; Fló et al., 2019). How they achieve this is still unclear. We investigated the role of the Maximum

Onset Principle (MOP) as a candidate mechanism for parsing syllables at birth. According to the MOP (Goldsmith et al., 2011; Prince & Smolensky, 2004), consonants are preferentially grouped at syllabic onset (located before the nucleus) instead of coda (located after the nucleus): when consonants appear in the middle of a word, as in *saklo*, they are parsed with the following syllable (as *sa_klo* rather than *sak_lo*).

We presented newborns ($n=25$; aged 9.25-50.17 hours) with three types of blocks of auditory stimuli. Standard blocks (ST) comprised five standard trials with repetitions of a MOP-following word (e.g., *sa_klo*; with consonants correctly parsed together). Segmentation cues consisted of 25ms pauses between syllables. In Deviant Word blocks (DW), two trials were standard (as above), three trials were deviant: the last item was a MOP-violating word (e.g., *sak_lo*; consonants are separated). In Deviant Syllable blocks (DS), two trials were standard, three trials were deviant, with the last item being just the first syllable of a MOP-violating word (e.g., *sak*).

Using fNIRS, we recorded newborns' brain haemodynamic response function (HRF) while listening to the three block types (Abboub et al., 2016). Preliminary analyses show that the amplitude of the HRF in ST blocks was significantly higher compared to that of DW blocks ($\beta=-0.13$, 95%CI=[-0.14, -0.12], $p<.001$). Previous studies have also reported higher amplitude HRFs for stimuli that follow phonological constraints, compared to those that violate them (Gómez et al., 2014). We also found stronger HRF in DW blocks, compared to DS blocks ($\beta=-0.02$, $SE=0$, 95%CI=[-0.02, -0.01], $p=.002$). Our results suggest that newborns are sensitive to maximal onset constraints at birth.

PB-51 Swayed by accent: The influence of informant accent on children's modal intuitions

Nazli Altinok¹, Gaye Soley²

¹Koc University, Turkey; ²University of Barcelona, Spain

For phenomena we cannot directly observe, from viruses to historical events, we often rely on others' testimony. However, testimony is not accepted indiscriminately. From an early age, children selectively trust the testimony of native speakers over that of foreign-accented speakers (Kinzler et al., 2011). Such accent-based selective trust may particularly shape how children evaluate improbable events, as children find these difficult to distinguish from impossible ones (Shtulman & Carey, 2007). In this study, 7- and 8-year-olds ($N = 48$) heard conflicting testimonies from a native- and a foreign-accented informant about six improbable events (e.g., "riding a zebra"). Children were randomly assigned to either a Native-Positive condition (native informant endorsed, foreign informant denied) or a Native-Negative condition (roles reversed). Afterward, children judged whether each event could really happen, rated their confidence, and indicated which informant they liked more. An additional 24 children completed a baseline condition without testimony. Results showed that children judged marginally fewer events as possible ($p = .056$) and agreed more with the native-accented speaker ($p < .001$) when she provided negative rather than positive testimony. However, judgments of event likelihood did not differ significantly between Native-Positive and Baseline ($p = .272$, one-tailed) and were only marginally different between

Native-Negative and Baseline ($p = .076$, one-tailed). Finally, children tended to prefer the native-accented informant more in the Native-Negative condition (20/23) than in the Native-Positive condition (14/24), $p = .049$. Together, these findings suggest that native accent biases children toward rejecting improbable events and that their social preferences for native speakers vary with the content of testimony.

PB-52 Laughing Together, Connecting Together: How Shared Laughter Shapes Synchrony and Liking in Child Peers?

Verena Schäfer, Carolina Pletti, Stefanie Hoehl

University of Vienna, Austria

Background: Shared laughter, a salient social cue in peer interactions, may foster neural synchrony by aligning brain activity between children. Both laughter and synchrony have been linked to increased liking. While most prior research has concentrated on parent-child dyads, this study investigates whether laughter promotes neural synchrony between preschool-aged peers and how these dynamics relate to their social evaluations of one another.

Methods: Using functional near-infrared spectroscopy (fNIRS) hyperscanning, we measured neural synchrony in 5-year-old preschoolers. Same-gendered dyads ($n = 196$ children; 98 pairs) were assigned either to a laughter condition, in which they watched funny animal videos, or to a control condition with neutral videos. Neural activity in frontal and temporal regions was recorded both during the video manipulation and during a subsequent 5-minute free-play session. Liking was assessed using smiley scales, and hypotheses were analyzed using Bayesian methods.

Results: Children in the laughter condition showed increased synchrony in bilateral IFG and TPJ compared to the control condition. Following the manipulation, participants from the control condition exhibited greater left-hemisphere synchrony than those from the laughter condition. The right hemisphere showed increased synchrony during laughter but reduced synchrony afterward, and no effects were found for liking.

Conclusion: These findings provide novel evidence that neural synchrony between young peers changes depending on shared laughter experiences. By revealing condition-specific and region-specific effects across time, this study highlights the dynamic nature of synchrony processes in early peer interactions.

PB-53 Pre-stimulus predictions in infants

Francois Leroy, Shruti Naik, Marie Palu, Ghislaine Dehaene-Lambertz

Cognitive Neuroimaging Unit, INSERM, CEA, CNRS, Université Paris-Saclay, NeuroSpin center, 91191 Gif/Yvette, France, France

Many studies have used surprise signals to know whether infants are expecting some learnt pattern in the environment (1-3). However, it is unclear when these expectations begin and whether infants

are able to make predictions before stimulus onset. In our experiment, three months old infants heard a pseudo-word then viewed a picture of a face, a house or a noise pattern two seconds later. There was one pseudo-word for each visual category and the association was learnt during the training phase. We used EEG and a decoding approach to investigate the content of expectations before the onset of the visual stimulus. Classifiers trained on a late time window of visual processing were able to correctly classify categories in a time window before visual onset. This late time window suggests that decoders are extracting category-related information from a high level of sensory processing. Classification scores show that this information is pre-activated when the associated pseudoword is processed. Besides, brain predictions are top-down inferences that require some form of attention (4). We computed the temporal expectation dipole (TED), a likely precursor of the contingent negative variation potential in adults (5). We found that category-related information primarily emerged when the TED was present. The activation of information related to the upcoming visual stimulus when it is temporally expected exhibits hallmarks of a pre-stimulus prediction.

- (1) Basirat Anahita, Dehaene Stanislas, Dehaene-Lambertz Ghislaine. A hierarchy of cortical responses to sequence violations in three-month-old infants. *Cognition*, 2014.
- (2) Kouider Sid, Long Bria, Le Stanc Lorna, Charron Sylvain, Fievet Anne-Caroline, Barbosa Leonardo S. & Gelskov Sofie V. Neural dynamics of prediction and surprise in infants. *Nature Communications*, 2015.
- (3) Wetzel Nicole, Buttelmann David, Schieler Andy, Widmann Andreas. Infant and adult pupil dilation in response to unexpected sounds, *Developmental Psychobiology*, 2016
- (4) Friston Karl and Kiebel Stefan. Predictive coding under the free-energy principle, *Phil. Trans. R. Soc. B*, 2009.
- (5) Mento Giovanni & Valenza Eloisa. Spatiotemporal neurodynamics of automatic temporal expectancy in 9-month-old infants. *Scientific Reports*, 2016.

PB-54 Not all beliefs are equal: core belief updating and the self in infancy

Maria Mavridaki, Maja Blesić, Ágnes Melinda Kovács

Central European University, Austria

Young children acquire vast knowledge about the physical and social world, and also about themselves, as intentional agents related to, but distinct from others. Some beliefs, e.g. moral beliefs and beliefs about their abilities (so-called core beliefs), may closely relate to their self-concept. Are core beliefs more resistant to change, because of their link to the self-concept? Here we hypothesize that 1. moral beliefs will be more resistant to change and 2. infants with a self-concept will revise moral beliefs less, compared to infants without a self-concept.

Eighteen-month-olds completed the mirror-self recognition (Amsterdam, 1972), a moral belief-update (adapted from Geraci & Surian, 2011), and a non-core belief-update task. In the moral task, infants watched Character A distributing resources fairly to two recipients (1-Cow, 1-Donkey), while Character B distributed unfairly, (2-Cow, 1-Donkey). During an update event, a third recipient was revealed

to have been present all along near Cow, thus Character B was in fact fair, and A unfair. Infants' manual choice (A or B, prefer fair) was used to assess fairness updating. In the non-core belief task, an experimenter distributed objects into two cups. Cup A initially contained more goods, but after additional rounds, Cup B had more. We measured updating using manual choice (cup A vs. B, prefer more). Pilot data (N=10) suggested that mirror self-recognition was at ceiling (90% passers), preventing assessment of self-concept modulation. Infants updated in the non-core belief task (70%), but not in the moral belief task (30%).

The ongoing study tests 16- to 18-m.o. to have variation in mirror self-recognition. We also simplified the moral task, so that one fairness update is needed: initially both characters are unfair, and one turns fair). Preliminary data (N=6, planned 34) suggests enough variation in the mirror task. The complete dataset will be presented at the conference.

PB-55 Ostensive communication promotes symbolic object categorization: evidence from alpha-band desynchronization in 6-month-olds

Giulia Mazzi¹, Stefania Benetti¹, Dora Kampis², Eugenio Parise¹

¹Centro Interdipartimentale Mente e Cervello (CIMeC) - University of Trento, Italy; ²Department of Psychology, University of Copenhagen, Denmark

Human communication is specifically adapted for the transmission of generic knowledge, and infants' sensitivity to ostensive signals makes them the main beneficiaries of this social learning system. Ostensive-referential communication induces expectations of receiving generalizable information, and primes the representation of objects as symbols for their kind. The aim of this study is to investigate the effect of ostensive communication on objects categorization in 6-month-olds. We use a category oddball paradigm to present pictures of objects from two familiar categories. All the objects are preceded by a non-labelling phrase in infant-directed speech and a pointing gesture. We measure ERPs and EROs in response to the frequent (FC) and infrequent (IC) categories. We predict a stronger Nc component over central electrodes in response to the oddball stimuli, reflecting a heightened attentional engagement driven by the different perceptual features. Additionally, we expect a stronger alpha-band desynchronization over frontal left electrodes in response to the oddball, suggesting that the infants detected the imbalance between category symbols. In a preliminary sample (N = 14, 8F) we find moderate evidence for a stronger Nc for the oddball, between 300 and 600ms after stimulus onset (IC < FC: BF-0 = 3.78). We also find moderate evidence for an alpha-band desynchronization in response to the oddball, between 300 and 800ms after stimulus onset (IC < 0: BF-0 = 4.20) – while only anecdotal evidence for desynchronization in the frequent category (FC < 0: BF-0 = 2.65). We expect this difference to increase with additional data. Further, comparing this communicative group with a non-communicative group (i.e., stimuli presented in absence of infant-directed communication), we expect the alpha-band desynchronization to disappear in the non-communicative group, and the Nc effect to still be present, distinguishing perceptual from abstract categorization. These findings would confirm that communication induces infants to represent objects as symbols.

PB-56 Increasing children and adults' interest in learning from disagreement

Kirsten Blakey, Samuel Ronfard

University of Toronto, Canada

Disagreement is common in everyday life, from trivial preferences to debates about established facts. While challenging, disagreement can prompt reflection by revealing the limits of our knowledge. Yet people tend to dismiss conflicting beliefs and seek confirmation instead (Chalik et al., 2022; Mercier & Sperber, 2011). Benefiting from disagreement requires a willingness to engage with those who hold different views, with the intention of learning. Prior work shows that adults, more than children, recommend that others engage with someone who disagrees when beliefs concern preferences or ambiguous situations, often citing the epistemic benefits of alternative perspectives (Ransom et al., 2025). However, it is unclear how children and adults approach learning from disagreement when their own beliefs are challenged directly.

In Study 1, we tested whether appreciation of conflicting perspectives predicts seeking them for oneself. Adults ($N = 100$) and 6- to 11-year-olds ($N = 99$) indicated their own belief before watching a video of two children—one who agreed with them and one who disagreed with them. Participants then chose whom they would talk to if they wanted to learn more. Beliefs spanned four domains: factual knowledge, moral beliefs, personal preferences, and ambiguous situations. Across age groups, participants were less willing to talk to someone who disagreed when reasoning about themselves than when recommending for others when the beliefs concerned preferences and ambiguous situations (Figure 1).

In Study 2, 100 adults and 96 children were explicitly reminded of the epistemic benefits of disagreement. This intervention increased willingness to engage with disagreement, across all domains, especially for adults and older children (Figure 2). These findings suggest that valuing disagreement alone is not sufficient, reminders are needed. More broadly, they inform theories of intellectual humility by highlighting the circumstances in which children and adults are willing to engage with conflicting perspectives.

PB-57 Proto-arithmetic abilities with empty and non-empty sets

Giulia Vigna, Annamaria Porru, Daniela Lucangeli, Silvia Benavides-Varela

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

Zero is a mental and mathematical object with properties distinct from other numbers. It emerged relatively late historically (Nieder, 2016), and poses difficulties for children (e.g. Güven Akdeniz et al., 2022) as well as adults (e.g. Benavides-Varela et al., 2018). Yet, when and why these difficulties first originate remain unclear. We tackled the most basic level of this problem, exploring whether kids can operate with non-symbolic representations of Zero (i.e. empty sets) in arithmetical tasks. Ninety-four preschoolers (mean age = 68 ± 5 months, 49 females) completed non-symbolic addition and subtraction tasks on a tablet. In the addition task, children observed dots sequentially entering

an occluded box from two different directions; in the subtraction task, one group of dots entered and then one exited the box. Children had to choose which of two sets represented the dots remaining in the box (either 0, 2, 3, 6, 8, or 12- controlled for their non-numerical visual properties). Trial-level accuracy was analyzed using logistic multilevel models with random intercepts for subjects nested within testing sites. Overall, children performed significantly above chance (68.15% correct in additions; 64.4% in subtractions), and their performance varied as a function of their spatial working memory capacities. Additionally, accuracy varied with target numerosity: it was low for targets 6 and 8 (between 53% and 58% in both tasks), but significantly higher for smaller sets (69–79%). Notably, responses to empty sets (zero) were comparable to the other targets in addition (75.4%), but were significantly higher in subtraction (76.5%). These results suggest that preschoolers treat “nothing” as a valid numerical outcome and operate with empty sets like (and even better than with) other small quantities. We conclude that later difficulties with zero likely stem from cultural and educational factors to which children are exposed later in life.

PB-58 The understanding of contrastive inferences in a game-like situation in adults

Zsolt Mayer, Bálint Forgács

Eötvös Loránd University, Budapest, Hungary

The study of communicational pragmatics is crucial for understanding human inferential communication, yet current findings remain inconsistent. A case in point is contrastive inference, which depends on hypothetical comparison. For instance, hearing “I drove my blue car” suggests that the speaker owns more than one car; otherwise, specifying the colour would be redundant. Seven-year-olds can draw implicit contrastive inferences but tend to struggle in explicit tasks. It is still uncertain whether this developmental pattern reflects limits in pragmatic ability or influences from memory and executive functions.

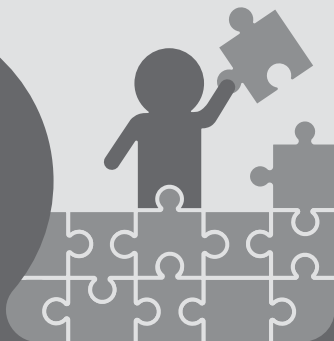
The present study investigates contrastive inferences by reducing task demands of a previously used card-game paradigm while also controlling for memory and executive functions. The new version was tested with adults before applying it to children.

Twenty-six adults played a card game, choosing one of three cards based on verbal cues. Our changes included making the third card clearly excludable and adding multiple contrastive cues in a Modified Contrastive (MC) condition (“Pick the small, brown rabbit!”), compared to the Classical Contrastive (CC) condition (“Pick the brown rabbit!”). In the baseline Genuine Guess (GG) condition, no descriptive cue was given (“Pick the rabbit!”). Participants then completed Digit Span (DS) and Backward Corsi Block (BCB) tasks, later entered as covariates in a repeated measures ANOVA.

Performance was significantly better in the MC (69%) and CC (64%) conditions than in the GG (46%) condition, though MC and CC differed only numerically. DS and BCB scores also affected performance, and their inclusion eliminated the main condition effect.

The results replicate earlier findings and indicate that the modified condition may offer a slight

performance advantage, potentially increasing sensitivity for children who find contrastive inferences challenging. Prior work, however, reported markedly higher adult accuracy (81%), highlighting the need for further study. Experiments with children are about to begin.



PC-01 When do young children differentiate between expressions of possibility and expressions of necessity?

Sorea Karimi, Leonie Baumann, Marina Proft, Tanya Behne, Hannes Rakoczy
University Göttingen, Germany

When young children develop modal reasoning competence is the subject of ongoing debate (Carey et al., 2020; Phillips & Kratzer, 2024). If they really are capable of explicit modal reasoning, they should also respond appropriately to modal language. However, the evidence is mixed: Leahy and Žalnieriūnas (2021) found four-year-olds to differentiate poorly between possibility and necessity modals, especially when evaluating necessity statements. However, other work shows three-year-olds to be competent in differentiating the two (Armstrong, 2020). To further investigate young children's modal language abilities, 75 four- to six-year-olds were tested on their understanding of necessity modals ("definitely have to") and possibility modals ("can"). We devised two new tasks, a selection task and a language-based planning task, which were embedded in a coin tossing game (adapted from Baumann et al., 2025). In the selection task, children were asked to choose the appropriate coins from an array of three. In the language-based planning task, children had to craft the appropriate coins themselves. Results of the binomial linear mixed effects model revealed the task and modal expression to be significant predictors of correct responses, with higher performances in the language-based planning task compared to the selection task ($b = -1.86, p < .001$) and in the possibility trials compared to the necessity trials ($b = 1.23, p < .001$). No interaction between task and modal expression was found ($b = 0.80, p = 0.27$). Children's response patterns seem to align with those reported by Leahy and Žalnieriūnas (2021) for the selection task but not for the language-based planning task. Further research is needed to reveal why performance decreases in the necessity trials in the selection task, whether the language-based planning task is better suited to investigate the comprehension of modal language in young children and whether the findings extend to three-year-olds.

PC-02 The emergence and development of syntactic combinatorics in early childhood

Cheslie C. Klein¹, Emiliano Zaccarella¹, Angela D. Friederici¹, Charlotte Grosse Wiesmann²

¹Max Planck Institute for Human Cognitive and Brain Sciences, Germany; ²Max Planck Institute for Human Cognitive and Brain Sciences; University of Technology Nuremberg, Germany

Syntactic combinatorics are at the core of human language, forming the basis for complex thought and our sophisticated communication system. Therefore, syntactic combinatorics constitute a crucial milestone during language acquisition. However, the age at which they develop – whether between 2 and 2.5 years or earlier – is still debated, as a comprehensive understanding of the developmental trajectory is lacking.

Thus, in the present eye-tracking study, we investigated the development of syntactic combinatorics in 9- to 15-month-old infants ($N = 152$) and 2- to 3-year-old toddlers ($N = 122$). We tested their ability to

process minimal syntactic two-word combinations in German. Specifically, we contrasted hierarchical adjective-noun phrases with morphosyntactic marking (e.g., “Rote Katze” [“red cat”]) to semantically matched coordinate phrases without such marking (e.g., “Rot und Katze” [“red and cat”]). One picture showed both concepts combined (e.g., a red cat on a colored background), and the other showed them decomposed (e.g., a different colored cat on a red background).

While 9- to 11-month-old infants did not show a preference for the combined picture when hearing the syntactic adjective-noun phrase compared to the semantic control, a subtle preference was visible in the looking patterns of the 12- to 15-month-olds. Only from 2 years, children showed a robust preference for the combined picture, with further clear improvements between 2 and 2.5 years. This indicates that although initial awareness of syntactic combinations may be present from around 1 year, significant developmental changes leading to more robust knowledge still occur during the third year of life. We are currently following up on this by re-inviting children from our infant sample at 2 to 2.5 years. We will present preliminary results from this ongoing research, which aims to provide a complete picture of how this fundamental cognitive process develops.

PC-03 Assessing Neural Correlates of Preschoolers’ Action Planning with an End-State Comfort Paradigm Using fNIRS

Lea Haerms¹, Charlotte Grosse Wiesmann², Markus Paulus³, Nicole Altvater-Mackensen⁴

¹Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig; University of Mannheim, Mannheim, Germany; ²Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig; University of Technology Nuremberg, Nuremberg, Germany; ³Ludwig-Maximilians-University Munich, Munich, Germany; ⁴University of Mannheim, Mannheim, Germany

The ability to plan goal directed actions considerably develops around the preschool years. Previous research in adults suggests that action processing recruits different subregions of the left inferior frontal cortex (IFC), specifically in BA44/ BA6 (for a recent review see Papitto et al., 2020). However, to this date, the underlying neural mechanisms of children’s action planning are largely unknown. Here, we investigate the neural correlates of children’s action planning employing an End-state comfort task (ESC) while measuring fNIRS. The ESC refers to the habit of avoiding an uncomfortable position at the end of a goal-directed movement. For example, starting an action (e.g. grasping a cup) in an uncomfortable position and finishing a second action (e.g. rotating the cup) in a comfortable position (Rosenbaum et al., 1990). We instructed N=59 children to place a cup from point A to point B while either rotating it or not. The opening of the cup could either be turned upside down or not. Participants were presented with 20 levels, four in each condition. We measured neural response using fNIRS in a 15 second planning phase, where the cup was presented but out of reach, followed by a 10 second execution phase, in which the cup was moved. We hypothesized that action planning abilities modulate the activation of regions in IFC depending on complexity, with stronger activation in the left hemisphere for rotation compared to non-rotation conditions. Our preliminary data suggest right lateralized modulation in IFC activation with stronger activation for rotation than no-rotation

conditions. The data is currently being analyzed and the final results of the full data set will be presented and discussed at the conference.

PC-04 Exploring infants' early strategies in solving label-referent relation problems: the role of ostension and the role of reasoning

Francesca Kummer¹, Kinga Anna Bohus¹, Núria Ferres Forga¹, Luca L. Bonatti²

¹Center of Brain and Cognition, Universitat Pompeu Fabra, Barcelona, ES, Spain; ²Center of Brain and Cognition, Universitat Pompeu Fabra, Barcelona, ES & ICREA, Ps. Lluís Companys 23, 08010, Barcelona, ES, Spain

The mutual exclusivity (ME) paradigm, in which infants map a novel label to a novel object when a familiar object is also present, has long been used to study early word learning. ME is often explained as generated by a novelty bias: infants simply pair a new label with a new object. However it may also signal a form of deductive reasoning involving the elimination of alternatives: if object A already has a known label, A is discarded as the referent of a new label, which is therefore assigned to object B. Adults and preschoolers use such elimination strategies in ME tasks: even when looking at the novel object while listening to the novel label, they still turn toward the known object before mapping the label to the novel object (Halberda, 2006). Studying oculomotor behavior, Bohus et al. (2023) reported analogous looking patterns ('double-checking') in 19-month-old monolinguals and bilinguals, suggesting that at that age (1) infants possess logical abilities that help them reduce uncertainty, and (2) rather than being grounded in linguistic experience (Spelke, 2003), logical reasoning supports aspects of language development.

Previous studies often found that younger infants fail ME tasks. However, Pomiechowska et al. (2021) showed that 12-month-olds can succeed when ostensive cues, such as pointing, help representing familiar objects by kind and hence foster learning.

Here, we build on this work, probing the process by which 12-month-olds succeed in ME when ostensive cues are present. We familiarize infants with a face looking at target objects, boosting its role by mixing it with "standard" test trials without ostensive cues. We control knowledge of labels by home-training infants with labels used in the experiments. We will monitor double-checking behavior. Because between 12 and 19 months infants' language knowledge grows exponentially, evidence of ME-based reasoning at 12 months would strengthen the claim that logical reasoning operates independently of language and may facilitate its acquisition. We are currently piloting the design and will present the results in the poster.

PC-05 Finding the limit of the altercentric bias with the deranged agent paradigm

Velisar Manea¹, Peter He¹, Marta Guarischi², Victoria Southgate¹

¹University of Copenhagen, Denmark; ²IIT Genoa, Italy

Testing for infant altercentrism (Southgate, 2020), Manea et al. (2023) presented 8-month-old infants with a scene in which an agent watched an object being hidden behind occluder A. After the agent exited, the object was transferred behind occluder B. At test, one occluder was lowered, revealing the object's absence: a congruent outcome at A (nothing should be there) versus an incongruent outcome at B (the ball should be there). For altercentric infants, if another's perspective overrides their own, they should misremember the object behind A and show surprise at the congruent absence. This effect was confirmed. Results in several control conditions, while in line with an altercentric bias, suggested that it is the agent's attention cues, rather than the attended object itself, that drive infants' expectations.

We thus simplified the original design to a single hiding event, where we can directly ask if infants engage in object-following against gaze-following. In this variant, the agent's attention follows the opposite direction of the object's sole motion toward occluder A, thereby cueing occluder B (we call the bizarre behavior the 'deranged agent'). Everything else was identical to the previous series, skipping any transfer phase directly to the outcomes. If infants form representations solely based on the agent's attention, they should not be surprised by the object's absence at occluder A (where the ball should be in this variant), but where the perspective cue points, at B. Another group of participants saw a control where the agent tracks the ball ('sane agent' condition). Data collection is ongoing, with results to be presented at the conference.

PC-06 Does object-directed gaze lead to agent-object binding?

Nicolas Goupil, Dora Kampis

Center for Småbørns Kognition - Institut for Psykologi of Copenhagen, Denmark

One-year-old infants spontaneously encode objects in memory, as typically evidenced by novelty responses, i.e. differential looking times on new objects presented simultaneously with familiarized objects. Social contextual information, like gaze cueing, mediates memory by shifting attention or establishing referential relations between agents and objects. To investigate the influence of social context, with possible asymmetries between memory for objects, agents, or object-agent association developing along with changes in social cognition during the second year of life, the current study tested longitudinally a cohort of 12- and 18-month-old children (N=130). At 12 months, object memory was tested in blocks varying social context at encoding (gaze cueing vs. no cueing), and retrieval (agent absent vs. present). Results showed novelty preference when familiar objects were uncued, regardless of absence ($p < .001$), or presence ($p = .001$) of agents at retrieval. Gaze cueing elicited familiarity preference when no agent was there at retrieval ($p = .036$). Further analysis will investigate

asymmetries of object memory with agent and object-agent relation memory, non-social contextual information like spatial location, as well as developmental trajectories for these effects. Altogether, this investigation will shed light on the intricate contextual influence of social agents and social cues, hypothesizing increasing precision and specificity in memory from 12 to 18 months of age.

PC-07 Is helping always a “good thing”?: Social evaluation of other’s behavior in young children and adults

Sayoko Yamaguchi, Wakako Sanefuji

Kyushu University, Japan

The ability to evaluate others’ actions is already present within the first year of life. Previous studies have shown that even infants positively evaluate helping behaviors and make judgments about others based on these evaluations (Hamlin, Wynn, & Bloom, 2007; Hamlin & Wynn, 2011). There are many studies investigating infants’ evaluations of helping behavior by showing puppet shows. However, few studies examine how more sophisticated behavioral evaluation abilities, such as recognizing that helping behavior is not always positive and adjusting evaluations of helping/hindering behavior based on details of the action being helped, develop after the toddler years. Therefore, this study examined whether young children and adults evaluate helping/hindering behaviors differently depending on the situations. We investigated children’s and adults’ evaluations of the Helper and Hinderer in the two kinds of scenarios based on the Hill paradigm (Hamlin et al., 2007): one where the character tried to do an action leading to a positive outcome (Helper-good condition) and another where the character tried to achieve an action leading to a negative outcome (Hinderer-good condition). The results showed that the evaluations of the Helper and Hinderer across the two scenarios differed between children and adults. Children consistently preferred the Helper regardless of whether the outcome of the character’s goal achievement was positive or negative. In contrast, adults evaluated the Helper positive only when helping the character led to positive outcomes for the character and did not show any preference for the Helper and Hinderer when the character’s goal achievement was negative. These findings suggested that children evaluated the act of “helping others” itself positively, regardless of the outcome of action the agent helped, whereas adults evaluated helping action by considering the action’s outcomes or influences on the character.

POSTER SESSION C
SATURDAY

PC-08 Infants’ aversion to plants: the role of affordances

Giovanni Lumicisi, Jonathan Kominsky

CEU, Austria

Plants cannot run. Their primary defense against herbivory lies in chemical compounds that deter, incapacitate, or poison consumers, while herbivores counter with specialized and energetically costly detoxification organs. For humans, who lack dedicated detoxification structures, cultural transmission

was crucial: communities transmitted knowledge about which plants could be safely handled, how to reduce their toxicity through preparation, and how to exploit them for tools, medicinal applications and, increasingly in the Upper Paleolithic, even as a dietary resource. Wertz & Wynn (2014) hypothesized that humans possess an early emerging cognitive adaptation in infancy: a social learning mechanism that delays manual exploration, and increases information-seeking from caregivers, thereby reducing the risks of engaging with potentially dangerous plants before cultural knowledge is acquired. This proposal has been supported by several behavioral experiments using an object exploration paradigm (Wertz & Wynn, 2014; Elsner & Wertz, 2019; Włodarczyk et al., 2018, 2020). Here, we investigated whether the previously reported differences between plants and other objects were in fact driven by confounding affordance levels. We conceptually replicated the experimental paradigm of Wertz and Elsner (2019) with 8- to 18-month-old infants, while explicitly controlling for affordances across object categories. Our results showed that infants still delayed manual exploration and increased social referencing for plants compared to other objects, but the difference was attenuated relative to earlier studies, supporting the interpretation that object affordances played a central role in driving the original effect.

PC-09 Object Individuation in Children (Aged 4–6) - The Influence of Hidden Properties

Laura Mareen Rösler

Germany

Object individuation is understood as the ability to identify perceptually identical items as distinct entities. While a substantial body of research has explored this phenomenon, drawing on object-file and physical-reasoning systems as explanations (Stavans et al., 2018), this view is theoretically challenged.

According to Tugendhat (1987), object individuation presupposes the use of singular terms anchored in spatiotemporal contexts. More recently, Hildebrandt et al. (2020) argued that the ability to identify feature-identical objects is closely linked to understanding their spatiotemporal information. An initial study suggests that while adults consistently use spatiotemporal information to identify feature-identical objects, 4- to 6-year-old children do so significantly less (Fenger et al., in prep.).

Our approach extends this study by conveying information about a hidden property that is of direct relevance to the children studied and by increasing motivational factors. 4- to 6-year-old children (planned sample size = 64) are presented with five visually identical wooden cubes; only one is described in a story as possessing a “special” property necessary to open a treasure chest. During the task, children are asked to ensure they can locate this cube again later. A small reward is provided to increase motivation. Analyses focus on error rates and age-related differences. Preliminary results indicate that children ($n = 20$ versus $n = 66$ children from the study by Fenger et al., in prep) do not perform better at individuating objects, even when given information about a hidden property that is directly relevant to them, and attempts are made to increase their motivation.

PC-11 When Children Choose Not to Know: The Development of Deliberate Ignorance

Linda Kerbl, Zoe Rahwan, Simon Ciranka, Ralph Hertwig
Max Planck Institute for Human Development, Germany

As adults, people often choose not to know certain information, even when it is freely available and potentially highly relevant, such as health or social information. While this phenomenon, known as “deliberate ignorance”, is well documented in adults, evidence of its development in childhood is only beginning to emerge. In this study, we examine preferences for deliberate ignorance among children aged 6 to 12 years across 13 narrated scenarios—for example, whether to find out if parents are arguing or the sex of an unborn sibling. Using Bayesian logistic regression models, we analyze how children’s age, future-oriented cognition, autonomy, and prior experiences relate to their preference not to know. We also explore whether children prefer not to know information they perceive as existentially threatening, how they justify choices not to know, and how their preferences align with parental reports of deliberate ignorance. Data collection is ongoing, but will be complete by the time of presentation. Preliminary data (n=32) show deliberate ignorance across all scenarios: children chose not to know in 35.6% of cases, and even 6-year-olds sometimes preferred ignorance. We expect these preferences to increase with age, driven in part by children’s developing future-oriented cognition—their ability to anticipate the consequences of knowing or ignoring information—and their growing autonomy in curating their information environments. We further predict that children with real-life experience with the scenarios’ content will be more likely to prefer ignorance. Children are known for their seemingly boundless curiosity, yet our preliminary data show that, even at an early age, they choose to remain ignorant of certain information. Our study offers new insights into the emergence of deliberate ignorance as a cognitive tool for navigating increasingly complex information environments.

PC-12 Deliberate Ignorance: Cognitive Correlates and Developmental Insights

Francesca Bonalumi¹, Azzurra Ruggeri²

¹Technical University Munich; Central European University, Austria; ²Technical University Munich; Central European University, Germany

Despite the growing research interest in deliberate ignorance and information avoidance, its developmental trajectory remains largely unexplored. Are children avid and curious learners no matter what, or do they display the same patterns of selective lack of information-seeking observed in adults? In two studies, we examine children’s (ages 5-17) and adults’ preferences to ignore potentially unpleasant information to capture the emergence and developmental trajectory of deliberate ignorance in various contexts, as well as the cognitive attributes potentially related to children’s desire (not) to know.

In Study 1, we presented participants with seven short questions adapted from Hertwig et al. (2021),

POSTER SESSION C
SATURDAY

which described distinct scenarios involving the choice between seeking or avoiding information. In Study 2, we further explored potential correlates of deliberate ignorance tendencies. In addition to the seven target questions, participants were presented with questions about their risk-taking and curiosity tendencies, and two personality traits ('openness to experience' and 'neuroticism') (Altgassen et al., 2024; Andreoni et al., 2020; Evans & Jirout, 2023; see Hertwig et al., 2021). Study 1 (n = 337), a linear regression analysis with z-scored age as predictor showed that with age participants generally become more inclined to ignore potentially impactful information ($t = 6.40$, $p < .001$), though with notable variation across different scenarios. Study 2 (data collection in progress, n = 179) shows a similar developmental trend, and two potential cognitive attributes – openness to experience, and curiosity – seem to negatively correlate with deliberate ignorance. Data collection is expected to conclude in autumn.

Our main finding supports previous research showing how age is a strong predictor of deliberate ignorance, and that the motivation to avoid emotional disappointment is especially vulnerable to this developmental effect. Furthermore, our findings suggest that the same attributes that predict deliberate ignorance in adulthood are also correlated with ignorance preferences in childhood.

PC-13 Is children's sense of rhythm associated with their numerical skills?

Feride Nur Haskaraca Kizilay, Mirjam Ebersbach

University of Kassel, Germany

Prior research suggests that musical training positively influences mathematical abilities (e.g., Román-Caballero et al., 2018). Musical rhythm is defined as a sequential pattern of varying tone durations within a melody, structured by a recurring pattern of beats (Frischen et al., 2022), which provides a temporal framework for organizing numerical relationships in time. Therefore, among all musical components, rhythm may be particularly relevant to numerical cognition. This potential link may arise from shared cognitive mechanisms, including temporal processing, sequencing, counting and proportional reasoning. However, empirical evidence on this connection remains limited, highlighting the need for further research.

This study aims to investigate whether intuitive rhythmic skills, specifically rhythm discrimination and reproduction, predict early numerical abilities in preschool children. Rhythm discrimination will be assessed by a task requiring children to differentiate rhythmic patterns, while reproduction will be measured through a task evaluating the replication of rhythmic sequences. Numerical cognition will be examined through tasks measuring general numerical skills such as cardinality and magnitude discrimination, and other numerical skills that are more closely related to rhythm, such as counting and proportional reasoning.

Both correlation and regression analyses will be conducted to explore potential relationships between rhythm abilities and numerical skills. To ensure robust findings, we will control for demographic factors (age, gender, SES) and cognitive variables, including intelligence, working memory, and attention. The study is currently in its early stages, with data collection set to begin soon.

By focusing on the development of rhythm abilities in early childhood, this research seeks to highlight their broader significance for cognitive development, specifically numerical cognition. Findings are expected to inform strategies that harness rhythm-based activities to support cognitive skills, offering an engaging and naturalistic approach to enhancing both musical and cognitive abilities in young children.

PC-14 What Makes a Good Question? Children's Developing Sensitivity to Information Gain

Hande Melis Altunay¹, Paula Fischer¹, Yi-Lin Li², Azzurra Ruggeri³

¹Technical University of Munich, Germany; ²Central European University, Austria; ³Technical University of Munich, Central European University, Germany

Children are active information seekers who often rely on questions to reduce uncertainty. While previous work has shown that preschoolers can identify informative questions among given alternatives, less is known about how older children weigh different determinants of informativeness. In particular, little is understood about the sensitivity of children's question-asking to differences in information gain.

The present study investigated how 7- to 14-year-old children evaluate the effectiveness of questions when selecting between two given alternatives, focusing on how three factors jointly shape children's questions: (1) expected information gain difference between two questions, (2) the difference in the number of hypotheses each question targets, and (3) the type of comparison, specifically constraint-seeking (CS) versus constraint-seeking or CS versus hypothesis-scanning (HS). A further distinction was whether the question pairs were consistent (the question targeting more hypotheses also provided higher information gain) or conflicting (the two indicators pointed to different questions). Fifty-nine children listened to 14 stories about fictional characters and everyday causal events (e.g., why a toy car stopped working). In each story, several possible reasons were introduced with their frequencies, and children were then presented with two alternative yes/no questions about the cause, and asked to choose a question to find out the reason in as few steps as possible. Preliminary analysis revealed that children's sensitivity to information gain increased with age. Across ages, performance was higher in consistent trials, whereas conflicting trials posed particular challenges, indicating that children struggled to integrate cues when they pointed to different options. While older children chose questions at chance level across conflicting trials, younger children tended to choose the one with a larger hypothesis space.

These findings suggest that school-aged children increasingly evaluate questions through a quantitative lens of informativeness, yet their developing strategies remain constrained when informational indicators conflict.

POSTER SESSION C
SATURDAY

PC-15 What Children Know About Numbers They Do Not Yet Know

Adelaide Kelsey, Yiqiao Wang, Elizabeth Spelke

Harvard University, United States

Children acquire cardinal meanings of small number words “one” through “four” in a gradual, stage-like process. For example, a three-knower can generate a set of exactly three upon hearing the word “three”, but cannot do so for “four.” Prior research shows mixed evidence on what children know about the number words beyond their knower level, with some suggesting that children may have partial understanding of number words just outside their knower level, e.g., $N+1$ for a N -knower (Barner and Bachrach, 2010; Gunderson et al., 2015). The present study tested this hypothesis using tasks in which three-year-olds ($N = 34$, Mage = 43.2 months, SDage = 3.63 months) saw two sets of objects, e.g., a target set of $N+1$ and a much larger set of 9, and were asked to identify the set matching a given number word. Children were tested on number words just outside their knower level ($N+1$, $N+2$, $N+3$) and on larger number words (“nine,” “ten,” “eleven”). Results provided no consistent evidence that N -knowers could identify $N+1$, $N+2$, or $N+3$ over a larger set. However, children did show partial understanding of larger number words, reliably choosing sets of 9, 10, or 11 over smaller alternatives. This cannot be explained by a simple preference for larger sets, as children chose randomly when asked to distinguish 10 from 20. These findings challenge long-standing stage-like models and suggest that children may build numerical knowledge in more flexible ways than previously thought.

PC-16 Becoming a member: The role of affective markers in deontic social learning

Emilie Jeanneret¹, Gökhan Gönül², Fabrice Clément¹

¹University of Neuchâtel, Switzerland; ²Cankaya University, Turkey

Social norms guide interactions from early childhood, yet how children learn them remains unclear. Emotional cues have been shown to influence social learning, but it is uncertain how they shape children’s understanding of rule legitimacy and enforcement. This study examines whether children follow a rule based on the emotional reactions of a rule-bearer (an authority figure) and whether they generalize the rule to a new agent. We also test whether the rule-bearer’s presence affects adherence. Seventy-five children (ages 3–5) were recruited. Children were randomly assigned to one of two conditions: (1) Rule-Bearer Present or (2) Rule-Bearer Absent. They watched a video where a child placed objects into two boxes. The rule-bearer reacted positively (smiling, high-pitched sound) to one box and negatively (frowning, low-pitched sound) to the other. At the end, children were asked which box should be used, which one was wrong in their school, and then helped a puppet decide where to pour objects, testing generalization of the rule. Responses were coded for rule understanding and application. Binomial and chi-square tests assessed effects of rule-bearer presence.

Children selected the correct box significantly above chance for the three questions. When looking at the two different conditions (rule-bearer present vs absent), surprisingly, they complied more

often when the rule-bearer was absent (71%) than present (61%), the latter not differing from chance. In the generalization phase, children again followed the rule above chance only significantly above chance when the adult rule-bearer was present in the video.

These findings suggest that children infer and generalize a rule based on the emotional reactions of an adult rule-bearer. Authority presence does not enhance compliance and may reduce independent adherence, underscoring the importance of emotional cues and intrinsic motivation in early social learning.

PC-17 How are learning and decision-making shaped by diverse childhood experiences?

Simon Ciranka¹, Anna Thoma¹, Charley Wu²

¹MPI for Human Development, Germany; ²University of Tübingen, Germany

Individuals who experience adversity early in life often face negative outcomes, such as reduced cognitive control, increased impulsivity, and various health issues in adulthood. Recent studies suggest that these developmental outcomes might initially be contextually appropriate responses to adverse environments where rewards are scarce and unpredictable. However, these responses can have long-term consequences on how individuals assess their potential for future success in obtaining rewards.

The search for rewards is influenced by how strongly individuals generalize from past experiences and how extensively they explore their environment. Current research suggests that adaptation to unpredictability may affect people's tendencies for generalization and exploration. It remains unclear however which extent of generalization and exploration could count as contextually appropriate responses to unpredictable environments, and how resulting strategies perform in more benign environments.

In a simulation study, we here investigate how adaptation to environments with varying statistical structures, characterized by different levels of unpredictability in spatially correlated multi-armed bandits, may lead to (mal-) adaptive search strategies when environmental characteristics change.

Specifically, this setup simulates a mismatch between adverse childhood environments and a potentially more benign adult world where previously learned strategies are no longer optimal. Predictability is altered by adjusting the autocorrelation of rewards in these environments.

The study evaluates whether strategies that seem optimal in adverse environments underperform in richer and more predictable settings. Simulation results show that adaptation to adversity limits the benefits of uncertainty-directed exploration and puts a ceiling on how much one should generalize from past to future rewards. Both strategy adaptations fail to maximize rewards in richer and more predictable environments. This simulation study underscores the need to systematically assess the statistical structure of adverse environments and examine the interaction between environments and adaptive behaviours with greater specificity.

PC-18 Working memory and language knowledge in sentence imitation: Evidence from Czech children with developmental language disorder

Klára Matiasovitsová, Filip Smolík

Institute of Psychology of CAS, Czech Republic

While sentence imitation (SI) is widely used in research and clinical assessment, the exact contributions of language skills and working memory remain debated (Riches, 2012). These contributions may vary with sentence morphosyntactic complexity and between children with and without developmental language disorder (DLD; Frizelle & Fletcher, 2015). This study examines how general language knowledge (receptive vocabulary), knowledge of syntactic structures targeted in SI (truth-value judgment task, elicited production), and working memory – phonological storage (nonword repetition) and the central executive (listening span) – relate to SI performance, measured by the number of changes. Participants were 63 Czech children with DLD (6;5–9;6) and gender- and vocabulary-matched typically developing (TD) children (3;7–6;7). Target structures were relative clauses and simple sentences with adjectival phrases, which differ in morphosyntactic complexity but share inflectional features in Czech, a highly inflectional language. Cumulative link mixed models showed that better phonological storage ($z = -3.07$, $p = .002$) and knowledge of specific syntactic structures improved SI in both groups. Central executive capacity contributed marginally less to SI performance in children with DLD than in TD children (listening span \times group: $z = 1.88$, $p = .06$), possibly reflecting difficulties in efficiently engaging the central executive during repetition or insufficient entrenchment of syntactic representations in long-term memory. General language skills also had weaker effects in children with DLD, but better vocabulary improved recall of relative clauses in these children (vocabulary \times group: $z = 2.03$, $p = .04$), highlighting the role of language knowledge in more complex structures. Working memory contributions did not differ across sentence types, possibly because morphological complexity increases central executive demands. Overall, sentence imitation in Czech, a morphologically rich language, reflects both phonological storage and central executive functioning, regardless of sentence type, and is a marker of general and specific language skills.

PC-19 Young Children's Cognitive Representations of the Family Network

Christina Steele, Ashley Thomas

Harvard University, United States

Background—Humans are born into rich social networks, often centered on family. How do children learn about these relationships? Across cultures, kinship terms convey relationship structures (e.g., a grandmother is a mother's mother), but such terms are slow and difficult to acquire. Research suggests that young children struggle to reason about family in relational terms (Landau, 1982). However, even before they can define kinship terms, children may track patterns of intimacy and connection in their environments. This study explores whether preschool-aged children can represent

relationship networks in their families (e.g., who is close to whom), even before producing accurate definitions of kinship terms.

Methods—Participants were 64 children aged 4–5 years, just before children typically succeed on definitional kinship tasks. Using the actual names of parents and grandparents in the child’s life, we asked children to select which grandparent (maternal vs. paternal) their parent would go to for comfort (a hug) or intimacy (sharing a spoon). Close physical contact is a phylogenetically ancient relationship cue recognizable from an early age (Sorokowska et al., 2021; Thomas et al., 2022). We predicted that children would expect parents to seek intimacy with their own parents (e.g., mom with maternal grandparents) rather than in-laws. As a control, children were also asked which grandparent their parent would ask for help with a skill. To ensure this could not be answered by mere association, the skill was tied to the “incorrect” intimacy match (e.g., when asking about dad, the skill came from the maternal grandparent).

Results—As predicted, children chose parents’ own parents on intimacy tasks but the other grandparent on skill tasks. These findings suggest that children track both social closeness and expertise, demonstrating early-emerging knowledge of their family’s relational structure.

PC-20 Chimpanzees consider who is able, but not who is willing to help

Hanna Schleihauf¹, Julia Fischer², Esther Herrmann³, Jan Engelmann⁴

¹Utrecht University, Netherlands; ²German Primate Center, Germany; ³University of Portsmouth, United Kingdom; ⁴University of California, Berkeley, United States

Help-seeking is an adaptive behavior, yet its strategic use in nonhuman primates remains underexplored. In three studies, we investigated whether chimpanzees selectively seek help when they need it (Study 1), whether they consider who is able (Study 2) and who is willing to help (Study 3). In Study 1, we found that chimpanzees seek help only when necessary. When faced with a problem that they could not solve independently, chimpanzees (N = 19) were significantly more likely to solicit assistance than when the task was within their capabilities ($\chi^2(1) = 30.821, p < .001$).

In Study 2, we found that chimpanzees (N = 14) take a helpers’ capabilities into account when seeking help. When access to one of two rewards was obstructed by a physical barrier, subjects preferentially chose the accessible option above chance level, both when retrieving the reward on their own (Predicted Value: 0.85, 95%CI = [0.77, 0.92]) and when they needed to ask for help to receive the reward (Predicted Value: 0.79, 95%CI = [0.72, 0.87]).

In Study 3, we found that chimpanzees (N = 14) consider their own willingness to obtain a low-cost over a high-cost reward, but not a helper’s willingness. When required to obtain a reward independently, chimpanzees showed a strong preference for a low-cost option; however, this cost-sensitivity was not evident when they solicited help from others ($\chi^2(1) = 7.989, p = .005$).

These findings indicate that chimpanzees seek assistance and consider a helper’s capability, but are not sensitive to a helper’s willingness.

PC-21 Optimal Dynamic Belief Updating in Some but Not Other 8- and 10-Year-Olds

Zixin Liu, Nina-Alisa Kollakowski, Ulf Liszkowski

University of Hamburg, Germany

Adults learn and update their beliefs in a Bayesian fashion when facing uncertainty (Bruckner et al., 2025), which deteriorates as they age (Nassar et al., 2016). While preschoolers exhibited similar yet limited abilities (Bejjanki et al., 2020), how children learn in volatile environments and whether there is a developmental trend remains unclear. This study addresses this gap using a task established for adults (Nassar et al., 2019), where participants learnt and estimated the mean of a Gaussian distribution of spatial outcomes (relative uncertainty, RU) that changed across trials (change point probability, CPP). We employ a reduced Bayesian learning model (RBM, Bruckner et al., 2025) that predicts trial-by-trial updates based on prediction error (PE) and its interaction terms with a dynamic learning rate (DynLR), calculated using CPP and RU. If children updated their belief in a Bayesian fashion, the coefficient for DynLR will differ from 0. Preliminary results ($n = 51$) indicate that DynLR is not different from 0 ($BF_{10} = 0.87$), suggesting children's learning differs from RBM. Further analysis reveal two distinct groups based on PE's coefficients: one with PE's coefficient between 0 and 1 ($n = 27$, comparable to adults) and one with PE's coefficient higher than 1 ($n = 24$). In the former group, the coefficient for DynLR is significantly different from 0, suggesting processes of optimal updating. In the latter group, this coefficient is significantly lower than 0, suggesting suboptimal updating, potentially informed by uncertainty. These subgroup differences suggest that Bayesian learning behaviours emerge optimally in some children, and sub-optimally in others. Further regression reveals that neither age group or cognitive capabilities of working memory and processing speed contributed to the differences observed, contrary to the results reported on older adults (Nassar et al., 2016). Thus, further investigation into this qualitative difference within children is warranted.

PC-23 Investigating how 14-month-old infants use emotional expressions to learn about food

Camille Rioux¹, Olivier Mascaró²

¹Inrae, France; ²CNRS, France

Food learning in early life largely relies on selective social learning. For instance, infants learn that a particular entity is edible after observing an adult eating it, but not when they handle it in other ways. If previous research has examined the effects of watching someone else eat a food on infants' food learning, the effects of other forms of food-related social information remain largely uninvestigated. Here, we asked across two Violation-of-Expectancy experiments how infants used a social signal that is ubiquitous in their life to learn about food: emotional expressions. In Experiment 1, infants saw during familiarization an adult (E1) being disgusted by the sight of a novel food A

(Disgust condition) or displaying anger towards food A (Anger condition). In both between-subject conditions, E1 expressed neutral emotion towards a novel food B. At test, all infants saw E1 eating food A (incoherent event) and B (coherent event) and we recorded infants' looking times toward these two events. In Experiment 2, infants saw during familiarization E1 being disgusted by the sight of food A and expressing neutral reaction towards food B using either ostensive communicative cues (Ostension condition) or not (No ostension Condition). At test, all infants saw a second adult (E2) eating both foods. In experiment 1, infants looked longer during the incoherent event in the Disgust condition but not in the Anger condition, revealing that they expected an adult to avoid eating food for which they have previously shown disgust but not anger. In Experiment 2, infants did not look longer during the incoherent event in neither of the two conditions. These results show selectivity in how infants use negative information about food and suggest that infants interpret disgust expressions as a person-specific subjective feeling rather than conveying information that generalizes across individuals.

PC-24 Examining Parent-Child Serve-and-Return Interaction Patterns in Web-Based Versus Traditional Delivery of the FIND Video Coaching Program

Xi Jia Zhou, Nick Haber, Philip Fisher

Stanford University, United States

Early parent-child serve-and-return interactions provide critical scaffolding for infant language development, exploration behaviors, and cognitive growth. The Filming Interactions to Nurture Development (FIND) program enhances these interactions through five evidence-based elements: sharing focus, supporting and encouraging, naming, back-and-forth interactions, and endings and beginnings. While traditionally delivered in-person, web-based adaptations have emerged after needs of the COVID-19, yet their impact on parent-child interactions and child cognitive development processes remains unexplored. This study examined how delivery modality affects parent-child interaction quality and infant cognitive engagement, with particular attention to infant and caregiver language use patterns, infant and children's exploration behaviors, and family socioeconomic influences on developmental outcomes. We analyzed 966 video clips from 76 families across four FIND implementation conditions (web-based vs. three face-to-face formats). Serve-and-return interactions were coded for duration using standardized protocols. Statistical analyses included Kruskal-Wallis tests, Dunn's post-hoc comparisons with Bonferroni correction, and mixed-effects models accounting for family clustering showed that web-based delivery significantly enhanced interaction durations compared to traditional methods ($H = 31.64, p < .001$). Mean interaction lengths were 25% longer in web-based conditions ($M = 12.93s, SD = 8.73$) versus face-to-face delivery (range: 10.25-10.51s). Post-hoc analyses confirmed significant differences between web-based and all traditional conditions (all $p < .003$), with a significant delivery method \times element interaction ($F(12,796) = 2.17, p = .012$). Additional investigations examined parent linguistic complexity and vocabulary diversity during interactions, infant visual attention patterns toward caregivers versus environmental stimuli, and

physical exploration behaviors across different activity contexts (reading, playing, eating). Preliminary analyses revealed that families' socioeconomic factors—including caregiver education, household income, and family composition—significantly moderated both parental language use complexity and infant curiosity-driven exploration behaviors, with implications for understanding how home environments shape early cognitive development trajectories.

PC-25 What babies know about ‘Stuff’—Infants’ understanding of non-solid substances

Vivian Paulun¹, Sanghee Song², Elizabeth Spelke²

¹University of Wisconsin-Madison, United States; ²Harvard University, United States

Humans interact with the physical world by handling both solid objects, such as cups or toys, and non-solid substances, such as sand or honey. Objects move as cohesive, bounded and continuous bodies, while liquids and granular materials deform, spread, and divide into parts. Infants' expectations about solid objects have been studied extensively (see Spelke, 2022), but their understanding of 'Stuff' is less clear. Some evidence suggests difficulty in reasoning about such materials (e.g., Huntley-Fenner & Carey, 2002), whereas other studies indicate that infants have different expectations about non-solid substances (Hespos, Ferry & Rips, 2009). We tested whether infants expect granular substances to behave differently from rigid objects, specifically whether they expect sand to split or stay one cohesive mass. Infants aged 4–6 months and 13–15 months (N = 54) viewed video events of computer animations. During familiarization, they saw either a rigid object or a granular substance interacting with rigid objects, demonstrating different motions (e.g., shaken, poured). In the test phase, the object/substance approached an edge and either maintained cohesion or divided into parts. We compared looking times to expected versus unexpected outcomes.

For rigid objects, both age groups looked longer when the object unexpectedly broke apart than when it remained intact. For granular substances, infants showed the opposite pattern: they looked longer when the material failed to divide. This effect was significant in the older group, and present but weaker in the younger group.

These findings indicate that by the end of the first year, infants expect granular substances to fragment upon contact, just as they expect rigid solids to remain cohesive. Even younger infants demonstrate emerging expectations of this kind. Our results suggest that core knowledge of cohesion and continuity extends beyond solid objects, shaping infants' early reasoning about the behavior of both "Things" and "Stuff."

PC-26 The development of theory of mind in deaf and hard-of-hearing children in the light of executive function and language abilities

Tímea Matuz-Budai, Beatrix Lábadi

Institute of Psychology, University of Pécs, Hungary

Research focusing on theory of mind (ToM) in deaf and hard-of-hearing children reveals that deaf children born into hearing families experience developmental delays, not only on false-belief tasks, but also in the stages preceding and following this stage of ToM development (Wellman et al., 2011). This developmental delay is not present in deaf children born into deaf families, who are able to perform on false-belief tasks as neurotypical hearing children of the same age (Wellman and Peterson, 2013). The difference between the two deaf groups is their early language experiences which has a key role in the development of ToM abilities (Peterson & Slaughter, 2006; Schick et al., 2007). In addition to language, executive functions also play an important role in ToM development. Studies of deaf and hard-of-hearing children show that differences in performance on ToM tasks cannot be explained by weaker executive functions (Meristo and Hjelmqvist, 2009; Woolfe et al., 2002). In our research, we sought to answer the question of how executive functions are related to ToM when using a less verbal task.

50 deaf and hard-of-hearing (age: 4-12 years) and 44 hearing (age: 3-6 years) children participated in our study. The two groups were matched by gender, nonverbal IQ, and executive function (cognitive flexibility, working memory, inhibitory control). To measure children's ToM abilities, the Theory of Mind Scale was used as a verbal task (Wellman & Liu, 2004) and Baron Cohen and colleagues' (1986) picture sequence task was used as a nonverbal task.

According to our results, hearing children performed significantly better on the verbal ToM task, while deaf children performed better on the nonverbal ToM task. The performance on the two ToM tasks also showed different correlations with executive function in the two groups. Our results suggest that deaf children can compensate with better attentional abilities and working memory when solving ToM tasks that do not require verbality, but this compensation does not work or works less effectively during verbal ToM tasks.

PC-27 Do children's pointing gestures elicit more animated contingent responses from caretakers?

Jekaterina Mazara

University of Passau, Germany

Pointing gestures are a milestone of early intentional communicative behavior and constitute an important part of triadic joint actions (Bakeman & Adamson, 1984). Interactions within point-mediated joint frames can help infants identify objects of verbal reference (Tomasello & Todd, 1983). Reactions to children's pointing can, thus, present important learning opportunities. Caretaker's contingent responses to infants' vocalizations have been shown to be beneficial for many aspects of young

children's linguistic development (Goldstein et al. 2003, 2009, Tamis-LeMonda et al. 2014).

This study investigates properties of pointing-contingent utterances in naturalistic contexts. We examine whether they differ in their prosodic features from other utterances, since these prosodic features might highlight certain words/constructions and facilitate learning.

We analyze caretakers' responses pointing in a large longitudinal data set of 6 Swiss children aged 2;0 - 4;0. Videos of the children's interactions with their siblings and caretakers were recorded by the parents in their own home environments and transcribed and annotated in ELAN. Pointing gestures are extracted through an automated pipeline using MediaPipe and spatial-temporal graph convolutional networks to categorize hand gestures. Following this, the caretakers' response directly following the point is extracted and analyzed according to content of speech (based on the transcriptions) and prosodic features of the utterance (latency of response, mean F0 and F0 range, mean vowel length, and intensity). To compare the speech following pointing gestures to other child-directed utterances, we use two matched samples: i) contingent responses to children's vocalizations without concurrent pointing; ii) non-contingent utterances. We control for the type of utterance (question, request, declarative).

Beyond the methodological contribution to gesture annotation in naturalistic settings, this study contributes to the growing body of research highlighting the importance of pointing in children's shaping of communicative dynamics and as drivers of opportunities for joint engagement and learning.

PC-28 Normativity in development

Antonio Scarafone

LMU Munich, Germany

Normativity permeates human life, and yet its developmental origins remain elusive. Accounts which focus on the representation of rules (e.g., Sripada & Stich 2006), seem to miss the most fundamental explanatory factors, since the conceptual resources to represent rules, in thought or talk, already presuppose rule following (e.g., Weiss 2022). On the other hand, accounts focusing on behaviour (e.g., Heyes 2023) may lack the resources to identify certain behaviours as normative, and to explain what it is to understand and represent norms.

The animating idea of this paper is to identify the key level of explanation with normative relationships, created and negotiated communicatively (broadly following Geurts 2025 and Weiss 2022). The upshot is that what makes a piece of behaviour normative is its mutually recognized potential to shape the record of the joint activity, namely, to establish what is permissible, mandatory, or impermissible. On this view, what matters is to identify when children start expressing normative attitudes, how they come to master conventions to negotiate normative relationships, and how they explore normative boundaries.

First, I review extant evidence that children express normative attitudes (e.g., by protesting or correcting), from around 18 months of age (Schmidt et al. 2019, Essler et al. 2023). Notably, children's endorsement of normative attitudes is sensitive to the authority of the demonstrator and to what is

mutually accepted, and indeed children this age typically master conventions to express acceptance and rejection (Kettner & Carpendale 2013). With respect to the genesis of these behaviours, I illustrate how ways of accepting and rejecting what others do are gradually and interactively shaped into the target conventions. Finally, I suggest that forms of teasing which incorporate elements of pretense (Reddy 2022) give infants excellent opportunities to safely experiment with the normative consequences of what is mutually accepted.

PC-29 Do preverbal infants set up mental programs to represent geometric shapes? A proof-of-concept study with 9-12-month-olds

Karthika Kamath¹, Konstantina Ladopoulou¹, Sophie Hayes¹, Paul Muhle-Karbe¹, Sarah Beck¹, Mathias Sablé-Meyer², Barbara Pomiechowska¹

¹University of Birmingham, United Kingdom; ²Sainsbury Wellcome Centre for Neural Circuits and Behaviour, University College London, United Kingdom

The development of geometric concepts is fundamental to human cognition, underpinning spatial cognition, navigation, and mastering STEM disciplines where geometry supports both theory and applications. Even without formal education, humans display sensitivity to several geometric properties: for instance, preverbal infants detect changes in angle (Dillon et al., 2020), symmetry (Bornstein et al., 1981), and size (Slater et al., 1990). Research further shows that humans (kindergarteners, adults), but not other primates, represent geometric shapes by combining geometric properties into structured, program-like mental representations (e.g., a square as 4 right angles + equal-length sides, Sablé-Meyer et al., 2021). Here, we investigated developmental origins of this combinatorial ability in preverbal infants.

We developed a novel eye-tracking intruder task. Infants (9–12 months, N = 24) viewed arrays of four stimuli containing 3 standards and 1 deviant (e.g. 3 regular squares, 1 distorted square). To assess deviant detection, we measured infants' proportion of looking at the deviant across different shapes that varied in complexity. If infants construct mental programs whose complexity reflects the complexity of represented shapes, their deviant detection performance should decrease with shape complexity. In Experiment 1, infants saw triangles, quadrilaterals, pentagons, and familiar objects. Infants detected deviants for familiar objects and squares, but not for other shapes. Notably, they discriminated squares more reliably than triangles and rhombi, suggesting sensitivity to shape complexity rather than to side number. In Experiment 2 (ongoing), we test a subset of quadrilaterals (square, rectangle, iso-trapezoid, rhombus, irregular quadrilateral) to further probe infants' sensitivity to geometric complexity.

Experiment 1 validated the intruder task and provided preliminary evidence that infants may represent geometric shape using mental programs that combine geometric properties. Extending these findings in Experiment 2 would provide further support for the idea that program induction may be an early-emerging cognitive mechanism independent from natural language acquisition.

PC-30 When do children consider the reason behind an intentional action?Anna Krämer¹, Beate Priewasser², Josef Perner³¹University of Göttingen, Germany; ²Paracelsus Medical University Salzburg, Austria; ³University of Salzburg, Austria

An action is intentional if the answer to ‘Why [did you do that]?’ gives a reason for acting (Anscombe, 1957). While studies show that infants can differentiate between intentional and unintentional actions in various contexts (e.g., Tomasello & Barton, 1994; Warneken & Tomasello, 2006; Woodward, 1998), little is known about when children start to consider the reason behind an intentional action. We administered two tasks to 99 children aged 15 to 63 months ($M = 33$, $SD = 9$): In the (acted out) sticker task, children observed an experimenter first looking into two boxes, then taking something out of one of them. Children knew that one box contained stickers, and the other one pieces of paper, but were not told about the identity of the sticker and paper box. In the (touchscreen) butterfly task, children observed an animated character, Tom, peeking behind different doors in search of a butterfly. Tom then enters one of the doors and returns with a happy expression. To test whether children consider the reason behind these intentional actions (i.e., taking something out of that box because it contained the stickers, or entering that door because the butterfly was behind it), we asked them where the stickers were, or where the butterfly was, respectively. Surprisingly, children aged 2 or younger were at chance in both tasks. Only 3- and 4-year-olds showed a preference for the box or door that the agent had previously chosen. Considering that 1-year-old infants understand intentionality (e.g., Woodward, 1998) and infer an agent’s preference for one of two characters (e.g., Liu et al., 2017), these results were rather unexpected.

PC-31 Do HRV and theta support infant learning in a social contingent context?Romane Boulanger¹, Louise Goupil², Adélaïde de Heering¹¹LuILABy, UNESCOG, CRCN, ULB Neuroscience Institute, Université libre de Bruxelles, Belgium, Belgium; ²CNRS, Université Grenoble Alpes, LPNC, Grenoble, France, France

Infants demonstrate exceptional learning abilities (Field et al., 1984), and these abilities are enhanced in social contexts. For instance, socially contingent naming, when an adult labels an object the infant is already focusing on, facilitates early learning (Goupil et al., 2024; Tomasello & Farrar, 1986). However, the exact physiological mechanisms underlying attention during social contingency remains underexplored. The present study investigates whether heart rate variability (HRV), a physiological index of sustained attention in infancy (Richards & Casey, 1991), and theta activity, a marker of free viewing attention (Goupil et al., 2024), support infant learning in a social contingent context.

To explore this, 12-month-old infants’ brain and cardiovascular activity is recorded with EEG and ECG. They are first tested using a frequency-tagging paradigm and exposed to sequences of images flickering at 6 Hz with two artificial object categories embedded at 1.2 Hz (1 in 5 items) and 1.5 Hz (1 in 4 items) (pre-intervention). During the intervention phase, they are then randomly assigned to

either a forced attention group, in which the experimenter directs their gaze to a stimulus from the novel categories, or a free viewing group, in which the infant gaze is self-directed. Infants are then taught, via pointing and naming, about the attended (6 contingent trials) or an unattended (6 non-contingent trials) stimulus. Post-intervention combines the same frequency-tagging sequences as during the pre-intervention and infants are evaluated on a preferential looking-while-listening task including the learned and novel items with the goal of evaluating learning.

If learning occurs, we predict higher theta activity during forced than free viewing attention (Goupil et al., 2024), and, critically, greater HRV during contingent than non-contingent trials. Overall, this would indicate that HRV can be used as a physiological marker supporting infant learning in a socially contingent context. Data collection is currently ongoing in infants.

PC-32 Cheating for Two: Investigating Collaborative Dishonesty in Children

Laura Tietz, Sebastian Grueneisen

Leipzig University, Germany

From a young age, children collaborate on tasks in which joint success depends on both interaction partners (e.g., Grueneisen et al., 2015; Hamann et al., 2012). Although collaboration has many positive implications, research with adults shows that collaborative tasks can also encourage dishonest behavior (Leib et al., 2021). In this preregistered study, we investigated if collaborative cheating already occurs in childhood. Eighty 5- to 8-year-old German children played 12 rounds of a sequential die-rolling game (Weisel & Shalvi, 2015), either together with a partner (collaboration condition) or individually (solo condition). In the collaboration condition, player 1 rolled a die and reported the outcome; player 2 then did the same. If both reported outcomes matched, both players won rewards according to their outcome (e.g., both players reporting a 5 resulted in five rewards each). In the solo condition, the participant's game partner was simulated by a computer producing random outcomes. As die-rolls were truly private, participants could cheat by inflating their outcome as player 1 and by dishonestly reporting a match as player 2. We hypothesized that children would be more likely to cheat in the collaborative context than when playing individually. We found no evidence for inflated outcome reports as player 1 (all $p_s \geq .296$). As player 2, children reported more matches than expected by chance in both conditions (collaboration condition: $V = 505$, $p < .001$; solo condition: $V = 261$, $p = .007$). Mixed-effects models predicting match reports revealed a significant interaction between trial and condition, $\chi^2(1) = 5.68$, $p = .017$. In the collaboration condition, the frequency of match reports indicated cheating throughout the game, whereas in the solo condition, cheating was only evident in the final two rounds. These distinct cheating trajectories suggest that collaborative contexts can motivate children to abruptly relinquish honesty in favor of joint goals compared to solo contexts in which honesty prevails for longer.

PC-34 Synchronization During Cooperation and Competition in Children

Carmel Moalem¹, Sagi Jaffe-Dax²

¹Tel Aviv University, Israel; ²Tel Aviv University, Israel

Cooperation and competition are fundamental aspects of human social interaction and help shape our ability to form relationships. Early peer interactions teach children essential skills like turn-taking, perspective-taking, and conflict resolution. When people interact, they continuously coordinate and synchronize their attention through multiple channels, including neural and gaze patterns. However, the interplay between cooperative and competitive contexts remains poorly understood, particularly in child-child interactions. This study investigates how children's brain and gaze patterns dynamically interact during cooperative versus competitive tasks, using simultaneous fNIRS hyperscanning and mobile eye tracking technology. Dyads of unacquainted children aged 7-8 will perform an identical game across three conditions: solo, cooperation, and competition, followed by a questionnaire to measure their competitiveness. We hypothesize that (1) cooperation will show greater levels of neural and gaze synchrony than competition, (2) both cooperation and competition will show greater synchrony than the control solo condition, (3) neural and gaze synchrony will be positively correlated, and (4) the more competitive child in each dyad will "lead" in the brain synchrony interactions. Our pilot study with 9 adult dyads using mobile eye tracking revealed significantly greater gaze synchrony during cooperation compared to competition ($t(8)=2.63$, $p=0.015$), demonstrating that this methodology can detect meaningful differences in social synchronization. Given these clear behavioral differences, underlying neural differences are likely to be even more pronounced, making this an ideal paradigm for investigating developmental mechanisms. These initial findings provide crucial validation that our experimental approach can capture social synchrony differences, setting the foundations to examine these behaviors in children.

PC-35 Infants' and dogs' perception of causality in launching events

Leslie-Ann Eickhoff¹, Jonathan Kominsky², Christoph Völter¹

¹University of Veterinary Medicine Vienna, Austria; ²Central European University, Austria

Detecting causality in movement patterns can be useful for many animals, as it can help predict objects' movements, while the absence of external causes can indicate animacy and therefore the presence of possible prey or predators. Research has established that infants are able to categorize Michottean launching events into causal and non-causal events based on spatiotemporal features. Initial evidence using similar methods suggests that dogs also have basic expectations of causality in launching events. To compare which spatiotemporal characteristics trigger the perception of launching events as causal in infants and dogs, we conduct an eye-tracking study. Both groups are shown animated videos of three variations of a Michottean launching event, in which ball A moves towards ball B, then stops, and ball B starts moving: a causal launching event, a gap event and a lag event. Dogs are familiarized with a video of a single ball rolling across the screen, while infants

are habituated to either the causal or gap event, before seeing all three test videos. To assess a Violation-of-Expectation effect, we analyze the baseline-corrected pupil size following the stopping of A. Additionally, we compare looking times after B stops across the conditions. We hypothesize that dogs' pupil size should be larger in the gap and lag events than the causal event. Infants' pupil size should be larger in the gap and lag events after they were habituated to the causal event, but larger in the causal event but not the lag event if they were habituated to the gap event. In addition to further establishing pupillometry as a measurement tool alongside looking time, the results will provide insights into which features support causal categorization across species. This will shed light on how the perception of causality might differ between species despite having evolved in the same Newtonian environment.

PC-36 The Effects of Action on Scene Recognition in Infants: Evidence from Pupil Dilation

Maja Blesić, Ágnes Melinda Kovács

Central European University, Austria

Extracting the gist of a scene—an abstract representation of its meaning—is central to human cognition, yet its developmental origins remain unclear. Here, we investigated whether action information supports gist extraction in 18-month-olds (N=23), by testing whether congruent actions facilitate gist recognition compared to incongruent ones.

We reasoned that if actions congruent to the scene aid gist extraction, infants should show evidence of such processing when presented with another exemplar of the same scene category. In a new three-step priming paradigm, infants first viewed an agent performing an action that was either congruent or incongruent with the subsequent scene (e.g., handwashing or eating action before a bathroom scene). After the presentation of the scene, they were shown a new exemplar of the same category in the test phase while pupil size was measured. Two categories, bathroom and kitchen, were used, each presented twice—once with a congruent and once with an incongruent action—yielding four trials in total.

If congruent actions facilitate scene gist extraction and infants can use the representation for top-down processing of the new exemplar at test—rather than simply responding to perceptual change—then pupil dilation should be greater in the congruent than in the incongruent condition. Alternatively, if pupil responses primarily reflect perceptual novelty rather than cognitive effort, reliance on gist in the congruent trials should reduce sensitivity to perceptual change, leading to reduced dilation in the congruent compared to the incongruent condition. Using generalized additive mixed models, we observed larger baseline-corrected pupil responses in congruent compared to incongruent trials ($\beta = 0.039$, $p < .001$). The increased pupil responses to the new scene exemplar in the congruent condition likely reflect additional effort required for top-down integration, suggesting that action information aids scene gist extraction in infants.

PC-37 Race Differences in Adults' Classroom Behavior Judgments

Maria Isabel Castaneda Barba, Sarah Stolp Shepherd, Celeste Kidd

University of California, Berkeley, United States

Stillness and sustained looking are often treated as evidence of attention and learning in classrooms (Fredricks et al., 2004). However, fidgeting is common and developmentally typical in school, and sustained looking during educational video viewing does not necessarily indicate better learning; children who were more attentive during a word learning task learned the least when scenes were more visually complex (da Câmara et al., 2018; Kirby, 2020; Shepherd & Kidd, 2024). Furthermore, evaluations of similar behaviors are not race-neutral: Black children, particularly boys, are more likely than White peers to be labeled disruptive and to receive harsher discipline for comparable behavior (Skiba et al., 2011; Okonofua & Eberhardt, 2015). Despite related work, to our knowledge, no study has directly tested whether adults treat stillness and sustained looking as positive cues across multiple judgments, or whether this varies by child race.

We investigate how adults interpret children's behavior during a classroom video activity and whether a child's race shapes those interpretations. Participants read vignettes describing an 8-year-old boy in a group lesson where students watched an educational video and were expected to learn from and discuss it. The child was identified as Black ("Tyrone") or White ("Alan") and was described as either sitting still with eyes on the screen or fidgeting (e.g., shifting, looking around). Participants rated perceived learning and academic prospects; attention/focus; disruptiveness; need for intervention; age-normativeness; likelihood of "troublemaker" labeling; expectations of future behavioral problems; perceived pattern (one-off vs. ongoing); developmental expectations (e.g., likely to "grow out of it"); and recommendations for traditional discipline versus developmental support. Data collection is ongoing; if these assumptions are applied differently by race, identical behaviors should elicit different judgments. If the expected trend does not appear, comparable evaluations across race will still provide informative baselines for interpreting fidgeting in screen-based lessons.

PC-38 Explaining Gender Differences in Adolescents' and Young Adults' Leadership Interests Following Experiences of Failure

Anastasiia-Lei Yang¹, Aashna Poddar², Andrea Vial¹, Andrei Cimpian²

¹New York University, United Arab Emirates; ²New York University, United States

Leadership often involves taking risks and the possibility of making public mistakes. These experiences can be especially discouraging when setbacks are met with little social support. Among adults, men report greater interest in pursuing leadership positions after experiencing failure than women do. This may be partly because women expect to—and do—receive less social support when they make mistakes in leadership roles. To examine whether this process contributes to the emerging gender gap in leadership interest during development, we assessed adolescents' and young adults'

interest in leadership roles after experiencing a relevant failure. Across two studies, participants were introduced to a hypothetical classroom-based leadership role and reported their leadership interest, self-efficacy, expectations of failure, and social support. They then imagined experiencing a failure in the role and re-evaluated their interest, as well as their expected social support from peers, family, and instructors.

In Study 1 (undergraduate students; $N = 95$; 72% women; M age = 19.7, $SD = 1.09$), women—but not men—who expected lower social support after failure reported lower interest in pursuing the role again. Leadership self-efficacy was positively related to post-failure interest for both men and women, though this relationship was stronger among men. In Study 2 (10- to 14-year-olds; $N = 175$; 51% girls), girls aged 13.5 years and older reported lower post-failure interest in leadership than boys of the same age. Both girls and boys who expected lower social support after failure were less interested in pursuing the leadership role again.

Together, these studies suggest that social support after experiencing failure is an important—but underexamined—contributor to emerging leadership interests, especially among young adult women. This research lays the foundation for developmentally appropriate interventions to create more supportive environments for women's leadership pursuits, and crucially, their failures.

PC-39 "You cannot feel color!" - Children's understanding of the relation between sensory experience and aspectual knowledge

Marina Proft, Lia Künnemann, Marlene M. Meyer, Hannes Rakoczy
Georg-August-Universität Göttingen, Germany

Children around the age of 3- to 4-year-old can identify sensory experiences such as smell or touch as the sources of knowledge about the identity of an object (e.g., O'Neill & Chong, 2001). However, only much later do they seem to understand which sensory experience leads to knowledge about which specific aspect of an object, such as its color or texture. For example, only 5- to 6-year-olds were able to correctly state that they (and others) needed to see an object to find out its color but feel it to find out its texture (O'Neill et al., 1992). The aim of the current project is to take a closer look at this modality-specific type of aspectuality understanding (Perner, 1991).

In the first part, we are interested in its robustness and generality. To this end we tested 90 3- to 5-year-olds with a task where we hid one out of four animals in a box that had feel-side and a see-side. While the 3-year-olds approached the two sides of the box randomly independent of the aspect of the animal that was asked for, 4-year-olds already competently felt inside the box when asked to find out the hidden animal's temperature and looked inside the box to find out its color. Additionally, we found significant correlations between children's performance in this box task and a task that measured children's understanding of the aspectuality of beliefs (Rakoczy et al., 2015), indicating a close relation between the development of the two forms of aspectuality understanding.

In the second part of the project, we are interested in the relation of modality-specific aspectuality understanding to metacognition. Or put differently: How and when does knowledge about aspectual

knowledge develop? The second part is currently in the pilot phase, but we expect to have first results in January.

PC-40 Here or There? Spatial Indexicals as Possible Keys to Object Individuation?

Merle Beims

Germany

Object individuation is understood as the ability to identify perceptually identical items as distinct entities. While a substantial body of research has explored this phenomenon, drawing on object-file and physical-reasoning systems as explanations (Stavans et al., 2018), this view is theoretically challenged.

Following Tugendhat (1987), object individuation presupposes singular terms anchored in spatiotemporal contexts. More recently, Hildebrandt et al. (2020) argued that the ability to identify featurally identical objects is linked to understanding their spatiotemporal information. From this perspective, spatial indexicals such as here and there may provide the linguistic basis for establishing a shared reference system independent of object features.

Spatial indexicals are among the earliest words in children's language. They mark relative distance contrasts, and can only be understood if context sensitivity, the understanding that the meaning of here / there changes, depending on the speaker's perspective, and substitution, flexibly replacing here / there, are mastered (Diessel, 2006, 2014). This understanding might shift attention away from feature-based discrimination and create a symbolic spatial coordinate system, enabling stable object individuation (Hildebrandt & Glauer, 2023).

The present study follows this line of reasoning by assessing whether performance in the spatial indexical task and the object individuation task is correlated.

A preliminary pilot test indicates that children (n = 5) tend to fix spatial indexicals to persons, rather than recognizing their context-sensitive usage. Further tests will be conducted in November and December.

PC-41 Spontaneous cognitive offloading in 3-year-olds

Julieta Medawar Dumandzic¹, Katarina Begus²

¹University of Copenhagen, Denmark; ²University of Copenhagen, Denmark

Cognitive offloading refers to the use of external tools, environmental structures, or actions to reduce internal cognitive demands (Risko & Gilbert, 2016). Through the invention and use of cognitive technologies, humans have offloaded increasingly complex tasks onto the environment, transcending the intrinsic limitations of memory and attention. These tools enable further innovations, driving open-ended technological evolution and cumulative cultural progress (Charbonneau, 2020, 2025).

Adult studies of cognitive offloading examine how task difficulty, memory load, and confidence shape reliance on external support, revealing that people offload more under high cognitive demand or low confidence, which boosts performance but can reduce later memory for offloaded information (Hu et al., 2019; Grinschgl et al., 2021). This capacity depends on metacognitive evaluations of own ability and uncertainty, and develops gradually in childhood as improvements in metacognitive control support more adaptive use of external aids. Most developmental evidence shows that younger children (4-5 years) can adopt taught strategies but rarely generate them spontaneously, whereas children 6 years and older increasingly offload independently and selectively (e.g., Armitage & Redshaw, 2022). More implicit emerging forms of offloading remain largely unexplored, leaving its development in early childhood unclear. To address this gap, we examine spontaneous offloading in 3-year-olds to see whether children engage in it, whether and how it varies between individuals, and whether cognitive offloading relates to other measures of metacognitive capacities collected in the same sample. We adapted Gilbert's (2015) intention-offloading task into a child-friendly, tablet-based version with animals, baskets, and hidden food items. Children can rely on memory or strategically offload by moving baskets early toward the correct animal at a cost. We plan to extract measures of accuracy, offloading, and adaptation to increasing difficulty, and relate them to measures of metacognition. Data collection is ongoing and will be analyzed in the months before the conference.

PC-42 Does Science Fiction Foster Creativity? A Meta-Analysis and Its Developmental Implications

Mengsi Liu¹, Sachiko Kiyokawa²

¹Keio University, Japan; ²The University of Tokyo, Japan

Creativity is a critical 21st-century skill, and its cultivation during childhood is an essential goal in education. Science fiction, with its counterfactual worlds and novel technologies, is widely assumed to stimulate imaginative processes that underpin creative thought, yet a systematic evaluation of this claim is lacking. To address this gap, the present meta-analysis synthesizes findings from five methodologically robust studies (N = 760) identified via a systematic literature search. The overall effect size was medium (SMD = 0.48); however, a robust variance estimation method indicated the effect was not statistically significant (95% CI [-0.22, 1.19], $p = .129$). Substantial heterogeneity suggests a complex relationship, likely moderated by developmental and contextual variables such as participant age, the type of activity, and the specific creativity outcome measured. While science fiction shows promise, our findings caution against a one-size-fits-all approach and call for future research to pinpoint the precise conditions under which science fiction can be an effective tool for fostering creativity.

PC-43 The neural basis of altercentric cognition and explicit false belief understanding in preschoolers

Chen Yang¹, Marie Speiger¹, Philipp Berger², Charlotte Grosse Wiesmann³

¹Max Planck Institute for Human Cognitive and Brain Sciences, Germany; ²Humboldt Science Center for Child Development (HumanKind), University of Leipzig, Germany; ³Max Planck Institute for Human Cognitive and Brain Sciences; Department of Liberal Arts and Sciences, University of Technology Nuremberg, Germany

Numerous studies show that both adults and infants exhibit altercentric biases (AB) where their judgments are influenced by incongruent visual perspective and false belief of other agents (e.g., Kovacs et al., 2010; Freundlieb et al., 2018). Explicit belief reasoning, in turn, emerges around the age of 4 (Wellman et al., 2001). This raises the question of how AB relate to emerging explicit FB reasoning at the critical preschool age. AB has been proposed to reflect implicit belief reasoning, which rely on different processes than explicit belief reasoning (Grosse Wiesmann et al, 2020). Conversely, a recent study found that children showed AB in an object search task only once they passed the explicit FB task, suggesting that AB may depend on explicit belief reasoning (Speiger et al., preprint). To investigate the processes underlying AB and their relation to explicit belief reasoning, we related cortical brain structure of children aged 3 to 5 to their performance in an altercentric search task and a traditional FB task. We reasoned that, if AB relate to explicit belief reasoning, they should be associated with the maturation of the mentalizing network (e.g., precuneus, TPJ). In contrast, if AB underly correct non-verbal action prediction in implicit FB tasks as proposed by altercentric theories (Grosse Wiesmann & Southgate, 2021), they should be related to the brain regions supporting these tasks (e.g., the SMG, Grosse Wiesmann et al., 2020).

Results showed that AB in children's search was associated with cortical maturational indices in the precuneus, also involved in explicit belief reasoning. In addition, a positive relation was observed in the supramarginal gyrus, in an area previously observed for implicit FB tasks (Grosse Wiesmann et al., 2020). Our findings suggest that the AB in the preschool age may recruit both explicit and implicit belief reasoning processes.

PC-44 Frequency tagging as a tool for research on logical reasoning

Alberto Moreno Santos¹, Luca Lorenzo Bonatti²

¹Universitat Pompeu Fabra, Spain; ²Universitat Pompeu Fabra; ICREA, Spain

Recently, research about the nature of representations underlying logical thought and their development has blossomed. While some researchers argue for the presence of natural logical abilities (Cesana-Arlotti et al., 2018, 2022; Martín-Salguero et al., 2023), others claim other processes, such as simulation building, can better explain existing data (B. Leahy et al., 2022; B. P. Leahy & Carey, 2020). Our work contributes to this debate by characterizing the representations involved in tasks, helping to adjudicate between competing views.

We designed a set of studies aiming to use periodic visual stimulation (frequency tagging) to characterize internally represented stimuli. Building on work that used this approach with eye tracker and EEG recordings in adults (Naber et al., 2013; Norcia et al., 2015) and infants (Kabdebon et al., 2022), we expect to show that frequency tagging can be used to track stimuli whose identity cannot be directly perceived, but can be determined by logical inference. In Experiment 1, we will test whether the association between a stimulus and its flickering frequency is conceptual, rather than purely perceptual. We predict pupillary and electrophysiological oscillations when a flickering stimulus (e.g., a snake) is presented and will persist when a conceptually similar (e.g., another snake, or the word 'snake') non-flickering stimulus follows immediately. Experiment 2 will assess whether these associations persist even when the presentation of each stimulus is temporally distant. Finally, Experiment 3 will test whether these oscillations emerge when subjects internally represent the flickering stimulus, without perceiving it, by deriving its identity.

These findings would advance frequency tagging as a tool for studying internal cognitive processes, especially in developmental research where participants' report is often unavailable.

We plan to apply these techniques to paradigms like Cesana-Arlotti et al's (2018), in order to better understand the representations that underlie logical thought throughout development.

REFERENCES

- Cesana-Arlotti, N., Martín, A., Téglás, E., Vorobyova, L., Cetnarski, R., & Bonatti, L. L. (2018). Precursors of logical reasoning in preverbal human infants. *Science*, 359(6381), 1263–1266. <https://doi.org/10.1126/science.aao3539>
- Cesana-Arlotti, N., Varga, B., & Téglás, E. (2022). The pupillometry of the possible: An investigation of infants' representation of alternative possibilities. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 377(1866), 20210343. <https://doi.org/10.1098/rstb.2021.0343>
- Kabdebon, C., Fló, A., de Heering, A., & Aslin, R. (2022). The power of rhythms: How steady-state evoked responses reveal early neurocognitive development. *NeuroImage*, 254, 119150. <https://doi.org/10.1016/j.neuroimage.2022.119150>
- Leahy, B., Huemer, M., Steele, M., Alderete, S., & Carey, S. (2022). Minimal representations of possibility at age 3. *Proceedings of the National Academy of Sciences*, 119(52), e2207499119. <https://doi.org/10.1073/pnas.2207499119>
- Leahy, B. P., & Carey, S. E. (2020). The Acquisition of Modal Concepts. *Trends in Cognitive Sciences*, 24(1), 65–78. <https://doi.org/10.1016/j.tics.2019.11.004>
- Martín-Salguero, A., Reverberi, C., Solari, A., Filippin, L., Pallier, C., & Bonatti, L. L. (2023). Seeing inferences: Brain dynamics and oculomotor signatures of non-verbal deduction. *Scientific Reports*, 13(1), 2341. <https://doi.org/10.1038/s41598-023-29307-3>
- Naber, M., Alvarez, G. A., & Nakayama, K. (2013). Tracking the allocation of attention using human pupillary oscillations. *Frontiers in Psychology*, 4. <https://doi.org/10.3389/fpsyg.2013.00919>
- Norcia, A. M., Appelbaum, L. G., Ales, J. M., Cottureau, B. R., & Rossion, B. (2015). The steady-state visual evoked potential in vision research: A review. *Journal of Vision*, 15(6), 4. <https://doi.org/10.1167/15.6.4>

PC-45 When should the majority rule?: Children's intuitions about majority rule voting

Hannah Hok Kim^{1,2}, Rebecca Saxe¹, Ashley J. Thomas²

¹MIT, USA; ²Harvard University, USA

Shared expectations about how people should behave play a crucial role in guiding behavior. These expectations can influence actions, even in the absence of explicit instructions. However, in some cases these shared expectations are formalized into explicit verbal or written rules. Little is known about how people think about why some expectations are implicit, while others are formalized into explicit rules. Across three preregistered experiments with U.S. adults (N = 360) and children aged 8–11 (N = 280), we investigated intuitions about when and why formal rules emerge. In Experiment 1, we examined what social conditions adults and children think lead to explicit written rules. In this study, two minimal groups varied on one of five dimensions: intergroup threat, natural threat, resource scarcity, group size, or diversity. Participants were introduced to a novel action, 'daxing', and told that while people in both groups know that no one should dax, one of these groups has a sign to remind everyone not to Dax. Adults consistently expected formal rules in larger and more diverse groups. Children consistently expected formal rules in larger groups and groups facing group threat. Experiment 2 tested whether these intuitions were driven by intuitions about mechanisms: social problems (ignorance of norms, rule defiance, and the cost of violations) and group interaction dynamics (low within-group intimacy and quibbling about norms). Across both samples, each of these mechanisms individually predicted formality intuitions (e.g., if a participant thought a more diverse town was where there was likely to be a social problem like rule defiance, they also thought the more diverse town would have a formal rule). Whereas children believed both social problems and group dynamics predicted formal rules, adults prioritized group dynamics, expecting formal rules especially when groups have low intimacy and frequently quibble about rules.

PC-46 The Impact of Executive Functions and Emotion Regulation on the Helping and Comforting Behaviors of Preschoolers

Rebeka Orbán, Cintia Bali, Melinda Pohárnok

University of Pécs, Hungary

During the preschool years, social, cognitive, and emotional development undergoes dynamic changes. Previous research has linked prosocial behavior to self-regulation, including executive functions and emotion regulation. However, this has primarily been done through teacher- or parent-report questionnaires focused on peer interactions. The present study examined two types of prosocial behavior toward an unfamiliar adult related to hot and cool EF and emotion regulation. Prosocial behavior, such as instrumental helping and comforting, was assessed in 69 children (Mage=64.97 months, SD=9.28, 28 boys) using playful dyadic tasks. To evaluate self-regulatory skills, a go/no-go task (cool EF), a resistance to temptation task (hot EF), and a

disappointment task (emotion regulation) were administered. Instrumental helping was not predicted by executive functions or control variables (age, gender). However, children who displayed positive or negative reactions to disappointment were more likely to help than those who reacted neutrally. Regarding comforting behavior, children who committed more false alarms on the go/no-go task were more likely to offer comfort. Additionally, there was significant interaction between gender and emotional reactions, suggesting that boys' and girls' comforting behavior differed depending on their emotional response to disappointment. Hit scores on the go/no-go task and age were not related to comforting. The hot executive function task could not be analyzed because only 11 children resisted temptation. These findings suggest that preschoolers' instrumental helping is linked to how they express emotions in disappointing situations. Additionally, boys with lower levels of self-regulation may show more comforting behavior toward unfamiliar adults, possibly indicating a greater tendency to engage in challenging situations.

PC-47 Novel, Uncertain, or Surprising? Young Children's Exploration When Simultaneously Facing Different Curiosity Triggers

Kai-Xuan Chai¹, Yi-Lin Li², Laura Ziemann¹, Azzurra Ruggeri³

¹Department of Educational Sciences, School of Social Sciences and Technology, Technical University of Munich, Germany; ²Department of Cognitive Science, Central European University, Vienna, Austria; ³Department of Educational Sciences, School of Social Sciences and Technology, TUM; Department of Cognitive Science, CEU, Vienna, Germany

Is children's curiosity a response to novelty, to surprise, or against uncertainty? Are these triggers all the same? How does the balance among these triggers change developmentally? To address these questions, we invited 4- to 6-year-olds to explore three card dispensers, each loaded with a predetermined sequence. Children could freely choose each dispenser and explore, but once they switched to a new one, they could not return. Before exploring, they received information about the possible card colors (sample space, SS) and the proportion of cards of each color (probability distribution, PD), and they practiced drawing and saw three beginning cards of each deck. Each dispenser captured a distinct trigger: the Novel deck withheld both SS and PD information, preventing from forming clear predictions; the Uncertain deck revealed only one type of information, leaving children with partial knowledge and unresolved uncertainty; and the Surprising deck disclosed both information, enabling precise predictions, but were contradicted by the SS or PD information (aligned with the Uncertain deck) of actual draws seen in practice. We predicted that younger children would be most drawn to novelty and surprise, as these heuristically support the formation of new predictions. In contrast, we expected older children to prioritize uncertainty, strategically avoiding highly unpredictable or completely unknown situations to maximize information gain. Preliminary results ($n = 43$; planned 60), however, revealed a different pattern: younger children tended to explore the uncertain decks first, whereas older children preferred to begin with the surprising decks. Across ages, children showed less persistence with the novel decks, drawing fewer cards overall,

suggesting that curiosity for the completely unknown attenuates more quickly. These findings hint at a developmental shift not from “irrational” to “rational” exploration, but of different ways of managing uncertainty — from sampling ambiguity to testing the limits of violated certainty.

PC-48 Concept-based word assignment: Can infants learn spatial thematic roles?

Mariem Diané, Gergely Csibra

Central European University, Austria

This project builds on the hypothesis that the capacity to establish stand-for relations for entities that are potential symbols is available in infancy. When there is no obvious description for what a symbol stands for (e.g., no iconic match with familiar entities), infants can assign to it the thematic role the symbol plays in the context (e.g., “the middle one”). We test this prediction by assuming that infants interpret labels applied to symbols according to the concept under which they describe them (cf. Yin & Csibra, 2015).

Specifically, we test the concept of the “loner”, which describes the relative position of a symbol compared to other symbols in the display. Fourteen- to 16-month-old infants were presented with a series of stimuli, each including 4 visual objects of the same kind. Three of these objects were grouped closely together, while an additional object was positioned farther away. The visual features of the objects, as well as their absolute location in the display, varied across trials, but in each one, an animated hand pointed to the lone shape while a voice said, “Hello baby! Look, this is a [dila]! Wow, a [dila]!”

After 6 training trials, the test phase included 4 additional displays of the same kind. In two of these trials, infants were asked, “Where is the [dila]?”, and the other two, “Where is the [moge]?” (i.e., a novel label). Infants are expected to look at the loner symbol primarily when they hear the same label as during the training trials. Infants’ gaze behavior is recorded by an eye-tracker (data collection is ongoing). If confirmed, such a finding would demonstrate that infants extract novel situational roles from symbolic displays by analyzing the relation of a symbol to other symbols in their spatiotemporal arrangement.

PC-49 Varieties of Logical Representations: Oculomotor Correlates

Àlex Alemany-Muñoz¹, Ana Martin-Salguero², Luca L. Bonatti³

¹Center of Brain and Cognition, Universitat Pompeu Fabra, Barcelona, ES., Spain; ²Center of Brain and Cognition, Universitat Pompeu Fabra, ES. Cognitive Neuroimaging Unit, CEA, INSERM, Université Paris-Saclay, NeuroSpin Center, FR., Spain; ³Center of Brain and Cognition, Universitat Pompeu Fabra, Barcelona, ES. ICREA, Ps. Lluís Companys 23, 08010, Barcelona, ES., Spain

The ability to infer conclusions beyond immediate sensory input allows us to navigate ambiguities, generate, test, accept or reject hypotheses. Understanding these abilities requires describing how

the internal or external world is represented. Yet, the same situation can be represented in many ways. Here, we aimed to identify how ambiguous scenes may induce different logical representations. We explored oculomotor correlates of disjunctive (e.g., there is an a or a b) vs. quantified (there is an x) representations. While the former can code a list of individuals, increasing in complexity as cardinality increases, the latter loses specificity but provides an efficient and compact way to code a wide array of situations. In our paradigm, adapted from Cesana-Arlotti et al. (2018), an object hidden in a container may remain unknown until disambiguating evidence may allow to individuate its content by logical inference. Potential representations were manipulated by varying the number of objects (2–8) or by changing object membership to shared or unique categories. We predicted that pupil should dilate more with increased cardinality until individuals cannot be represented, inducing a change from a disjunction of singletons to a quantified representation. In Experiment 1, objects belonged to two categories, allowing grouping strategies. In Experiment 2, each object belonged to a distinct category, blocking grouping. Results suggest that increasing cardinalities prompted a shift from identity-based to variable-based representations: adults' pupil dilated more when scenes could be represented by disjunctions of 2–4 objects, but decreased relative to these scenes when there were 6–8 objects, indicating a switch to more abstract representations as working memory reached saturation. These findings suggest that adults possess different logical resources to represent scenes; that representations of a different nature can be associated with specific oculomotor signals; and that quantification might shape how representations are organized. We are currently adapting this paradigm to infants.

PC-50 Modal Reasoning Depends On WHAT Went WHERE

Peter Mazalik, Justin Halberda

Johns Hopkins University, United States

Modal Reasoning involves thinking about what is possible, necessary, or impossible. This suite of abilities matures during the preschool years, but toddlers sometimes succeed at reasoning over possibilities and sometimes fail. Does this diversity of results reflect mere variability? We propose that these mixed findings reflect a deeper distinction: toddlers fail when tested about ambiguous locations of objects (WHERE) and succeed when tested about ambiguous identities of objects (WHAT). In Experiment 1, we directly compared these forms of ambiguity using yoked tasks. In each task, toddlers had to choose a target card (the one with a bunny). In the WHAT task, toddlers knew where the cards were, but what was on each card was ambiguous. In the WHERE task toddlers knew what the cards were, but where they were located was ambiguous. Consistent with our hypothesis, toddlers succeeded at reasoning about ambiguous identities (WHAT) but failed when the ambiguity concerned location (WHERE).

Experiment 2 replicated this asymmetry in language comprehension. Using the same materials as Experiment 1, toddlers successfully mapped modal language terms like “can” and “have to” to the merely possible or necessary scenarios in the WHAT task, but not in the WHERE task.

These findings reveal a striking asymmetry in early modal reasoning between WHAT and WHERE, which reflects the relative contributions of distinct cognitive systems. These results carry broader implications for the phylogenetic and ontogenetic origins of modal reasoning. Non-human primates may yet be shown to succeed in Modal Reasoning under conditions of WHAT-ambiguity (as was shown here for toddlers) revealing deeper evolutionary continuities. The results also militate for a revision of the presumed centrality of language to the acquisition of Modal Reasoning but highlight the role of language in extending modal reasoning to location ambiguity, and perhaps many other cognitive domains.

PC-51 Sharpening Time's Arrow: A Developmental Study

Sandra Stojčić¹, Virginie van Wassenhove², Zoltan Nadasdy¹

¹ELTE PPK, Hungary; ²INSERM, NeuroSpin, France

Unlike space, time is typically conceptualized as a unidirectional flow at a constant rate. For human adults, it is natural to perceive a sequence of events as unfolding in time, and many of these events are conspicuously irreversible. A paradigmatic example is the dropping of a glass vase with a single action: once shattered, the vase cannot be reassembled into its intact state with a single action. According to classical theories of cognitive development (e.g., Piaget, 1969; Friedman, 2005), such intuitions about irreversibility form one of the foundations of the mature concept of time, often referred to as Newtonian or “absolute” time. However, the developmental trajectory of this understanding remains unclear, i.e., it is not yet known at what age children begin to conceptualize time as inherently unidirectional, or whether they initially entertain a more flexible, potentially bidirectional view of temporal flow before gradually adopting irreversibility as a fundamental feature of physical reality. The present study investigates 4- to 6-year-old children’s ability to recognize the “arrow of time” in everyday scenarios.

In total, eight video clips were played: half were shown in their natural forward sequence, and half were shown in reverse. The videos also varied by agency (presence or absence of a human agent) and plausibility (possible vs. impossible events). In addition to the binary estimation task, children completed a card-sorting task to assess whether their layout reflected the sequential order of events, whether it was congruent with orthography, and dependent on literacy skills (data collection is ongoing). Since no similar study has been conducted to investigate the onset age of the acquisition of the concept of irreversibility, this study aims to advance our understanding of the development of temporality-related concepts in early childhood.

PC-52 The Language of Belief: Cross-Linguistic Insights into Theory of Mind

Irem Ozturk Mihci, Anna Theakston, Ben Ambridge, Birsu Kandemirci

University of Manchester, United Kingdom

In Wellman and Liu's (2004) Theory of Mind (ToM) scale, Turkish children underperform relative to English-speaking children on the Diverse Beliefs (DB) task – understanding that two persons may hold different beliefs about the location of the hidden object (Ilgaz et al., 2022). This raises concerns about the linguistic and cultural validity of the DB task for Turkish speakers, as it relies on the verb think (“düşün-”) to elicit belief attribution even though there is no evidential support. Turkish, unlike English, frequently employs non-mental state expressions such as in my opinion (“ben-ce”) in belief contexts (Göksel & Kerlake, 2004).

To address this, two studies investigate how belief expressions are used in Turkish and English. Study 1 compared Turkish- and English-speaking adults' preferences among in my opinion (“ben-ce”), think (“düşün-”), and know (“bil-”) across three levels of evidence (no evidence (belief formed without any observable evidence), weak evidence (belief formed based on indirect or unreliable evidence), and strong evidence (belief formed based on directly perceivable, reliable evidence)).

Results (N = 200, 100 per language group) showed that English speakers consistently preferred think in no- and weak-evidence conditions, whereas Turkish speakers alternated between think and in my opinion. These findings suggest that while the verb think may function as the default belief marker for English-speaking adults, in my opinion may serve as an alternative belief marker for Turkish-speaking adults. Study 2 (currently ongoing) extends this investigation to Turkish-speaking children aged between 3-6, examining their choices of in my opinion, think, and know across the same three evidence conditions.

Together, these studies aim to provide empirical insight into the pragmatic function of in my opinion as a belief expression in Turkish and to contribute to the development of culturally sensitive methods for assessing belief reasoning in cross-cultural Theory of Mind research.

PC-54 Probing epistemic and non-epistemic modal reasoning in 4- and 5-year-olds

Katherine Howitt, Elizabeth Swanson, Valentine Hacquard

University of Maryland, United States

Previous studies disagree about whether children show delays in their understanding of settled but unknown possibilities (epistemic, e.g. It might be raining), compared to future, unsettled possibilities (metaphysical, e.g. It might rain) [1-7]. Our study hones in on the role of settledness while eliminating a potential confound: the need for the child to represent the experimenter's epistemic state. We find no difference in 4- and 5-year-olds' ability to prepare for epistemic vs. metaphysical possibilities.

We asked children to place trays beneath gumball machines to catch gumballs. On critical trials, the machine had green and yellow gumballs; gumballs always came out of the color-matched chute (Fig.1).

Children either placed trays before the coin was turned to select a ball (metaphysical condition) or after the coin was turned and they heard a ball drop, but couldn't see its color (epistemic condition). In both conditions, the expected adult-like response was preparing for either ball to fall, and thus placing two trays.

Children (mean age=4;11, range=4;0–5;11) saw a total of 8 critical trials, 4 epistemic. Children (N=34, target N=48) consistently placed fewer trays than adults (N=18), but neither group differed significantly by condition in number of trays placed ($p>0.05$) (Fig.2&Fig.3).

Our findings suggest that while children sometimes fail to prepare for two possibilities, this behavior is not mediated by epistemic vs. non-epistemic reasoning. This aligns with recent work questioning whether children in fact do show a cognitive delay for epistemic reasoning and language [3,5]. Prior studies that find a difference likely conflated children's epistemic reasoning abilities with task effects associated with experimenter knowledge. A follow up study (in progress) seeks to further explain when children fail and succeed at deploying their knowledge of epistemic and metaphysical possibilities.

PC-55 Attribution as a Developmental Milestone

Velisar Manea, Peter He, Victoria Southgate

University of Copenhagen, Denmark

The cognitive act of attribution is, we propose, absent in early infancy. By "attribution" we mean an inference about social agents, drawn from an individual action in a situation because of some aspect of their private data. This capacity is central to taking the intentional stance (Dennet, 1985: private data concerning the individual's mind), but is not limited to mental states. For example, when taking the institutional stance, actions suggest social roles and the norms attached to them (Jara-Ettinger & Dunham, under review). Thus, inferences about kinship, rank, property, distributive fairness qualify as attributions.

We propose that, prior to the onset of Joint Attention at about 9 months, infant social cognition does not involve reasoning about the causes of others' behavior. Moreover, the data infants attach to particular agents is (particularly) sparse, sourced from perception with little extra, and concerns mainly detection, or making use of the agent, not inference, not in model. Before the social-agent concept is online (which emerges later, cf. Spelke, 2022), infants use specialized stances to detect/classify agents (Opfer & Gelman, 2011), extract information from agents (Gergely et al., 2007) about objects in general (Csibra & Gergely, 2011), their valence (Wu et al., 2021) or instrumental actions (Csibra & Gergely, 2007), or to extract particular scene data from cues of perspective (Manea, 2023; Southgate, 2020).

Our negative proposal does not explain the incapacity of attribution in terms of general capacity limits, although models of optimal learning (Kidd et al., 2012; Poli et al., 2022) suggest the tension addressed by this proposal. I will explore the ecological demands of early development and why they may not require attribution, how existing data on goals, preferences, expected utility or false belief challenges this account, and what we think are the features of attribution that could allow us to empirically test this hypothesis.

PC-56 Development and validation of a digital, gamified version of a dyscalculia assessment tool

Veronika Konok, Regina Mezólaki, Bernadett Svraka

Hungary

Developmental dyscalculia (DD) is a prevalent and persistent learning disability, affecting approximately 3–6 % of school-aged children. Affected children often struggle with number sense, basic arithmetic operations, time comprehension, spatial reasoning, and quantity estimation, which can hinder academic performance, limit educational attainment, and negatively impact long-term well-being.

Early detection of dyscalculia is critical because it enables timely intervention. Digital testing offers a promising direction: it enables standardized, objective, large-scale data collection, which can be used for nation-wide screening. Furthermore, children can be more motivated with gamified digital tests, which can lead to increased measurement efficiency.

The aim of our study was to develop and validate a digital, gamified version of a dyscalculia assessment tool, the Pedagogical Assessment of Dyscalculia (DPV; Dékány et al., 2020), a test developed for the preschool age group. The DPV is a widely used tool by the Hungarian Pedagogical Service, designed to measure the development of number sense, operational skills, and other cognitive functions, and to support dyscalculia screening by identifying partial skill weaknesses. Among others, the test evaluates spatial orientation, mechanical calculation, number memory, understanding of quantitative relations, and the manifestation of operational skills during task performance.

We conducted a validation study comparing pre-school children's performance on the digital version compared to the original paper-and-pencil version in a within-subject design, counterbalanced for the order of the two tests. Our findings demonstrate consistent performance across the two versions, supporting the validity of the digital adaptation and its suitability for large-scale, early detection of dyscalculia.

PC-57 Intervention that promotes abstract reasoning and control-of-variables reasoning schemes improves junior-high school academic achievements

Reuven Babai, Wisam Bishara

Tel Aviv University, Israel

A key goal of junior high school biology curricula is to promote not only content knowledge but also critical thinking and systems-level reasoning, such as understanding ecosystems. Nevertheless, biology remains a challenging subject for many students. Piaget's theory suggests that abstract reasoning and control-of-variables reasoning schemes emerge during the formal operational stage, implying that students with a lower cognitive level may face particular difficulties in mastering biological understanding.

This study examined whether a short, structured cognitive intervention could enhance students'

reasoning abilities and improve learning outcomes in biology. The intervention, adapted from the Cognitive Acceleration through Science Education (CASE) program, consisted of five sessions targeting abstract reasoning and control-of-variables reasoning schemes. Participants were 263 seventh graders across six classes, with three classes randomly assigned to intervention or control groups. Prior to the intervention, students completed a general science exam and a cognitive level assessment. Following the intervention, a posttest on cell biology was administered, and later posttests on ecology and general science were conducted.

Findings showed that the five-session intervention had a significant positive effect on students' achievements in all posttests. Notably, the strongest gains were observed among students who had not yet reached the Piagetian formal operational stage, aligning with the study's theoretical rationale. In conclusion, these results emphasize the importance of considering students' cognitive developmental levels in science education. Incorporating brief, targeted cognitive acceleration activities into biology instruction can help students overcome developmental constraints and foster deeper engagement with complex scientific ideas.

PC-58 Communicative signals drive early visual responses for non-human agents in 4-month-old infants

Giulia Mazzi¹, Tibor Tausin², Alice Guerrini¹, Eugenio Parise¹

¹University of Trento, Italy; ²Department of Linguistics, University of Vienna, Cognitive Science Hub, University of Vienna, Austria

Previous works found that variability in the exchanged signal sequences in turn-taking interactions indicates information transfer as opposed to the exchange of identical signals, and induces preverbal infants to attribute communicative agency to the interacting entities. Additionally, faces preceded by infant-directed speech elicit a stronger face-specific N290 ERP response in 4-month-olds, suggesting that communicative signals generate the expectation of a communicative partner and facilitate the processing of its visual features. In the present study, we investigated whether 4-month-olds attribute communicative agency to novel, non-human agents and whether such attribution facilitates the anticipation and the processing of the agent's physical appearance—as indexed by early visual (P1: 100-200ms; N290: 200-300ms) ERP components. In the warm-up phase, we familiarised infants with two visually distinguishable dyads of unfamiliar entities: one dyad that engaged in a turn-taking exchange of variable signals (communicative condition), and one that exchanged identical signals (non-communicative condition). In the test phase, we measured ERPs in response to pictures of either the communicative or the non-communicative entities, always preceded by the congruent sound signals. In a preliminary analysis (N = 20, mean age = 140 days), we observed an enhanced visual processing in parieto-occipital electrodes (100-400 ms after stimulus onset) in response to the communicative entity, but no Nc effect over fronto-central channels (300-600 ms after onset). These results suggest that 4-month-olds' process communicative and non-communicative entities differently, as only the anticipation of the appearance of a communicative agent facilitates the early

processing of the agent's visual features. This response pattern is consistent with previous findings, which revealed that after hearing infant directed speech, 4-month-old infants showed enhanced visual processing (N290 component) to a human face, but not enhanced attentional processing (Nc component). Our results suggest the extension of previous findings to communicative non-human agents.

PC-59 Learning abstract relational terms in infancy based on cross-situational contrastive labeling

Elena Luchkina¹, Elizabeth Spelke²

¹The University of Texas at Dallas, United States; ²Harvard University, United States

Children begin comprehending and using relational terms like same and different around 2.5–3 years, despite being able to represent and generalize relational structures before their first birthday (Anderson et al., 2018). Infants as young as 15 months can also map words to abstract or non-visible referents (Luchkina & Waxman, 2025). Why, then, is acquisition of relational terms so delayed?

We hypothesized that natural input offers scarce opportunities to infer their meanings. Relational terms are polysemous and ambiguous (e.g., “same dress,” “same day,” “pick a different one”), and corpus analyses (CHILDES) revealed that caregivers seldom explicitly label relational structures. Such ambiguity may obscure the relevant dimensions of variability required for word learning.

To test whether more structured input supports relational word learning, we used contrastive, cross-situational labeling with referential cues (Figure 1). Seventy-four infants (Mage=16.11 months) participated via Children Helping Science and were assigned to one of three conditions:

Control (N=25): No familiarization, only test trials.

Simple Familiarization (N=20): 16 alternating trials labeling sets of identical or distinct images.

Complex Familiarization (N=29): Similar, but with varying set sizes, mimicking natural input ambiguity. Infants then completed four test trials (two same, two different) with novel image pairs (Figure 2). We measured the proportion of looking to the target pair.

Only infants in the Simple Familiarization condition looked to the target pair above chance on both same and different trials. Infants in Control and Complex conditions showed a preference for the “different” pair (which contains more information and is more salient) on all trials (Figure 3).

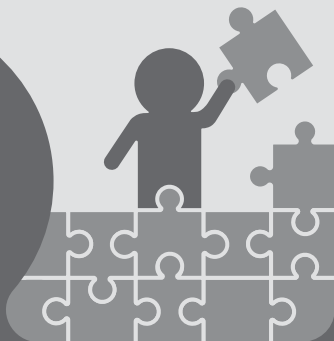
These findings show that 15-to-18-month-olds can learn relational terms and generalize them to new contexts when input is structured and contrastive, with variation limited to the relevant dimension. Future work will test whether this extends to other abstract terms (e.g., likely) and across broader generalizations.

PC-60 Exploring sensitivity to network structures in sleeping neonatesClaire Njoo-Deplante¹, Lucas Benjamin², Marie Palu¹, Fosca Al Roumi¹, Ghislaine Dehaene-Lambertz¹¹UNICOG, Neurospin, CEA Saclay, France; ²Institut des neurosciences des systèmes, Aix-Marseille Université, France

Humans make sense of the world by detecting regularities across multiple levels ranging from local statistics to global complex structures. Even in the first months of life, infants can track statistical regularities between both adjacent (Saffran et al., 1996) and non-adjacent items (Fló et al., 2019). Higher-order regularities were long thought to depend on specialized cortical circuits that are not yet developed in early infancy. However, recent work (Benjamin et al., 2023, 2024) suggests that a low-level associative learning mechanism may be sufficient to account for adult sensitivity to all levels of regularities, including higher-order ones.

To elucidate this question, we investigated whether neonates could be sensitive to complex network structures through an associative mechanism similar to the one described in adults. To do so, we passively presented 40 neonates with sequences of tones generated through a structured random walk within a two-cluster network, while recording their brain activity using a 128-channel EEG system. In a pilot study using MVPA, we first confirmed at the individual level that infants processed each tone of the sequence, by successfully decoding low-level features of the tones. Next, we revealed that the neonates indeed encoded the network structure by successfully decoding whether a transition between 2 tones remained in the same community or switched to another. Complementary analysis should confirm these findings at the group level, enabling us to assess whether a long-horizon associative mechanism supports the encoding of the network structure even in asleep neonates.

This study not only contributes to our understanding of neonates' capacities to encode complex structures, but also offers broader insights into the neural mechanisms supporting human sensitivity to higher-order regularities, potentially bridging our understanding of the learning mechanisms at different orders in a unified theoretical framework.



FOOD PLACES AROUND CEU

1. HUMMUSBAR €

Október 6. u. 19, 1051 Budapest
*Middle Eastern, Street Food,
 Vegetarian-Friendly*

2. PASTA CULTURE €

Október 6. u. 19, 1051 Budapest
Soups, Sandwiches, Pasta, Pizza

3. ISTANBUL KEBAB €

Október 6. u. 22, 1051 Budapest
Self-service, Fast food

4. DELIBABA €€

Nádor u. 19, 1051 Budapest
*Soups & Sandwiches,
 Vegetarian-Friendly*

5. BÖRZE €€-€€€

Nádor u. 23, 1051 Budapest
Hungarian

6. HILDA €€-€€€

Nádor u. 5, 1051 Budapest
Farm-to-table

7. TERV PRESSZÓ €€

Nádor u. 19, 1051 Budapest
Hungarian

8. TRATTORIA POMO D'ORO €€-€€€

Arany János u. 9, 1051 Budapest
Italian

9. RETEK BISZTRÓ €€

Nádor u. 5, 1051 Budapest
Hungarian cuisine

10. BIG FISH €€-€€€

Zrínyi u. 2, 1051 Budapest
Farm-to-Table

11. BAMBA MARHA €

Október 6. u. 6, 1051 Budapest
Burger Bar

12. PAD THAI WOKBAR €€

Október 6. u. 4, 1051 Budapest
Asian, Fast food

13. PIZZA ME €€

Sas u. 10, 1051 Budapest
Fast Food

**14. FRUCCOLA €€
(Temporarily Closed)**

Arany János u. 32, 1051 Budapest
Soups & Sandwiches

15. RETRO LANGOS €-€€

Bajcsy-Zsilinszky út 25, 1065 Bp.
Hungarian Street Food

16. ARTIZÁN BAKERY €

Hold u. 3, 1054 Budapest
*Pastry, Sandwiches,
 Vegetarian-Friendly*

17. BEST BAGEL BASILICA €€

Zrínyi u. 16, 1051, Budapest
Sandwich food

18. COOKIE BEACON BRUNCH €€

Hercegprímás u. 15, 1051, Budapest
Coffee, sweets, eggs, beacon

19 BOMBAY BUDAPEST €€

Október 6 u. 17, 1051, Budapest
Indian restaurant

20. HOPPÁ! BISTRO €-€€

Október 6 u. 15, 1051, Budapest
Hungarian restaurant with French twist

**21. QUÍ RESTAURANT & BAR
€€-€€€**

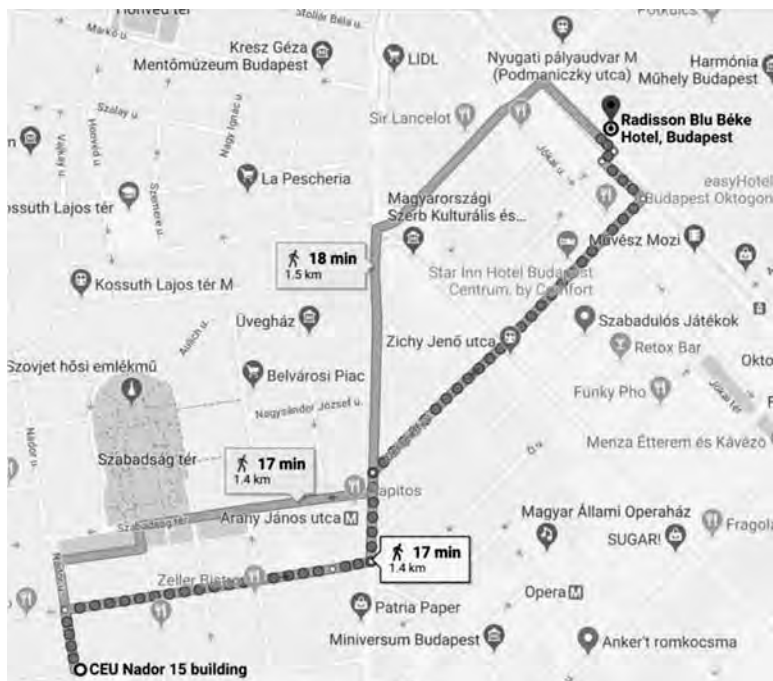
Arany János u. 13, 1051, Budapest
Thai restaurant

22. POKITO €€

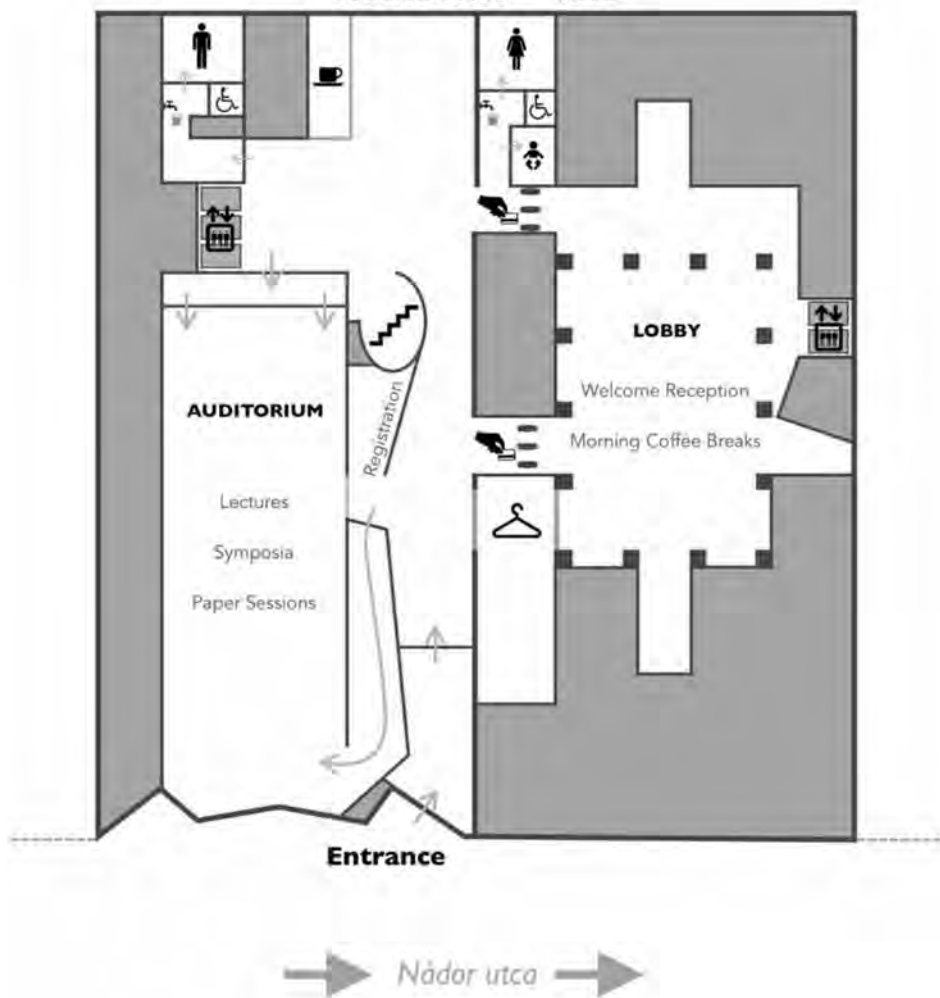
Nádor u. 17, 1051 Budapest
Hawaii superfood, poke bowls, fish

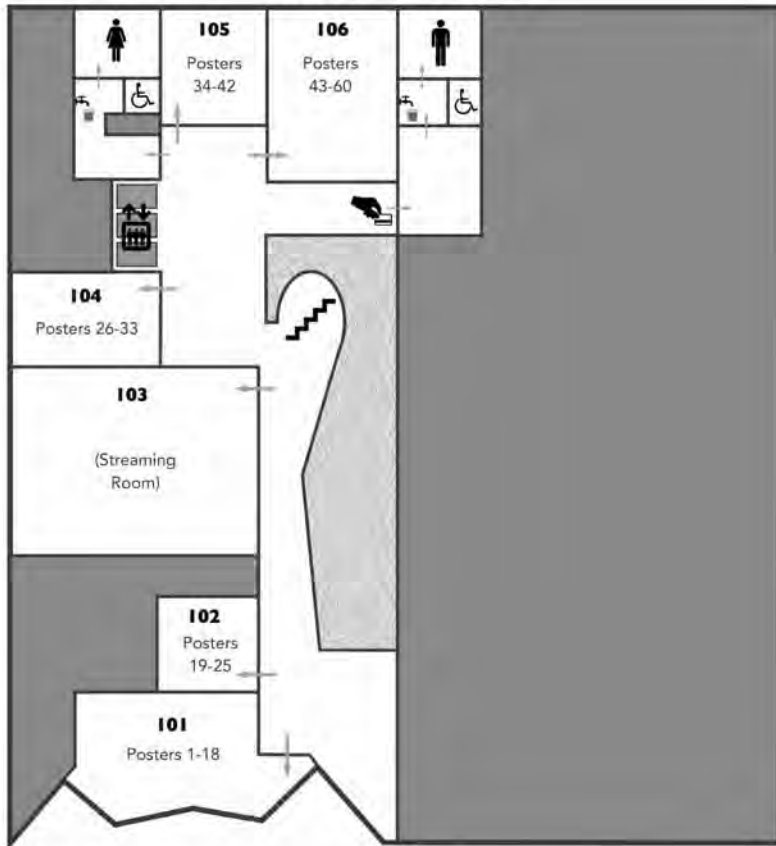
**23. CAFE BRUNCH BUDAPEST
BAZILIKA €€-€€€**

Zrínyi u. 10, 1051, Budapest
*Sandwiches, egg dishes, vegan,
 lactose, gluten free meals*



Ground Floor -- Talks



First Floor -- Posters

—————> *Nádor utca* <—————



