

**10TH LANCASTER INTERNATIONAL
CONFERENCE ON INFANT AND
EARLY CHILD DEVELOPMENT**
26-28 AUGUST 2026



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- Infant cognitive development
- Language and communication development
- Parent-child interaction and synchrony
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LOCATIONS

LCICD will take place on the Lancaster University Campus, in the **Management School** building. If you stay in town, you can comfortably reach the campus by bus to the 'Underpass' – From the underpass go up the stairs or in the lift. You will be facing Costa Coffee. Turn left until you see the left turn to the South Spine (between work in progress and the library). Walk down the south spine, past Fylde College and Engineering One. Turn right behind Engineering One, opposite the Science and Technology Building, you will see a left turn into the Management School. The registration desk will be available in the reception area.

If you are planning to park on campus, please note the University now has ANPR cameras and parking must be paid for

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-  Management School Building.
-  University Print Shop
-  Gala Dinner at Barker House



You can also use [Mazemap](#) to find your way around campus. (QR-code on the right)



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WELCOME!

Dear LCICD 2026 attendees,

Welcome to the **10th Lancaster Conference on Infant and Early Childhood Development!** We're so glad you're here to celebrate a decade of LCICD. A special thank you to our returning attendees, some of whom have been with us since the very beginning. We're also privileged to have a number of former keynote speakers joining us this year as attendees.

Over the past ten years, LCICD has grown tremendously. We now receive more than 130 submissions each year. As a result, this year we've been able to offer even more hardship fund grants to support a more inclusive and accessible conference.

LCICD continues to be a space for sharing successes (and lessons learned), asking questions, and exploring how new research is shaping our understanding of infant and early childhood development. This year, we're also excited to introduce our first mentorship scheme, and we hope it creates even more valuable opportunities for connection and learning.

We hope you enjoy your time here and leave with fresh ideas, helpful feedback, new connections, and great memories.

Eleanor Johns, Gert Westermann
and the LCICD Organising Committee



SCHEDULE DAY 1

Wednesday, 26th August 2026

8:30 - 9:30	Registration
9:30 - 9:45	Welcome
09.45 - 10:45	Keynote 1: Linda Smith, Indiana University, USA Secrets in the training data: How infant behaviour creates solutions to hard learning problems. <i>Moderator: Gert Westermann</i>
10:45 - 11:45	Talk session 1: Behaving to Learn Dimensional label learning impacts neurocognitive mechanisms of executive function <i>Presenting author: Aaron Buss</i> When Words Delay Novelty Preference: Testing predictions of the WOLVES Model in Infant Preferential Looking <i>Presenting author: Andrea Brancaccio</i> <i>Moderator: Andrea Knott</i>
11.45 - 12:15	Coffee Break
12.15 - 13:15	Talk session 2: New Tools Psychometric properties of the Global Scales for Early Development (GSED) in children under 3 years across seven countries <i>Presenting author: Gareth McCray</i> The TinyExplorer Ecosystem: Open tools for studying infants' everyday visual environments <i>Presenting author: Hana D'Souza</i> <i>Moderator: Jill Lany</i>
13.15 – 13.25	A brief introduction to our sponsor, NIRx

LCICD 2026

13.25 - 14:15	Lunch Break
14.15 - 15.45	Poster Session 1
15.45 - 16:15	Coffee Break
16.15 - 17.45	Talk Session 3 : Atypical Development Rethinking Early Communicative Delay in Preterm Children <i>Presenting author: Miriam Teresa Löffler</i> Looking for Threat: Examining Whether Infant Attention Bias and Temperament Are Longitudinally Associated with Childhood Anxiety <i>Presenting author: Frances Doyle</i> Variability in Language and Motor Development: Early Screening and Outcomes at Age Four in the Generation R Study <i>Presenting author: Jelle Kisjes</i> <i>Moderator: John Spencer</i>
19.00 onwards	Conference dinner (Barker House Farm)

SCHEDULE DAY 2

Thursday, 27th August 2026

8:30 - 9.00	Registration
9.00 - 10.00	Keynote 2: Gustaf Gredebäck, Uppsala University, Sweden Social Cognitive Development Across Cultures and Contexts: Universality, Diversity, and Adversity <i>Moderator: Marina Bazhydai</i>
10.00 - 11.00	Talk session 4: Developmental Outcomes Intrinsic neural timescales at 2 months as early markers of infant developmental trajectory <i>Presenting author: Anna Truzzi</i> Does visual working memory performance in infancy predict later executive function abilities? A longitudinal study with a longitudinal replication <i>Presenting author: John Spencer</i> <i>Moderator: Samuel Forbes</i>
11.00 - 11.30	Coffee break
11.30 -13.00	Talk session 5: Social and Emotional Development 15-month-old infants' sensitivity to norm violations across multiple forms of expressions <i>Presenting author: Katharina Tisborn</i> Giving a helping hand: Communicative origins of early helping and sharing <i>Presenting author: Sofiya Karnovska</i> Multimodal Emotion Integration in Preverbal Infants: Behavioral Patterns, Neural Responses, and the Role of Family Expressiveness <i>Presenting author: Chuchu Jia</i> <i>Moderator: Eugenio Parise</i>

13.00 - 14.00	Lunch Break (and opportunity for mentor-mentee conversations)
14.00 - 15.30	Talk session 6: Early Vocabulary Development Out of the mouth of babies: Single words serve a variety of communicative functions <i>Presenting author: Catherine Tamis LeMonda</i> From Moments to Meanings: Dynamic Multisensory Naming Experiences Shape Infants' Word Knowledge <i>Presenting author: Huanhaun Shi</i> Scale Errors Reflect Semantic Differentiation in Early Vocabulary Development <i>Presenting author: Mikako Ishibashi</i> <i>Moderator: Larissa Samuelson</i>
15.30 - 16.00	Coffee Break
16.00 - 17.00	Talk session 7: Curiosity Adapting Caregiver-Report Measures of Early Childhood Curiosity Cross-Culturally <i>Presenting author: Elena Altmann</i> Early multiscale complexity and developmental reorganisation in infant head movement <i>Presenting author: Dean D'Souza</i> <i>Moderator: Mathilde Prenevost</i>
17.00 - 19.00	Poster session 2 <i>and Drinks Reception</i>

SCHEDULE DAY 3

Friday, 28th August 2026

8.30 - 9.00	Registration
9.00 - 10.00	Keynote 3: Sam Wass, University of East London, UK Finding order in chaos: influences of environmental complexity and predictability on development <i>Moderator: Abigail Fiske</i>
10.00 - 11.00	Talk session 8: Speech Temporal Structure of Infant Vocalizations and Mother Speech at Multiple Timescales <i>Presenting author: Catalina Suarez</i> Speech in the home shapes the structure of the brain: A longitudinal investigation into language experience and myelination <i>Presenting author: Samuel Forbes</i> <i>Moderator: Dean D'Souza</i>
11.00 - 11.30	Coffee break
11.30 - 13.00	Talk session 9: Infant-Caregiver Interactions Beyond the visible and beyond here-and-now: Parents' use of internal state verbs and decontextualized language to young children with and without hearing loss <i>Presenting author: Chi-hsin Chen</i> Playful minds: Exploring the role of parental playfulness within the relation of toddlers' pretend play and executive functioning <i>Presenting author: Tobias Constien</i> Parent Speech in Free Play Is Guided by Infant Attention, but Organised by Object Familiarity <i>Presenting author: Anne-Kathrin Mahlke</i> <i>Moderator: Catherine Tamis-LeMonda</i>
13.00 - 13.15	Awards and closing remarks
13.15 13.45- 14.30	Take away boxed lunch Optional: Tour of Infant and Child Development Lab

KEYNOTE SPEAKERS

Linda Smith



Sam Wass



Gustaf Gredebäck



Secrets in the training data: How infant behavior creates solutions to hard learning problems

Linda Smith

Indiana University Bloomington

Much of the information in the world is latent, not revealed without some action by the learner. What we see, for example, depends on our posture, on where we turn our heads and eyes, what we do with our hands, where we move and how we move. In human infants and toddlers, the tight tie between momentary behavior momentary properties of experience bias the training data and structure it coherently across multiple levels: sensory, perceptual, semantic. I will present findings from our analyses of infant and toddler ego-centric audio and visual experiences collected at the scale of daily life in the home. When the efficiency of human learning exceeds current understanding of learning mechanisms theorists often posit intrinsic “inductive biases” in the learning machinery that constrain learning outcomes enabling faster and more certain learning from complex, variable, and noisy training data. Our findings suggest a different conclusion. Infant and toddler generated inputs in the everyday world are constrained by the physics and biology of space and time, by the body’s morphology, by intrinsic properties of the neural system, and by infant development. The constrained directly bias experience, making hard learning tasks, much easier. The findings provide insights to potential principles of designing training data that may support efficient learning even by machines.

Social Cognitive Development Across Cultures and Contexts: Universality, Diversity, and Adversity

Gustaf Gredebäck

Uppsala University

A central question in developmental psychology concerns the extent to which human development is shaped by universal processes versus experience-dependent pathways. Evidence from adverse contexts (including war, poverty, displacement, and family instability) demonstrates the importance of developmental experience. At the same time, many early-emerging abilities appear strikingly similar across cultures. The social domain is particularly informative in this debate because it supports learning from others while also being embedded in culturally specific practices.

In this presentation, I draw on data collected across markedly different developmental contexts, including a Swedish university town, urban and rural settings in Turkey, rural Bhutan, high-density communities in Zimbabwe, refugee populations from the Democratic Republic of Congo living in camps in Uganda and Syrian refugees living in Turkey. These populations differ substantially in education, income, child-rearing practices, and exposure to adversity, including war-related trauma, displacement, and climate-related hardship.

I focus on three aspects of social cognition: gaze following in infancy and theory of mind in early childhood and emotion processing in late childhood.

In a sample of 809 nine-month-old infants from Bhutan, Sweden, Uganda, and Zimbabwe, gaze following was highly similar across sites. Infants followed gaze regardless of cultural background, maternal well-being, or exposure to severe family adversity.

In contrast, theory of mind, assessed in 2501 children aged 3–5 years from Bhutan, Uganda, Turkey, and Zimbabwe, showed greater heterogeneity. Children in all populations demonstrated emerging theory of mind, but the developmental factors associated with performance differed across settings and no common set of predictors explained variation across sites. Notably, exposure to war-related trauma and climate-related adversity was not associated with theory of mind performance.

Yet, findings from a smaller study of 220 Syrian refugee children aged 6–18 years in Turkey indicates that this resilience does not extend equally to all aspects of social cognition. In this study, maternal post-traumatic stress was strongly associated with poorer emotional processing in children, demonstrating a link between parental post-traumatic stress, harsh parenting, and overall family vulnerability.

In sum, different aspects of social cognition appear to vary in sensitivity to experience. Early gaze following is remarkably stable across contexts, whereas theory of mind emerges through developmental pathways that differ across populations. Emotion processing, on the other hand, appear to be closely linked to parental investments and parental practices. Together, these findings suggest that the question is not whether development is universal or experience-dependent, but which aspects of development are robust across contexts, which remain sensitive to experience, and at what points in development those sensitivities emerge.

Finding order in chaos: influences of environmental complexity and predictability on development

Sam Wass

University of East London

Environments are dynamic and complex. Some children experience more predictable early life environments than others. Here, we discuss how moment-by-moment complexity and predictability in our early environments influences early development. We identify three types of environmental predictability: periodicities ('at X time intervals, Y happens'), stability ('given $state_x$, $state_{x+1}$ is known'), and contingency ('when I do X, Y happens'). We discuss how the temporal dynamics of environments may differ between individuals and the diverse developmental neural pathways through which this may influence outcomes, such as central nervous system (CNS) arousal and executive control. Finally, we discuss practical consequences and directions for future research.

PAPER TALK ABSTRACTS



Session 1

Wed 26th August, 10:45 - 11:45

Dimensional label learning impacts neurocognitive mechanisms of executive function

Aaron Buss, Alexis McCraw, Kubra Genc-Akyuz
University of Tennessee, Knoxville, United States

We assessed how early measures of neurocognitive function at 30 months of age predict executive function outcomes at 42 (n= 31) and 54 (n= 28) months. Recent empirical (McCraw, et al., 2024) and neurocomputational simulation results (Spencer et al. 2025) suggest that dimensional label learning would uniquely predict aspects of complex executive function. At each age, children completed a dimensional label comprehension ("which one is red") and production tasks ("what color is this?") for both shape and color dimensions. Children also completed a simple executive function task (Simon) in which children made a left/right button press response to a stimulus that was presented either in the center of the screen (neutral) or on the side of the screen that was congruent or incongruent with the button associated with the stimulus. At 42 and 54 months, children completed a complex executive function (the dimensional change card sort, DCCS) that required children to switch between using different sets of rules to sort cards by shape or color. During all tasks, functional near-infrared spectroscopy data were collected and advanced image-reconstruction techniques (Forbes et al., 2021) were used to align channel-based measures to a standard age-appropriate brain atlas.

Our results showed left inferior frontal cortex activity developmentally increased during dimensional label production tasks. Performance on the Simon task was associated with developmental increases in right frontal and parietal regions. Critically, performance on the complex EF task was best predicted by activity in inferior frontal cortex during label production at 30 months of age. These results highlight how domain specific learning of dimensional labels confer EF skills. These results also highlight learning-based opportunities for interventions aimed at improving executive function and other associated developmental outcomes such as academic skills.

When Words Delay Novelty Preference: Testing predictions of the WOLVES Model in Infant Preferential Looking

Andrea Brancaccio¹, John Spencer¹, Ajaz Ahmad Bhat², Samuel Forbes³, Larissa Samuelson¹

¹ University of East Anglia, Norwich, United Kingdom, ² Universiti Brunei Darussalam, Bandar Seri Begawan, Brunei Darussalam, ³ Durham University, Durham, United Kingdom

How auditory input modulates visual attention during early learning remains a central question in infant cognitive development. Mather et al. (2011) showed that, compared to a silent condition, presenting a word along with visual stimuli delayed the development of a novelty preference. One proposed explanation is that the word ‘overshadowed’ the visual stimuli, reducing the processing resources needed to develop a novelty preference. Bhat et al.’s (2023) simulations of a formal computational model, WOLVES, suggested an alternative – that a word-object association forms that draws attention toward the ‘familiar’ item thereby reducing the novelty preference.

Simulations made a novel prediction: presenting multiple novel words would not cause a familiarity preference to develop, because no single word-object mapping could form. Thus, WOLVES predicted a novelty preference like in a silent condition. This is counter to an overshadowing account which predicts that multiple words would cause a slower novelty preference due processing of more auditory information. Here we present data from two experiments testing this prediction.

We conducted two preferential looking experiments with infants aged 15 to 19 months. Participants viewed trials in which two images were presented simultaneously: one remained constant, whereas the other was novel on each trial. Three conditions were examined: a silent condition, a single-label condition in which the same auditory label accompanied the images across trials, and a multiple-label condition in which a different label was presented on each trial. In the first experiment labels were presented twice per trial. In the second experiment, trials were shorter and labels were presented once.

Results were generally consistent with model predictions. However, two aspects of the data diverged: (1) a familiarity bias emerged earlier in the empirical data than in the model, suggesting faster word learning, and (2) the familiarity bias was short-lived, suggesting that attention toward the familiar item attenuated during the trials. Additional simulations adjusting word–feature association parameters captured the earlier emergence of the familiarity bias. However, accounting for its attenuation requires further development of WOLVES. We are currently incorporating a

habituation mechanism for repeated auditory exposure to capture these findings. We discuss the implications of this extension for the theory as well as broader implications of our findings for the field of early word learning and visual exploration.

Session 2

Wed 26th August, 12:15 -13:15

Psychometric properties of the Global Scales for Early Development (GSED) in children under 3 years across seven countries

Gareth McCray¹, Rasheda Khanam², Melissa Gladstone³, Raghbir Khur⁴, Vanessa Cavalera⁵

¹ Keele, University, United Kingdom, ² Johns Hopkins University, Baltimore, United States, ³ Liverpool University, Liverpool, United Kingdom, ⁴ WHO, New York, United States, ⁵ WHO, Geneva, Switzerland

Background: Robust and comparable measures of early child development are needed for global population monitoring and programme evaluation, yet many existing instruments are difficult to implement consistently across cultures. The World Health Organization Global Scales for Early Development (GSED) were developed to address this gap. We evaluated the psychometric properties of the caregiver-reported Short Form (GSED-SF, 139 items), the directly administered Long Form (GSED-LF, 155 items), and a Combined Fit (GSED-CF), which places both forms on a common D-score scale with age-adjusted Development for Age Z-Scores (DAZ).

Methods: We analysed data from 9,235 children aged 0 to 41 months from Bangladesh, Brazil, China, Côte d'Ivoire, the Netherlands, Pakistan, and Tanzania. Concurrent validity was assessed against the Bayley Scales of Infant and Toddler Development, Third Edition, or Griffiths II, using within-country Pearson correlations, with the prespecified benchmark of $r > 0.30$. Convergent validity was assessed using within-country Pearson's or Spearman's correlations with gestational age, birthweight, anthropometry, home stimulation, maternal education, maternal depression, psychosocial adversity, family support, resilience, and socioeconomic status, with prespecified directional hypotheses of positive or negative association, depending on construct. Inter-rater and test-retest reliability were assessed using intraclass correlation coefficients, ICC (2,1), with the prespecified benchmark ICC > 0.50 . Internal consistency was examined graphically across age.

Results: Concurrent validity on the D-score scale was high for all three GSED scores, with correlations generally above 0.90, although these estimates are greatly inflated by shared age dependence. On the DAZ scale, concurrent validity was lower but typically above the prespecified benchmark ($r > 0.30$), and in many analyses exceeded 0.50. Convergent validity findings were mixed. Associations with gestational age, weight-for-age, and home stimulation were generally in the hypothesised direction. Associations with maternal education, socioeconomic status, maternal depression, psychosocial adversity, family support, and resilience were often small and generally consistent in direction across countries. Inter-rater and test-retest reliability on the D-

score scale were mostly above 0.90, and DAZ-based ICCs generally exceeded the benchmark of 0.50. Internal consistency was highest for the GSED-CF, exceeded 0.80 for most of the age range for the GSED-SF and GSED-LF, and was lower for the GSED-LF below 3 months. Cross-form method bias was observed in some settings, particularly in younger children.

Interpretation: The GSED yields valid and reliable population-level developmental scores across diverse global settings. The findings support its use for within- and cross-country population-based measurement in early childhood.

The TinyExplorer Ecosystem: Open tools for studying infants' everyday visual environments

Teodor Nikolov¹, Julia Yurkovic-Harding², Tamas Foldes³, Charlotte Bocchetta¹, Jessica Bradshaw², Yu-Kun Lai¹, Hana D'Souza¹

¹ Cardiff University, Cardiff, United Kingdom, ² University of South Carolina, Columbia, United States, ³ University of Surrey, Guildford, United Kingdom,

Developmental science is undergoing an exciting transition. Advances in technology, including more user-friendly hardware and AI-powered software, are opening up new opportunities to study the everyday experiences of infants and toddlers in rich and scalable ways. Egocentric video offers a powerful route into children's visual and auditory environments, capturing the people, objects, and interactions available to them during daily life. However, widespread use of these methods remains limited by two key barriers: building safe, lightweight, child-friendly recording systems, and the time-consuming nature of manual video annotation.

To address these barriers, we developed the TinyExplorer ecosystem: an integrated hardware and software solution designed to support naturalistic research on infants' and young children's everyday experiences. TinyExplorer Gear is a lightweight head-mounted camera system suitable for infant egocentric research, with an accompanying build manual to support reproducible construction. The TinyExplorer Detection App provides a user-friendly, openly licensed desktop interface for automated detection in egocentric video. Crucially, all processing occurs locally on the researcher's machine, so sensitive identifiable video data do not need to be uploaded to external servers or cloud-based platforms.

Our initial focus is automated face detection, an area of high machine-learning sophistication and clear relevance for developmental science. Faces are central to children's early visual experience, and detecting them in dynamic first-person video

can help quantify social input. Automating this process enables larger, better-powered studies otherwise constrained by labour-intensive manual annotation.

First, to address algorithm selection, we systematically evaluated 13 state-of-the-art face detection algorithms from the DeepFace library using data from two developmental methodologies involving children under three years of age: head-mounted eye-tracking in structured settings and head-mounted cameras in naturalistic home environments. Benchmarking against manual annotations showed that YOLOv11Face (M) and RetinaFace consistently outperformed other models in precision and recall, with strong concordance with manual ratings, lower error, reduced bias, and robust rank-order correlations with manual annotations.

Second, to address technical implementation, we created the TinyExplorer Detection App. The app integrates multiple open-source models, allowing researchers to balance accuracy with computational resources. It generates structured outputs, including bounding box coordinates, confidence scores, timestamps, and frame identifiers, which can be integrated into downstream analysis pipelines.

By combining open hardware documentation, systematic benchmarking, and local automated analysis, TinyExplorer provides an accessible and reproducible framework for studying infants' and young children's everyday environments. This presentation will introduce the tools, their methodological rationale, and their potential applications for advancing naturalistic research in early development.

Session 3

Wed 26th August, 16:15 - 17:45

Rethinking Early Communicative Delay in Preterm Children

Miriam T. Loeffler^{1,2}, Lisa Wagner^{1,2}, Xin Tong³, Tabea Stähli³, Giancarlo Natalucci⁴, Moritz M. Daum¹

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

Preterm birth (before 37 weeks of gestation) affects around 1 in 10 infants worldwide and is associated with health complications and developmental difficulties. Communicative differences between preterm-born children (PTBC) and full-term-born children (FTBC) emerge in early childhood (Loeffler et al., 2025). However, research in this area often focuses on highly vulnerable subgroups of PTBC born at very low gestational ages or measures communicative development at only one or a few selected time points. To address these limitations, we used data from the Pebbles App (Daum et al., 2022), a smartphone tool developed by developmental psychologists, that enables respondents to log children's development continuously. This approach yields high-density, longitudinal measurements across multiple milestones, allowing for the collection of a sample that reflects the gestational-age distribution in the population better than typical clinical studies. We assessed the attainment of 14 communicative milestones (e.g., babbling, pointing) in N = 4,853 children aged 0-2 years (6.57% preterm, 93.43% full-term). For most milestones, group differences were below the practical-significance threshold. Unexpectedly, some milestones were attained earlier by PTBC (e.g., combining two or more words), possibly reflecting longer postnatal communicative exposure. To examine this further, we compared chronological (time since birth) and corrected age (time since expected day of delivery) to contrast experience ("nurture") and maturation ("nature") for each milestone. For 3 of 14 milestones, the age at milestone attainment aligned more closely with extrauterine experience than with maturational timing. For all other milestones, maturational processes seem to have a stronger impact. It is important to acknowledge that this approach relies on a simplified contrast between chronological and corrected age as proxies for experience and maturation and does not identify underlying causal mechanisms. Post-hoc analyses further suggest that FTBC born early term (37 to <39 weeks) attain most communicative milestones later than PTBC and FTBC born ≥ 39 weeks. In sum, these findings challenge the notion of general communicative delays in

PTBC and underscore the importance of both biological and environmental factors in shaping early communication.

Looking for Threat: Examining Whether Infant Attention Bias and Temperament Are Longitudinally Associated with Childhood Anxiety

Frances Doyle^{1,2}, Chloe Goldsmith¹, Samudra Radhakrishnan^{1,2}

¹ Macquarie University, Sydney, Australia, ² Western Sydney University, Sydney, Australia

Anxiety disorders are the most common mental illnesses among young people (Rapee et al., 2023). Whilst anxiety disorders are highly prevalent in childhood, their developmental origins remain poorly understood. Early differences in how infants attend to threat and how they temperamentally respond to experiences are thought to shape risk for later anxiety (Dadds & Frick, 2019; Field & Lester, 2010; Morales et al., 2016). Findings regarding the presence, strength, and developmental trajectories of attention biases toward threat in children have been mixed (Dudeney et al., 2015; Lisk et al., 2020). It is possible that individual factors, such as temperament, may partially explain the mixed findings, as these individual factors may influence the link between attention biases and anxiety risk (Dadds & Frick, 2019; Field & Lester, 2010; Pérez-Edgar et al., 2017). However, there is limited longitudinal research that examines early attention bias to threat, moderating factors, and the later development of anxiety disorders. Consequently, this study seeks to investigate whether attention bias to threat in infancy is associated with anxiety symptoms and diagnoses in early childhood. Further, this study aims to examine whether this relationship is moderated by temperament. A community sample of 94 culturally and linguistically diverse Australian mother-infant dyads (53% girls) were followed longitudinally. Infants were recruited in three age groups to capture key points in the rapid development of attention and emotion regulation across the first year of life with 37 infants aged 4-months ($M = 4.29$, $SD = 0.57$), 31 infants aged 8-months ($M = 8.13$, $SD = 0.47$), and 26 infants aged 12-months ($M = 12.37$, $SD = 0.50$). At the baseline ‘infancy’ assessment, infants completed the Baby-Dot probe eye-tracking task to assess attention bias to threat (Pérez-Edgar et al., 2017), and mothers reported on infants’ negative affect (Putnam et al., 2014). Three years later ($M_{age} = 3.55$ years, $SD = 0.35$; 51% female), maternal ratings of toddler anxiety symptoms (Edwards et al., 2010) and clinician-rated anxiety diagnostic severity (Tissue et al., 2022) were collected. Results demonstrated that higher infant negative affect significantly predicted increased childhood anxiety symptoms and greater childhood anxiety diagnostic severity. Furthermore, greater attention engagement to threat independently predicted more childhood anxiety symptoms, but not clinician-rated childhood anxiety diagnostic severity. These findings demonstrate that temperament and early attention processes independently

contribute to anxiety risk. Furthermore, they emphasise the crucial role of longitudinal developmental research in understanding the development of childhood psychopathology.

Variability in Language and Motor Development: Early Screening and Outcomes at Age Four in the Generation R Study

Jelle Kisjes ^{1,2}, Novika Purnama Sari ³, Marie-Christine Franken ⁴, Pauline Jansen ^{4,5}
Remo Mombarg ^{1,3}, Ellen Gerrits ^{6,2}, Margreet Luinge ¹

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Early detection of developmental language or motor disorders is crucial for determining appropriate care. Due to significant individual variation, distinguishing between temporary delays in development and persistent disorders is difficult at an early age. Previous studies have shown that children with developmental language disorder (DLD) often also have motor problems, and older children with developmental coordination disorder (DCD) often have language problems too (Kisjes et al., 2025). The aim of this study is to gain more insight into (1) the association between language and motor development in the first four years of life, and (2) to what extent early delays are predictive of later problems in language and motor development.

We analysed data from the GenerationR study (Kooijman et al., 2016), a prenatally recruited large population-based cohort in Rotterdam, the Netherlands. Language and motor development were assessed using parent-report questionnaires (Ireton, 1992) at ages 6 months, 1 year, 1.5 years, 2 years, 3 years, and 4 years of age. We investigated several developmental trajectories of children based on their outcome at 4 years (no problems, only language problems, only motor problems or both problems).

Children with typical outcomes in both language and motor skills at age 4 generally showed typical scores at earlier measures. On the other hand, children with atypical outcomes in both language and motor problems at age 4 generally scored below threshold at multiple earlier measures, with some showing consistently low scores over time. Additionally, regression analyses showed that most early screenings for language and motor problems significantly predicted outcome group membership at

age 4, with stronger predictive effects for later screenings at 2 and 3 years of age than for earlier screenings at 6 months or 1 year.

These distinct early growth trajectories of children with both language and motor problems, contrasted to those with typical outcomes or domain-specific problems, may suggest a shared underlying aetiology or neurodevelopmental mechanism similarly affecting both language and motor development. Additionally, early screening of children's language and motor skills may benefit from a joint approach instead of domain-specific investigations, allowing for earlier identification of broader developmental needs and more integrated care pathways.

Session 4

Thu 27th August, 10:00 - 11:00

Intrinsic neural timescales at 2 months as early markers of infant developmental trajectory

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In adults, intrinsic neural timescales, a measure of how long a brain signal is sustained in different areas, index the functional organisation of the adult brain and relate to cognition and clinical symptoms (Watanabe et al., 2018; Wu & Gollo, 2025). It has recently been shown that neonates and infants have longer intrinsic neural timescales compared to adults (Truzzi et al., 2023) suggesting a fundamentally different regime of neural processing. Yet, it remains unknown whether, as in adults, intrinsic timescales in early infancy index the brain's functional state and, in turn, predict its developmental trajectory. Here, we test the hypothesis that intrinsic timescales in the infant brain forecast emerging cognitive and behavioural outcomes across the first 18 months of life.

In a longitudinal cohort (N = 130), resting-state fMRI was acquired during natural sleep at 2 months. Intrinsic timescales were estimated voxelwise using autocorrelation-based methods and averaged within the seven Schaefer functional networks. Infants were classified into longer versus shorter timescale groups within each network. Developmental outcomes were assessed using the Ages and Stages Questionnaire (ASQ) at 2 and 9 months, and the Vineland Adaptive Behaviour Scales at 18 months. Group differences were quantified using bootstrapped mean differences with stringent correction for multiple comparisons.

No associations were observed concurrently at 2 months. However, longitudinal effects revealed a selective and consistent pattern: infants with longer intrinsic timescales in the visual network at 2 months showed higher fine motor scores at 9 months. By 18 months, the same infants demonstrated higher socialisation scores on the Vineland. These associations were specific to the visual network, with no reliable effects observed in other functional systems.

Taken together, the results demonstrate that the temporal structure of spontaneous neural activity in early infancy carries meaningful information about emerging behaviour. Crucially, the specificity of effects to the visual network suggests that early-developing perceptual systems may scaffold broader communicative and socio-adaptive skills. These findings align with previous evidence that infants later diagnosed with autism show reduced white matter integrity in components of the visual system during infancy (Girault et al., 2022). Overall, intrinsic neural timescales emerge as a promising early biomarker of individual differences in developmental trajectories. By demonstrating that temporally extended neural dynamics at 2 months forecast behaviour up to 18 months later, this work highlights intrinsic timescales as a potential novel lens for understanding the maturation of functional brain systems in early life.

Does visual working memory performance in infancy predict later executive function abilities? A longitudinal study with a longitudinal replication

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Executive function (EF) is a collection of higher-level skills that integrates component abilities including working memory, cognitive flexibility, and inhibitory control (Miyake et al., 2000). Research suggests that these basic component skills must develop before children can complete complex EF-based tasks in childhood (Devine et al., 2019). A central question is, therefore, whether early developing component skills predict EF abilities later in childhood. This is important as EF improves dramatically from 3 to 5 years (Carlson, 2005) and is strongly correlated with academic achievement (Blair & Razza, 2007).

Our study focuses on the early development of visual working memory (VWM). VWM can be measured in infancy and is predictive of later cognitive abilities, with individual differences in visual cognition tasks predicting outcomes up to 11 years later (Rose Feldman, & Jankowski, 2012). Examining VWM allows us to study young infants using tasks that do not require language. Here we asked whether VWM in infancy predicts later EF.

In an initial study, 64 infants (31 girls) were examined longitudinally at 6-, 18-, and 30 months. They completed a VWM preferential looking task at all assessment points (see Ross-Sheehy et al., 2003). This preferential looking task used two displays with colourful blinking squares. On one side, one square changed colour after each 'blink';

on the other, the colours remained the same. Children also completed the Minnesota executive function scale (MEFS; Carlson & Zelazo, 2014) at 30 months.

Results showed that looking behaviours in the VWM task from 6 to 30 months were predictive longitudinally within the same task. In addition, greater total looking at 6 months was associated with better EF outcomes, particularly for girls with less educated mothers. At 18 months, greater total looking and greater looking to the changing side predicted better EF outcomes at 30 months, again for families with a less educated mother.

Replication is a key challenge in developmental science. Thus, we conducted a longitudinal replication/extension study with a second cohort. Because there was stronger evidence of a relationship between VWM and EF after 6 months, we decided to sample VWM more densely at 12 (N = 82), 18 (N = 80), 24 (N = 76), and 30 months of age (N = 72). All participants completed the MEFS task at 30 months of age. We are currently analysing these data and will report results of our longitudinal replication/extension at the conference.

Session 5

Thu 27th August, 11:30 - 13:00

Giving a helping hand: Communicative origins of early helping and sharing

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Prosocial behaviors, such as sharing and instrumental helping, emerge in the beginning of second year of life (Brownell, 2013; Dunfield & Kuhlmeier, 2013). Interactionist approaches to prosocial development (Carpendale et al., 2021) propose that early instances of prosocial behaviors emerge from infants' early gesture use, including giving and showing gestures. This longitudinal study investigates the associations between giving and showing gestures and sharing and helping behavior in infants at 10 and 14 months (n=118, 42% female, mostly German and middle-class). Gestures of interest were coded from infant-caregiver free play interactions at 10 and 14 months respectively. Data on infants' sharing and helping were gathered in established tasks (Dunfield et al., 2011; Kärtner et al., 2021) at 14 months with an experimenter. Giving at 10 months was positively related to sharing, whereas giving at 14 months was positively related to helping. In contrast, showing was not related to either helping or sharing. This pattern of results remained stable, even when controlling for infants' general motor abilities. From these results, it follows that giving gestures, but not showing gestures are positively tied to infant's early prosocial development. These results provide first support for the interactionist theoretical proposal that early gesture use is connected to prosocial development. In this context, our results suggest that not all forms of gesture use, but rather specific forms (i.e., giving) are particularly relevant. Overall, this study advances our understanding of the developmental roots of sharing and helping by highlighting their communicative roots.

Multimodal Emotion Integration in Preverbal Infants: Behavioral Patterns, Neural Responses, and the Role of Family Expressiveness

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Infants' ability to integrate emotional cues across facial and vocal modalities is fundamental to early socio-emotional development. However, how this ability emerges during early infancy and how it is shaped by environmental experience remain insufficiently understood. The present work investigates the development of

audiovisual emotional integration in 6–8-month-old infants, integrating behavioral evidence of multimodal emotion matching, emerging neural responses to emotional congruency, and the role of family emotional expressiveness.

Study 1 examined 35 infants (19 female) aged 6–8 months using an intermodal matching paradigm. Infants were presented with dynamic facial expressions in three affective pairings (happy–angry, happy–neutral, angry–neutral), while simultaneously hearing a vocal expression that was congruent with one of the facial expressions. Results revealed significantly greater matching for happy expressions relative to both angry and neutral conditions. Interestingly, matching performance showed a modest decline across the 6–8-month age range. Moreover, family emotional expressiveness was positively associated with infants’ matching performance, suggesting that everyday emotional exposure may contribute to the development of multimodal emotion processing.

Study 2 extends these findings by investigating the neural sensitivity to audiovisual emotional congruency using functional near-infrared spectroscopy (fNIRS) in 6–8-month-old infants. Infants are presented with congruent (e.g., happy face–happy voice) and incongruent (e.g., happy face–angry voice) emotional stimuli, while hemodynamic responses are recorded from bilateral temporal and prefrontal regions. Differential neural responses are expected between congruent and incongruent face–voice emotional pairings. Specifically, congruent stimuli are hypothesized to elicit greater hemodynamic responses, as indicated by increased HbO and decreased HbR. This study aims to provide neurophysiological evidence that complements behavioral findings.

Overall, the present work demonstrates that 6–8 months is a key developmental window for multimodal emotion integration, highlighting the interplay between maturation and environmental factors in early infancy.

Session 6

Thu 27th August, 14:00-15:30

Out of the mouth of babies: Single words serve a variety of communicative functions

Catherine Tamis LeMonda, Kristy Lai, Catalina Suarez-Rivera
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Infants are prodigious vocalizers from birth. They grow from producing coos, to canonical babbles, to using up to 300 words by 24 months. But why do infants use words at all? A baby does not care that their ‘vocabulary size’ portends later skills. Nor is a baby compelled to use conventional words merely to do so. Rather, words allow infants to engage with others in new ways: Words can be used to request, protest, describe, exclaim, and so on. Pragmatics—the flexible use of words in context—has a long history, yet has received less attention than other aspects of language such as semantics or syntax.

In three studies, we quantified the vocalizations of 1- to 2-year-olds for two hours during the ebb-and-flow of everyday home activities. In Study 1 (N=100), we distinguished ‘conventional words’ from nonwords (e.g., babbles), and tested whether infants’ vocal productions differed when within- versus out-of-arms reach of mother. Infants displayed hundreds of vocalizations per hour, regardless of location. Infants were equally likely to babble when out-of-arms reach as within-arms-reach, but production of conventional words was greater when proximal to mother. Infants thus channeled vocalizations towards mature forms in a social context. Study 2 (N=60) focused on the pragmatics of infants’ single-word utterances. Infants communicated a variety of meanings with just a single word: ‘mommy’ as a request to be picked up, ‘mommy’ as the possessor of a shoe; ‘mommy’ as the actor eating ice cream, and ‘mommy’ as the recipient of a hug. As vocabulary expanded, infants grew in pragmatic diversity, expressing a greater range of meanings with single words, and following a regular developmental progression in how they used their words (e.g., requests and protests preceded naming people/objects, which preceded references to location and possession). Study 3 (N=31) zeroed in on infants’ requests and protests—two ways that infants regulate others’ behaviors. Annotations of the actions/gestures that accompanied infants’ words revealed that although infants’ gestures/actions often ‘matched’ their words in intent (e.g., “no” while throwing a toy), infants also displayed mismatched gestures/actions (e.g., “no” while reaching for a different toy). Centrally, matched multimodal communications (but not mismatched ones) were more likely to elicit a maternal response than words alone. Characterizing when and how infants use words, and how infants’ words shape

others' behaviors, highlights the functional importance of language and begins to illuminate why infants use words at all.

From Moments to Meanings: Dynamic Multisensory Naming Experiences Shape Infants' Word Knowledge

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Infants' word learning unfolds during everyday experiences. Contextualized naming of present referents provides grounded, multisensory input that supports infants' word-referent mappings—for example, hearing “apple” while seeing, touching, and mouthing the fruit.¹ In contrast, decontextualized naming events (to absent referents) support infants' understanding that word referents extend beyond the here and now (e.g., we ate apples yesterday).² Prior research largely focuses on 1) contextualized naming events, 2) the role of multisensory experience in laboratory settings, and 3) aggregate data across infants/toddlers³, rather than the experiences of individual infants. We characterized the ebb and flow of contextualized and decontextualized naming events within natural home environments and tested whether infants' unique sensory experiences with specific words predict their word knowledge at the individual level.

English-speaking mothers and their infants (N=28; 18–23 months) were videorecorded during two hours of home activities. We identified naming events for 245 CDI nouns in mother speech, and coded each event as decontextualized or contextualized (in which the infants looked at, touched, made body contact with, or mouthed the named referent within a ± 5 -second window). Sensory richness could thus range from 1-4. Mothers reported children's production of each word on the MB-CDI.

Across 10,657 naming events, 69.6% were contextualized and 30.4% were decontextualized. Critically, infants' sensory experiences with repeated words were dynamic: The same word was sometimes decontextualized and other times involved 1-4 sensory inputs. Sensory richness predicted infants' production of words ($p < .05$), controlling for word frequency and age of acquisition.

This study is the first to characterize how contextualized and decontextualized naming events unfold over time in the home environment, with both forms of speech input being critical for the initial mapping of words to referents and the understanding of absent reference. Moreover, infants' own sensory inputs during

exposure to specific words support their word knowledge, thus moving beyond aggregate data that say little about what any given child experiences in their language environment.

Scale Errors Reflect Semantic Differentiation in Early Vocabulary Development

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Scale errors, which are attempts to use objects clearly too small for the body, have been linked to early vocabulary development. Previous studies suggest that toddlers with intermediate vocabulary sizes produce scale errors most frequently, indicating a non-linear relation between vocabulary size and scale error production. However, the developmental mechanisms underlying this relation remain unclear. One possibility is that scale errors reflect a transitional phase in which the meanings of object words are not yet differentiated from their associated actions. The present study tested this possibility by (1) replicating the relation between vocabulary size and scale error frequency, and (2) examining whether semantic differentiation of object words from associated actions, measured via eye-tracking, relates to scale errors and vocabulary development. We predicted that children with more differentiated semantic representations would make fewer scale errors, which would in turn promote vocabulary growth.

Fifty-five children aged 15 to 35 months participated. After a scale error task, in which children's behaviors toward miniature objects were observed when normal-sized objects were replaced with miniatures, an eye-tracking task assessed object–action semantic distinction. Each trial presented two side-by-side video clips of object–action pairings with an auditory target word (e.g., "Which is the shoes?") under four conditions: (1) Object–Action Match (target object with canonical action vs. distractor with unrelated action); (2) Object–Action Mismatch (target with unrelated action vs. distractor with target's canonical action); (3) Same Object (target with canonical vs. unrelated action); and (4) Different Object (distractor with target's canonical action vs. distractor with unrelated action). Children with differentiated word meanings were expected to look longer at the target in conditions (1) to (3) but show no preference (or avoid the canonical action) in condition (4). Parents completed the Japanese-MacArthur-Bates Communicative Development Inventories.

Zero-inflated Poisson mixed-effects models revealed that comprehension vocabulary predicted scale error frequency via an inverted-U pattern, with intermediate-vocabulary children producing the most scale errors (best model: total vocabulary,

AIC = 217.02). Vocabulary outperformed age alone as a predictor. Using generalized linear mixed-effects models on noun and verb production, age was the strongest vocabulary predictor (χ^2 s = 26 to 34, $ps < .001$). We found a marginal interaction between scale error frequency and looking preference in the Different condition appeared for both noun and verb production ($ps = .08$ to $.10$), suggesting that scale error experience may modulate the link between action-based semantic differentiation and vocabulary size.

Session 7

Thu 27th August, 16:00 - 17:00

Adapting Caregiver-Report Measures of Early Childhood Curiosity Cross-Culturally

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Curiosity plays a critical role in learning, and having a shared metric to assess children's curiosity across cultures would advance developmental research. This is especially crucial for a construct like curiosity, for which there is still little consensus on how to define it even within a more homogeneous Western discourse. At the same time, behaviors interpreted as curiosity-driven and socially desirable in one cultural context may be evaluated differently in another, creating challenges for adapting caregiver-report measures originally developed in Western settings. As part of the development of Japanese and Chinese versions of the Infant and Toddler Curiosity Questionnaire (ITCQ; Altmann et al., 2025a) and the Early Childhood Curiosity Questionnaire (ECCQ; Altmann & De Boer et al., 2025), we conducted a pilot study to examine whether the original UK items capture curiosity in different cultural contexts and whether these behaviors are seen as socially desirable by caregivers. This work was carried out in China, Japan, and Germany, with around $n = 60$ participants per curiosity questionnaire (ITCQ and ECCQ). Caregivers of children aged 5 months to 5 years evaluated approximately 50 items, including original UK items, items excluded during the original scale development, and distractor items reflecting temperament or culturally normative behaviors. For each item, caregivers rated on 7-point Likert scales either how strongly the behavior reflected curiosity or how socially desirable it was. Original and excluded items were rated as reflecting curiosity significantly more strongly than distractor items ($ps < .001$), supporting discriminant validity. Across all three populations, the overall pattern of ratings was highly similar, with at most single-item differences, for instance, between curiosity and desirability scores. This indicates a surprising degree of agreement across cultural contexts often assumed to be very different, while also identifying specific behavioral items that might require cultural adaptation. Overall, this pilot underscores the importance of culturally grounded evaluation when developing caregiver-report measures of curiosity and supports the ongoing standardization of the Japanese and Chinese versions toward globally valid curiosity assessments.

Early multiscale complexity and developmental reorganisation in infant head movement

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How does infant exploration become organised across the first two years of life? Infants' everyday movements often appear variable, irregular, and noisy. Yet from a dynamical systems perspective, such variability may reflect an active perception–action system adapting to a changing body, emerging motor skills, and a richly structured environment. This study asks whether infant head movement during naturalistic exploration is merely variable, or whether it already shows organised temporal structure across multiple timescales.

We analysed head-mounted inertial measurement unit data from 43 infants aged 3–25 months as they explored their home environments. To characterise the temporal organisation of movement, we applied Multifractal Detrended Fluctuation Analysis to four signals: pitch rate, yaw rate, accelerometer magnitude, and gyroscope magnitude. We focused on two indices: multifractal spectrum width, capturing the richness of multiscale temporal structure, and the generalised Hurst exponent, capturing the degree to which movement patterns persist over time.

Infant head movement showed multifractal structure across all four signals and throughout the full age range, including among the youngest infants. This suggests that multiscale complexity is not something that simply emerges late in infancy. Rather, early exploration is already temporally structured. What changed with age was the organisation of this structure. Temporal persistence increased most clearly for yaw rate, suggesting that lateral head turning becomes increasingly sustained and sequentially organised over development. Pitch rate showed a weaker increase, whereas accelerometer magnitude decreased with age, indicating distinct developmental trajectories for directional, translational, and rotational aspects of movement. Gyroscope magnitude showed a nonlinear dip-and-recovery pattern, consistent with a period of reorganisation around major postural and locomotor transitions.

A supplementary sliding-window analysis suggested that multifractality remained relatively stable within sessions, indicating that the observed structure was unlikely to reflect simple switching between discrete movement modes. Instead, it appears to reflect the ongoing coupling of multiple interacting processes. To extend this perception–action account, ongoing analyses will integrate these movement dynamics with convolutional neural network (CNN)-derived estimates of visual

complexity from head-mounted camera footage and measures of infants' posture and motor ability.

Overall, these findings suggest that infant exploration develops not through the simple reduction of noise, but through the reorganisation of already-complex movement dynamics. More broadly, this work situates early exploration within a multiscale perception–action system, in which posture, locomotion, attention, visual input, and action become increasingly coordinated as infants gain new ways of engaging with the world.

Session 8

Fri 28th August, 10:00 - 11:00

Temporal Structure of Infant Vocalizations and Mother Speech at Multiple Timescales

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Infants learn language in a social context, and infant-caregiver language interactions support language learning. Yet most research emphasizes aggregate properties of input (e.g., amount and lexical diversity), overlooking its temporal structure. We propose that infant–caregiver language exchanges are organized across multiple timescales, and that this temporal organization constitutes a critical, yet underexplored, dimension of the language learning environment. Specifically, we examine how fine-grained temporal coordination (on the order of seconds) and broader temporal rhythms (across minutes to hours) jointly characterize naturalistic interactions and may support language acquisition.

We analyzed two-hour-long home recordings from 100 infant–mother dyads (12–24 months; US English- and Spanish-speaking). Infant vocalizations and maternal speech were transcribed and time-locked. At fine-grained timescales, cross-recurrence quantification analysis captured moment-to-moment alignment based on our conceptualization and implementation of three theoretically motivated parameters: (1) temporal ordering (whether mother speech follows or precedes infant vocalizations), (2) temporal proximity (tightness of coupling between vocalizations), and (3) temporal regularity (consistency of coordination over time). At longer timescales, we quantified the burstiness of each partner’s vocal activity, reflecting whether vocalizations occur in clustered versus evenly spaced patterns (Goh & Barabási, 2008).

We asked, to what extent do mother utterances and infant vocalizations coordinate at fine-grained timescales in their ordering, promptness, and consistency? Do infant vocalizations and maternal speech match in their temporal structure—the unique ebb-and-flow of individual dyads—across longer timescales during natural interactions? To test whether the observed temporal structure of infant vocalizations/maternal speech differed from what would arise from chance, we

compared empirical data to systematically shuffled time series that retained the base rates of behaviors.

Results revealed robust temporal structure across timescales. At the fine-grained level, mothers reliably followed infants' vocalizations, typically within 1 second, demonstrating tighter, more regular coordination than expected by chance (p 's < .001). At longer timescales, infants and mothers exhibited bursty temporal rhythms, characterized by clusters of vocal activity interspersed with pauses (p 's < .001). Importantly, moment-to-moment and extended rhythms were significantly more structured than shuffled baselines and were correlated within observed dyads only ($r = 0.37$, 95% CI [0.24 – 0.57], $p < .001$).

Infant–caregiver communication is temporally structured across nested timescales, from coordinated rapid turn-taking to extended rhythms of interaction. Our integration of micro- and macro-temporal analyses advances a multiscale account of early language exchanges and underscores the importance of temporal dynamics as a key feature of input.

Speech in the home shapes the structure of the brain: A longitudinal investigation into language experience and myelination

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Recent government guidance has recognised the importance of language interactions, with advice to reduce screen time in children under the age of five coming alongside calls to increase parent-child language interactions. 90% of the brain's growth occurs in the first five years of life, with the early years formative in the development of brain structure. At the same time evidence shows that language development in these first five years are a crucial springboard to later language, literacy and schooling abilities, and a strong predictor of school readiness. Early evidence from cross-sectional studies suggests that myelination – a concrete measure of brain maturation – is related to language abilities in 1- to 6-year-olds (O'Muircheartaigh et al., 2013) and that myelin in key language regions, the Arcuate Fasciculus (AF) and Superior Longitudinal Fasciculus (SLF) relates to the number of conversational turns a child has in the home (Romeo et al., 2018), and at 30 months adult word count in the home relates to myelination (Fibla et al., 2023). Before 2 years of age however, the pattern is less clear, with a pattern of negative results.

We build on existing findings by presenting results from the first large-scale, longitudinal investigation into language exposure and myelination from infancy. In an accelerated longitudinal design, we measured language exposure and myelination in two cohorts (6 – 18 – 30 months and 30 – 42 – 54 months) with 111 participants. Language exposure in the home was measured with LENA devices, capturing the adult word count (AWC), conversational turns (CTC) and child vocalisations (CVC), while brain myelination was measured using mcDESPOT (Dean et al., 2014), the most sensitive measure of myelination in early infancy.

Results from our pre-registered analyses demonstrate that in the older cohort (from 30-months) children with higher AWC and CTC show more myelination in language tracts, and that this effect strengthens over time. In the younger cohort (from 6-months) we demonstrate that children with high early AWC have an initial delay in myelination in language regions, followed by subsequent rapid growth, and a positive relationship by 30 months.

These results demonstrate that the socio-linguistic environment shapes brain development, with factors such as timing and social quality matter just as much as quantity, and the nature of that shaping undergoes fundamental shifts in the first years of life.

Session 9

Fri 28th August, 11:30 - 13:00

Beyond the visible and beyond here-and-now: Parents' use of internal state verbs and decontextualized language to young children with and without hearing loss

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Parental language to young children tends to focus on visible objects or events closely tied to the here-and-now. In this study, we investigated two topics: (1) how parents move beyond the visible to talk about internal states, and (2) how parents use decontextualized language to discuss things removed from the here-and-now. These two types of language have been studied separately in prior literature and have been used to predict different aspects of development (e.g., theory of mind or academic language understanding). However, a close look at the definitions and measures suggests that these two types of talk may be related. This project aims to provide a comprehensive picture of parents' use of internal state verbs and decontextualized language with their children with and without hearing loss, and to investigate how these two types of talk are associated.

Forty-eight parents and their children (aged 5.61–32.36 months; 29 girls) participated in a 20-minute toy-play session. Of these children, 25 had hearing loss (HL) and 23 were typically hearing (TH). We transcribed parents' speech and coded the types of internal state verbs and decontextualized language they used. The internal state verbs included perception (e.g., look or hear), volition/desire (e.g., want or need), emotion/affect (e.g., feel or like), and cognition (e.g., think or know). Decontextualized language included pretend talk, past/future talk, absent entities/distant places, explanations, and connections. We used generalized mixed-effects models to test whether children's hearing status, chronological age, and hearing experience predicted the types of internal state verbs and decontextualized language parents used.

Across analyses, children's hearing status was a significant predictor of parents' use of internal state verbs and decontextualized language. Parents in the HL group used more volition/desire verbs and fewer emotion and cognition verbs than their counterparts in the TH group. With regard to decontextualized language, parents in the HL group were more likely to talk about future events and less likely to refer to absent entities/distant places, provide explanations, or make connections. These

findings suggest that parents in the HL group were more likely to talk about children's needs and wants and to provide more guidance for future events. Importantly, parents who produced more internal state verbs also produced more decontextualized language. Our study demonstrates the role of children's hearing status in parents' use of internal state verbs and decontextualized language, as well as the positive relationship between the two.

Playful minds: Exploring the role of parental playfulness within the relation of toddlers' pretend play and executive functioning

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Many parent-child interactions are based on play. Parents play peek-a-boo, push around toy cars, or pretend a spoon is an airplane. Accordingly, parental playfulness has been identified as an important contextual variable within children's development (e.g., Cabrera et al., 2017; Shorer et al., 2019). Yet, no study has explored its links to children's executive functioning, which has been previously found to be related to children's play, specifically their use of pretense and imagination (Constien et al., 2026). Playfulness may play a role within this association as it guides and supports children's expressions of play. The current study sought to explore these links during toddlerhood. It was hypothesized that toddlers' pretend play is linked to their executive functioning and that this association would be strengthened by parental playfulness.

This study included 102 toddlers ($M = 23.44$ months, $SD = 2.77$) and their mother (90%) or father (10%). Toddlers completed tasks of pretend play and executive functioning (i.e., Six-Boxes, ECITT, Reverse Categorisation). Additionally, parents completed the Parental Playfulness Questionnaire (Shorer et al., 2019), which identified two factors, namely humour (e.g., using games or humor helps me resolve parenting conflicts) and spontaneity (e.g., when I am busy with household chores, I like to share these activities with my child, even if it more time). All hypotheses and analyses were pre-registered (osf.io/7b3g8).

A set of multiple regression models were used to test the hypotheses. A first model ($F(4, 86) = 13.81$, $p < .001$, Adj. $R^2 = .36$) identified pretend play as a significant predictor of executive functioning ($\beta = .43$, $p < .001$) while accounting for age, language, and parental education. A second model ($F(8, 82) = 8.37$, $p < .001$, Adj. $R^2 = .40$), which included parents' playfulness scores, identified a significant interaction between toddlers' pretend play and parents' use of humour ($\beta = .25$, $p = .008$). In

other words, toddlers whose parents engaged with them in a more humorous manner showed a stronger association compared to their peers.

Findings from this study mirror previous results indicating a link between pretend play and executive functioning. Importantly, it explored this association within toddlerhood, which has been previously neglected in research. Moreover, it identified an important moderator of this association, namely parents' use of humour (e.g., games, jokes, pretense) within everyday parent-child interactions. These results may guide future research on children's executive functioning development, but also inform early inter

Parent Speech in Free Play Is Guided by Infant Attention, but Organised by Object Familiarity

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Successful coordination of infant attention and parent speech supports infants' language development. Parents' responsive linguistic input reduces uncertainty in label-referent associations and provides information when infants are especially attentive and receptive to information (Tamis-LeMonda et al., 2014). While infants frequently lead the dyads' focus of attention, parent speech has been shown to scaffold infants' attention towards the focal object (Schroer & Yu, 2022). So far, however, little is known about the role of the qualitative characteristics of parent speech in coordinating the dyad's joint focus and supporting infants' attention.

Here, we analysed caregivers' speech to their 18-month-old infants (N = 31) and the interaction of caregiver speech with infant visual attention during table-top play with novel and familiar toys. We investigated the topical alignment of caregivers' speech and infants' gaze, and the differences in caregiver speech characteristics (1) when infants' gaze or caregivers' speech initiated an interaction, and (2) when caregiver speech co-occurred with sustained infant attention.

Interactions were most likely to be infant-led, both temporally and topically, expanding previous findings by showing that caregivers follow their infants' focus of attention not only with their gaze (Madhavan et al., 2026), but also their speech content. Illustrating the supportive effect of caregiver responsiveness, caregivers' topically aligned, but not misaligned speech were associated with infants' sustained attention. Qualitative analysis of speech types revealed mostly object-focused speech in interactions with familiar objects, but a broader range of speech types in interactions with novel objects. We propose that speech in interactions with familiar objects is structured by shared

experience, whereas the lack of common ground with novel objects potentially induces caregivers to use more varied speech to engage their infants.

Overall, this study expands previous findings that caregiver-infant dyads coordinate their interactions in a way that seems to be supportive of infant learning, and raises new ideas and questions about differences in the interaction dynamics with novel and familiar objects.

POSTER SESSION 1



A1 Scoop, there it is! A longitudinal measure of the cognitive correlates of preschool children's episodic future thinking

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Episodic future thinking (EFT) involves retrieving past experiences to generate hypothetical future outcomes, often as plans in service of a goal (Atance & O'Neill, 2001). Explicit EFT develops similarly to episodic memory (EM) and planning in early childhood (i.e., largest improvements around 4-years-old; Blankenship & Kibbe, 2019), but implicit EFT development remains understudied. We aim to tease apart the development of memory retrieval and planning during both explicit and implicit EFT across the 5th year of life, when EFT shows rapid maturation.

Children will complete an EFT task using coins to retrieve ice cream scoops from a machine while wearing a head-mounted eye-tracker. In the memory formation phase, children learn which coins make specific ice cream flavors (e.g., the red coin only makes vanilla ice cream) for four pairs, and are tested on their memory comprehension of each pair ("Which coin makes [flavor] ice cream?"). In the test phase, after a 2-minute delay, children are shown 2, 3, or 4 sequences of ice cream scoops that are either stacked (planning trials) or unstacked (memory retrieval trials) and select the necessary coins to recreate the sequences. Planning trials require both the retrieval of the relevant memories and correct ordering; memory retrieval trials do not require ordering. Children's coin choice will be measured by their gaze (implicit EFT) and gestures/verbalizations (explicit EFT). Fifty children will be tested at ages 48-, 54-, and 60-months on this task.

First, children's performance differences will be measured for each component (planning or memory retrieval), sequence length (2, 3, or 4), and type of EFT (explicit or implicit). We predict that all children will perform above chance, with overall performance improving with age (Blankenship & Kibbe, 2019). We hypothesize that children will perform better on memory retrieval than planning trials, with scores decreasing for each additional sequence length; implicit performance will be better than explicit performance, but this distinction will decrease with age. Finally, path models will be used to examine the developmental stability of memory retrieval and planning across timepoints. We hypothesize that memory retrieval will predict planning performance at each timepoint, both concurrently and at subsequent visits. We further expect that memory retrieval and planning performance will show developmental stability, with earlier visits predicting subsequent visits. This study will

be the first to examine the components of EFT longitudinally during a period of rapid cognitive development, providing a critical foundation for understanding EFT development.

A2 Children's Understanding of the Subjective Nature of Seeing

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Lempers et al. (1977) identified a distinctive intermediate behavioural pattern in which two-year-olds, in visual perspective-taking tasks, show objects while keeping them within their own visual field. This raises the question of how children reconcile their first-person experience of 'seeing' with the visual experience of others. Despite its theoretical importance, this finding has not been replicated.

We revisit this question with 81 children aged 12–37 months. Across four trials, children viewed a picture inside a cube visible only to them and were asked to show it to their parent. Younger children rarely produced showing responses. From around 18 months, children showed the cube while keeping it within their own visual field; from around 30 months, they oriented it towards the other's viewpoint.

These findings extend the original observation, suggesting that children initially do not yet treat their own and others' visual perspectives as comparable, with the transition from this intermediate pattern to other-oriented showing marking the emergence of this understanding and increased sensitivity to the subjective nature of others' visual experience.

A3 Perinatal Maternal Stress and Neural Markers of Habituation and Novelty Detection in Early Infancy

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The perinatal period is a critical window in early infant cognition and brain development, with maternal stress being implicated in differences in early infant brain activity. Both physiological (usually indexed by maternal hair cortisol levels) and psychological (perceived) stress have repeatedly been associated with altered infant resting electroencephalography (EEG) power (Brandes-Aitken et al., 2023; Pierce et al., 2019). A recent pre-registered study by Troller-Renfree (2025), however, found maternal perceived stress to be consistently associated with infant EEG power while maternal physiological stress was not suggesting that they may be mechanistically unique. Existing work has focused mostly on resting-state paradigms. This study positions habituation and novelty detection (HaND) as a novel approach for investigating whether stress-related differences extend beyond baseline neural activity into the cognitive domain.

Functional Near-Infrared Spectroscopy (fNIRS) studies have shown reliable patterns of HaND in the brain hemodynamic responses of infants as young as 3 months old, with reduced responses to repeated stimuli followed by recovery to novel ones. Prefrontal regions may play an important role in both repetition suppression and novelty detection in infancy (Nakano et al., 2009; Emberson et al., 2017) and as they are particularly sensitive to maternal stress through pathways such as HPA-axis programming and differences in infant arousal regulation (Hostinar et al., 2014), habituation tasks may be uniquely suited to detect potential differences in task related neural activity. Individual differences have also been seen in this cohort at 1 month in temporal channels (Greenhalgh et al., 2026) and this study aims to parse those as well.

The present study is part of the larger Perinatal Imaging in Partnership with Families (PIPKIN; Clackson et al., 2025; N = 123) Study. Maternal perceived stress was assessed at three time points (34 weeks gestation, 1-and 5-months postpartum) whilst infants completed an established HaND task (Lloyd-Fox et al., 2019) at 5 months during high-density diffuse optical tomography (HD-DOT) acquisition. A smaller sample of mothers also provided hair samples for measurements of physiological stress. We hypothesize that higher maternal perceived stress will be associated with altered patterns of HaND in infancy. We will also exploratorily examine whether the timing and trajectory of maternal stress across the perinatal period differentially relate to infant neural

responses. Data collection has been completed, and analysis aims to be completed before the conference.

A4 I Like This More Because There Are Fewer of It Left – Do Infants Understand Economic Demand?

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Imagine there are two resources, A and B, but resource A has fewer items remaining. Which resource would people prefer? Adults often show preference for the scarce resource (i.e., resource A). In this situation, adults can infer that the resource with fewer items remaining was preferred by others, and accordingly, prefer that resource themselves (e.g., Aggarwal et al., 2011). By age 6, children are also able to infer that a scarce resource is in higher demand by others, though they do not personally prefer the scarce resource more than the abundant resource (Smith-Flores et al., 2021). In the same study, children younger than 6 years tended to prefer the abundant resource, even if they correctly inferred that others preferred the scarce resource. However, some contrasting evidence suggests that by 6 years (John et al., 2018) or even 5 years (Ferera et al., 2020), children can choose the scarce resource reliably, suggesting that there may be variation in how children perceive scarcity based on experimental design.

These findings raise an important developmental question: are younger children's failures driven by an inability to infer social preference from scarcity, or by later-developing cognitive demands involved in using that inference to guide their own choice? Infancy provides a useful test case because infants can often detect others' goals and choice patterns (e.g., Woodward, 1998) before they can explicitly report or strategically use that information. By using infant-appropriate measures such as looking behavior, we can ask (1) whether infants interpret a scarce resource as one that is preferred by others, and (2) whether they themselves prefer the abundant resource as younger children tend to do (Smith-Flores et al., 2021), or whether a nonverbal task design may allow infants to demonstrate more sophisticated personal preference understanding.

Infants will watch a variety of actors take from two different resources, then must reason about which resource a new actor will take from and which resource they want for themselves. We use eye tracking, including violation of expectation, anticipatory looking, and preferential looking to investigate how infants from 18-30 months understand economic demand. Our study is ongoing and we expect to have some preliminary results by the time of the conference. Regardless of the direction of the results, we will have gained novel knowledge about how infants understand economic demand and apply it to their own choices.

A5 Baby vs. Machine: Do infants prefer listening to natural or synthesised infant vocalisations?

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A sense of agency depends on detecting contingencies between movements and their sensory effects. Spontaneous limb movements in early infancy may provide the raw material for this detection. If so, differences in how infants move, before any contingency is encountered, should shape what they can learn from it (Fujihira et al., 2025).

We tested this through a secondary analysis of data from Zaadnoordijk et al. (2020), in which 36 infants aged 3–4.5 months ($M = 115$ days; 29 male) completed a mobile conjugate reinforcement paradigm with baseline, connect (one arm activated a mobile), and disconnect (contingency removed) phases. We measured baseline limb individuation (how independently each limb moves at baseline), learning specificity (selective acceleration of the trigger arm during the connect phase), and extinction burst, the transient surge in movement when a learned contingency is removed in the disconnect phase, a signature of expectation violation. We hypothesised that greater limb individuation would support more specific contingency learning, indexed by both learning specificity and extinction burst.

Infants whose limbs moved more independently at baseline showed more limb-specific learning ($r(34) = .68$, $p < .001$) and stronger extinction bursts ($r(34) = -.35$, $p = .036$), possibly because independent limb movements provide less ambiguous evidence about which limb produces the effect. However, a mediation analysis revealed a counterintuitive twist: infants learn specifically, but burst globally. Those with the most limb-specific learning showed the most diffuse extinction bursts ($\beta = -.20$, $p = .008$). Greater motor individuation may thus enable a more precise causal expectation, but when that precise expectation is violated, the response spreads broadly across the motor system, possibly reflecting frustration, cognitive overload disrupting focal motor control, or an exploratory reset to rediscover the causal link.

These findings suggest that spontaneous motor variability may not be merely a backdrop to learning but a pre-intentional form of exploration (cf. Adolph & Franchak, 2017): variance in movement patterns generates the sensorimotor evidence from which causal movement-effect relationships can be extracted. The capacity for causal learning is not built from scratch during contingency exposure. It is already shaped before the learning opportunity by the structure embedded in infants' early motor activity.

A6 Nine-month-olds anticipate communicative correction of other's epistemic states

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In turn-taking interactions, variability in the exchanged signal sequences—as opposed to the exchange of identical signals—indicates communicative information transfer (Tauzin & Gergely, 2019). Thirteen-month-olds can retrospectively infer that variable signals have been exchanged between communicative partners in order to update the goal-relevant but incorrect knowledge of one of them (Tauzin & Gergely, 2018). Here, we investigated that when the epistemic update of an incorrectly informed agent is a prerequisite to achieve its goal, preverbal infants anticipate the communicative exchange of variable signals between this agent and its correctly informed communicative partner.

In our EEG paradigm, 9-month-olds (N = 28) were familiarized with videos of two novel agents. The main protagonist in these videos aimed to retrieve a target object that moved to one of two containers, while the other agent observed these events. At test, infants were presented with trials in two conditions: Correct Information and Incorrect Information. In the Correct Information condition, both agents knew the location of the target object. In the Incorrect Information condition, only the observing agent had information about the location of the target object, as the main protagonist was not present when the target moved. In both conditions, before the main protagonist approached one of the containers, the agents exchanged variable, communicative signals. We predicted that infants would anticipate this communicative interaction only in the Incorrect Information condition, where the main protagonist required an update regarding the location of the target object in order to retrieve it.

Since the expectation of relevant information elicits synchronization of EEG theta rhythm (Bergus et al., 2016), we hypothesized to find an increase in the theta-band oscillations in the Incorrect Information condition in contrast to the Correct Information condition before communication took place. The results supported our hypothesis. We found an increased theta-band activity in frontal and right temporal areas in the Incorrect Information condition only. These results suggest that 9-month-olds expected information exchange only when it was necessary to update the protagonist's knowledge about a goal-relevant fact.

To examine whether infants understand that only the exchange of communicative signals enables epistemic updating, we are currently conducting a control experiment using the same procedure, except that the two entities exchange identical, non-communicative signals. Since information transfer—and therefore an update of epistemic states—is not possible when identical signals are exchanged, we predict no difference in theta activity across conditions.

A7 Neural markers of infant habituation and associations with language outcomes

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Infants with hearing loss show substantial variability in language outcomes (Tamati et al., 2022). Explaining this variability remains a central challenge for researchers and clinicians. Robust predictors of language outcomes are currently lacking, limiting both theoretical understanding and the ability to guide intervention.

Hearing loss is associated with differences in cognitive skills that support language development. For example, deaf infants habituate more slowly to visual stimuli than hearing infants (Monroy et al., 2019), suggesting early differences in processing speed. However, behavioural measures alone cannot determine whether these differences reflect slower processing or deeper processing. To address this question, we aim to characterise the neural responses underlying visual habituation in deaf and hearing infants using EEG, and test whether these neural responses are associated with language outcomes one year later.

In our study, infant visual habituation is tested at 9 to 12 months of age while EEG is recorded. One year later, language is assessed using the Preschool Language Scales (PLS-5 UK; Zimmerman et al., 2014), a standardised measure of receptive and expressive language. While follow-up data collection is ongoing, we will present preliminary findings (N = 30) from our hearing cohort examining associations between early habituation measures and later language outcomes. Specifically, we will test whether theta power (an index of learning) and the Nc, P3, and slow wave components (event-related potential components reflecting attention and memory) are predictive of toddler language scores on the PLS5-UK. Identifying such markers may improve early prediction of developmental trajectories in children with and without hearing loss.

A8 Are the Benefits of Nature Innate?: Exploring the Effects of Nature on Infant Attention?

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Nature has been found to benefit attention, both in adults (Stevenson et al., 2018) and in children (Taylor & Kuo, 2009). However, no research has explored the effects of nature on infant cognition. The current research details two studies exploring whether short-term and habitual nature exposure effects infant Visual Recognition Memory (VRM), as well as how scene type and familiarity elicit 'soft fascination' in infants. In the first study, 46 infants (5-14 months) and 27 adults (18-37 years) completed a VRM task (Ross-Sheehy et al., 2003) and a Visual Working Memory (VWM) task (Balaban et al., 2019) respectively and watched videos of either nature or urban environments. The percentage of green space surrounding infants' home addresses were also measured. Adults displayed better VWM scores when watching nature rather than urban videos ($F(1, 63) = 7.59, p = .008, BF = 4.32$), however there was no difference in infant VRM scores between video conditions ($F(2, 795) = 1.47, p = .226, BF = .16$). A Bayesian Regression Model found that higher levels of surrounding green space for infants were associated with better VRM scores ($b = 0.23, 95\% CI[-0.08, 0.54]$), whereas in the urban video condition the relationship was reversed ($b = -0.20, 95\% CI[-0.81, -0.04]$). This suggests that infants experience attentional benefits from more familiar environments. The second study investigated whether familiarity and environment type effects infants' 'soft fascination': the idea that nature is effortlessly engaging which reduces cognitive fatigue (Kaplan & Kaplan, 1989). Soft fascination was measured using scanning efficiency via eye-tracking, with a lower scanning efficiency indicating soft fascination (Berto et al., 2008). Forty infants (3-12 months) were eye-tracked looking at 48 images ranging from plant to urban scenes, and caregivers rated each image on how familiar their baby may be with them. Thirty adults (18-31 years) also rated the images on how natural, restorative, and fascinating they perceived them to be. Infants tended to scan images less efficiently than adults rated as more natural ($r(46) = -0.40, p = .004, BF = 12.288$), fascinating ($r(46) = -0.40, p = .005, BF = 10.835$), and restorative ($r(46) = -0.36, p = .012, BF = 5.406$). There was no effect of image familiarity on infant scanning efficiency ($r(232) = -.03, p = .605, BF = 0.173$). These results contribute to our understanding of how affiliation with nature develops across the lifespan.

A9 Early emergence of selective cognitive offloading in three-year-olds

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Cognitive offloading refers to the use of external tools or actions to reduce internal cognitive demands (Risko & Gilbert, 2016), thereby extending the limits of our cognition and supporting cumulative cultural and technological progress (Charbonneau, 2026). Adults routinely offload information, particularly under high task demands and low confidence, resulting in improved performance (Gilbert, 2015; Grinschgl et al., 2021). However, although children's cognition is even more limited than adults' and would thus benefit from using external tools, spontaneous and demand-sensitive use of offloading has not been demonstrated before 4-6 years of age (e.g., Armitage & Gilbert, 2025). Due to task designs, it remains unclear whether this capacity is absent in young children, or whether cognitive offloading could be seen in simpler action-based contexts earlier in development. To address this gap, we examine whether three-year-olds (N=47) show selective cognitive offloading in a memory task, how this behaviour varies with task demands and performance, and whether it relates to children's memory abilities. We adapted Gilbert's (2015) intention-offloading paradigm into a child-friendly touchscreen task in which children could reduce memory demands by moving items before recall. Memory load varied across trials, and time-constraints required prioritising items to offload. A memory-alone condition provided a baseline measure of memory ability. Three-year-olds showed selective cognitive offloading, preferentially moving task-relevant items. Children's performance improved when offloading was an option, and greater and more selective offloading was associated with better task performance. However, offloading did not increase with task difficulty and was unrelated to individual differences in memory ability. These findings suggest that early cognitive offloading is already selective and beneficial, but not adjusted to variations in task demands or memory ability, instead emerging in the form of children structuring their environment and decomposing actions to reduce cognitive demands.

A10 Attention in Transition: Examining the Neurocognitive and Behavioral Mechanisms that Support Emergent Attention Profiles

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Various recent lines of work suggest that attention is organized around visual dimensions such as shape and color. Work examining dimensional label learning suggests that children learn to attend to dimensions as they learn labels. children typically learn to attend to shape when learning novel object category labels, but these patterns can be altered by prior experience with feature dimensions. Further, the ability to attend to visual dimensions is a central aspect of executive function.

This work situates dimensional attention within a dynamic systems framework in which children's experiences interact with task demands to yield measures of cognitive function. Foundational work suggested that young children are initially non-selective in their attention to object dimensions and become more selective with age (Garner, 1970). These ideas gave way to the differential sensitivity account (Cook et al., 1992), which posits that children place varying weights on object dimensions and show differing trajectories in flexible attention.

Previous accounts have highlighted the weights children place on different object dimensions and how these shift with age. The goal of the current work is to synthesize studies to present a more integrated picture of dimensional attention including the factors that give rise to it, how it can be manipulated, and the individual trajectories children take to gain it. We present a study measuring functional near-infrared spectroscopy data from 129 children aged 36–55 months completing the triad classification task. Children selected which of two objects best matched a reference: one matched exactly on one dimension but differed on the other, while the other was more similar overall across both dimensions. Typically, children select the identity match more frequently with age and improved dimensional attention skills. We grouped children based on whether they (1) selected the identity match frequently for both dimensions (n=33), (2) selected the holistic match frequently for both (n=30), (3) selected the identity match for shape only (n=35), or (4) selected the identity match for color only (n=27). Patterns of neural activation suggest that holistic categorizers use less specialized brain regions to complete the task, the color dimension requires more cognitive effort, and that shape identity selectors showed more neural evidence of feature binding than color selectors.

A11 Neural Mechanisms of Attention Predict School Readiness and IQ

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IQ has long been the gold standard assessment for predicting later academic, social, and socioeconomic achievement in early school-aged children. However, IQ scores acquired in early childhood (before age 6) are often not reliable (Macfarlane, 1953). Alternative assessments that are predictive of later life outcomes involve executive function testing. It is often reported that executive function ability in early childhood is a better predictor of later IQ2 (Mahone et al., 2002). The current study looks not only at executive function task performance but also on neural activation during the tasks at age 4 to predict IQ at age 6. We assessed 29 children who all received the dimensional change card sort and a modified triad classification task at age 4 and were assessed on the WIPPSI and the BRACKEN at age 6. Both executive function assessments involve flexible attention to the feature dimensions of shape and color. The dimensional change card sort task requires children to sort cards first by one feature dimension and then switch to another in an explicit fashion. The triad classification, on the other hand, does not provide explicit rules, but instead asks children to group objects based on which go best together. In this sense, the triad classification is a measure of the child's ability to autonomously engage attention to visual dimensions. During the executive function testing at age 4, children wore a functional near-infrared spectroscopy (fNIRS) cap consisting of 8 sources and 16 detectors placed over bilateral frontal, temporal, and parietal brain regions. The fNIRS results were put through an advanced image reconstruction pipeline align channel-based data to underlying neural structures in age-appropriate brain templates, allowing for fNIRS data to be analyzed in image-space. Results showed that neural activation during the dimensional change card sort is predictive of several aspects of the school readiness assessment whereas activation during the triad classification task is predictive of aspects of IQ. This is the first study of our knowledge to use neural measures collected during executive function tasks as a predictor of later IQ.

A12 Do infants see what we see? A novel EEG approach to investigate real-time object categorisation in infants

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To understand how humans make sense of the world, we must first understand how conceptual knowledge is formed and organised in the brain. Even very young infants can group objects based solely on perceptual information (Quinn et al., 1983). Research shows that these perceptually derived categories can be shaped by top-down influences, such as learning linguistic labels (Althaus, & Westermann, 2016). Behavioural methods, such as novelty preference paradigms, have established reliable outcome measures of categorisation in infants. However, these do not allow us to disentangle perceptually driven and linguistically driven categorisation processes, nor how these processes interact. Electroencephalography (EEG) offers an alternative by enabling the measurement of categorisation as it unfolds in real time. Two commonly used EEG approaches, event-related potentials (ERPs) and steady-state visual evoked potentials (SSVEPs), have been employed to investigate visual categorisation in adults and, to a lesser extent, in infants. In ERP paradigms, stimuli from different categories are typically presented with equal probability at a relatively slow rate (approximately one image every 2.5 seconds). In contrast, SSVEP paradigms involve rapid visual stimulation at a base rate (e.g., 6 Hz; one image every 166 ms), with category changes embedded periodically (e.g., every fifth image, 1.2 Hz).

ERP studies have demonstrated category differences that are both perceptually and conceptually distinct (e.g., animate versus inanimate), as well as for perceptually-grounded shape-based categories in adults (Linnert et al, 2026; Tokudome & Wang, 2012). Moreover, top-down factors such as attention and training in category recognition have been shown to modulate visual ERP responses (Tokudome & Wang, 2012). However, the use of visual ERPs in infants remains limited, particularly for shape-based categories. SSVEPs, in contrast, have proven effective in distinguishing between animate and inanimate categories in both adults (Stothart et al., 2017) and infants (Peykarjou et al., 2024). It remains unclear, however, whether shape-based categories elicit comparable differentiation and whether such responses are sensitive to top-down influences.

The aim of the current project is to establish an EEG signature of online categorisation processes in 9-month-old infants. First, we will examine whether both familiar (animate vs. inanimate) and novel shape-based animal categories elicit differential responses using ERP and SSVEP paradigms. Second, we will investigate whether initial

perceptual categorisation, as indexed by these neural measures, can be modulated through training with category labels. Data collection is currently underway, and pilot results will be presented.

A13 Longitudinal Development of the Visual Working Memory Network from Infancy to Early Childhood: An fNIRS Study

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Introduction. Visual working memory (VWM) is our ability to temporarily store and recall visual information (Xu, 2021). From infancy, VWM abilities predict educational and cognitive outcomes, making it an important predictor of developmental trajectories (Johns, 2025). Prior cross-sectional investigations have uncovered the neural correlates of early VWM (Buss et al., 2014). The present study represents the first longitudinal examination of the VWM network development at both behavioural and neural levels from 6 to 54 months of age.

Methods. An accelerated longitudinal design was used with two overlapping cohorts of typically developing children (6, 18, 30 months; 30, 42, 54 months). Eye tracking and functional near infrared spectroscopy (fNIRS) recorded gaze behaviour and haemodynamic responses during a VWM task. The preferential looking task included a changing and a no changing side, with variation in the memory load (the number of items on each display) across trials. The haemodynamic response function (HRF) was first examined to confirm comparability across age groups. A general linear model using a canonical HRF with a load by chromophore design was then applied separately at each age.

Results. Load-related activation was observed in bilateral parietal and precuneus regions. The left parietal cortex was active across all ages, while right parietal engagement was most prominent at 30 months. Precuneus activity emerged at 30 months. The temporoparietal junction (TPJ), showed variable engagement, with right TPJ activity in early infancy and at 42 months, alongside ventro-occipital activation. Frontal activation was minimal early on, emerging at 42 months in the left middle frontal gyrus.

Discussion. These findings suggest that during early in development, the VWM network undergoes gradual reorganisation, with an early reliance on parietal regions and later recruitment of frontal areas. Ongoing analyses will extract average beta maps for each cluster to conduct a longitudinal linear mixed effects model describing how the network changes longitudinally over early development.

A14 Comprehensive neurodevelopmental assessment through non-specialists:**Validation of the STREAM digital platform in India and Malawi**

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Children in low-resource settings often lack access to feasible, culturally appropriate neurodevelopmental assessment. Many existing tools are proprietary, require specialist training, and are difficult to scale in community settings. We developed the Scalable TRansdiagnostic Early Assessment of Mental health (STREAM), a tablet-based platform for non-specialist delivery in community settings. STREAM integrates metrics from three existing tools: the Malawi Developmental Assessment Tool (MDAT), the DEvelopmental assessment on an E-Platform (DEEP), and the Screening Tool for Autism Risk using Technology (START), to assess motor, cognitive, and social development in children aged 0 to 6 years.

We analysed data from 3,992 children recruited in New Delhi, India, and Blantyre, Malawi. STREAM metrics were age-standardised and combined into motor, cognitive, and social domain scores using structural equation modelling. Structural validity was evaluated using standard model fit indices, criterion validity against the Griffiths Mental Development Scales using Pearson's correlations, and convergent validity using Pearson's or Spearman's correlations with anthropometry, socioeconomic status, home stimulation, caregiver-child relationship measures, psychosocial adversity, maternal depression, sleep, and participation. Known-groups validity was assessed using area under the curve (AUC) analyses, test-retest reliability using intraclass correlation coefficients, ICC(3,1), and responsiveness using longitudinal correlations over approximately 18 months.

The final structural model met conventional fit criteria (RMSEA=0.03, CFI=0.98, TLI=0.97). Criterion validity was supported by correlations between STREAM and Griffiths domains in India and Malawi, ranging from 0.31 to 0.65. Convergent validity was more variable: 9 of 12 related constructs showed significant associations in the expected direction, with the most consistent correlations observed for home stimulation, caregiver warmth, maternal education, and socioeconomic status. No clear associations were observed with maternal depression, sleep quality, or hair cortisol. Known-groups validity was supported across all hypothesised contrasts. STREAM discriminated enriched from community samples (AUC 0.89 to 0.98), children at risk on the Rashtriya Bal Swasthya Karyakram (RBSK) from those not at risk (AUC 0.83 to 0.93), and children with versus without anthropometric risk, particularly stunting, wasting, and microcephaly. Test-retest reliability ranged from 0.45 to 0.69, with the lowest value in the Malawi cognitive domain. Responsiveness evidence was limited and was observed mainly in the Indian longitudinal subsample.

STREAM provides evidence of structural validity, criterion validity, convergent validity, known-groups validity, and acceptable short-term reliability in two low-resource settings. It offers a scalable approach to neurodevelopmental assessment for children aged 0 to 6 years using non-specialist delivery in community contexts.

A15 Investigating the Neural Bases of Multisensory Attention in 54-Month-Olds

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Multisensory attention, the ability to maintain, match, and shift attention to audiovisual events among competing stimulation, is foundational to early development. The Multisensory Attention Assessment Protocol (MAAP) yields three nonverbal indices of selective attention: maintenance, intersensory matching, and shifting speed that predict later language, cognitive, and social-emotional outcomes (Bahrick et al., 2018). Yet the neural substrates underlying these skills remain unexplored.

This study examines brain correlates of MAAP-assessed multisensory attention, combining fNIRS with an advanced image reconstruction method in 54-month-old children (N = 15). Children viewed two simultaneous lateral events, one social (person speaking), one nonsocial (object), only one of which was synchronous with an accompanying soundtrack, under low (no distractor) and high (central distractor) competition.

Behaviorally, consistent with the developmental literature, high competition significantly reduced attention maintenance and slowed shifting, and social events were more resistant to competing stimulation than nonsocial events (Bahrick et al., 2004).

Neural analyses revealed three key patterns. First, bilateral superior parietal lobule showed heightened activation under high competition suggesting that this region is involved in releasing attention from its current focus (Corbetta et al., 2002). Second, bilateral temporal regions were selectively recruited under low competition, suggesting these regions are involved more in exogenous orienting of attention (Corbetta et al., 2002; Xue et al., 2025). Third, right frontal areas showed greater activation for social than nonsocial events whereas the opposite was observed in left parietal cortex, suggesting neural specialization for different kinds of stimuli (Konrad et al., 2005).

These findings provide first neural evidence that MAAP-assessed multisensory attention in preschoolers recruits a distributed fronto-parieto-temporal network differentially modulated by event type and competition level.

A16 Measuring Cognitive Flexibility in Toddlerhood with the Dimensional Change Bear Sort Task

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Cognitive flexibility – the ability to adapt thinking and behaviour in response to dynamic contexts – undergoes rapid development during the preschool years. A gold standard measure of this development is the Dimensional Change Card Sort task (DCCS; Zelazo, 2006). However, the high linguistic, working memory, and attentional demands of this and similar task precludes children younger than 4 from succeeding.

Traditional DCCS research highlights a robust perseverative gap where 3-year-olds often fail to switch sorting dimensions (e.g., from colour to shape), whereas 4-year-olds succeed (Doebel & Zelazo, 2015). Recent DCCS adaptations suggest that using 3D objects (rabbits, boats) rather than 2D cards can enhance switching performance in 3-year-olds (Beaucage et al., 2020), highlighting a promising, lower-demand framework for measuring flexibility in toddlerhood. However, for toddlers, these objects represent meaningful taxonomic categories (Rakison & Butterworth, 1998) rather than geometric properties of "shape", potentially introducing an object-identity bias that could interfere with dimensional switching.

To address this, we introduce the Dimensional Change Bear Sort Task, a novel 3D adaptation designed to optimise dimensional salience for toddlers. Children sort "teddy bear" objects by size (big, small) and colour (red, blue) into physical pots. By utilising size, a salient, inherent physical object property, rather than less-familiar shape categories, we aim to minimise the representational conflicts between dimensions and their given labels in the task. This tangible, multisensory experience may more accurately reflect toddlers' emerging cognitive flexibility.

Data collection is ongoing across laboratory and nursery settings in the UK and USA. We will report preliminary results from 18–36-month-olds ($N \sim 60$) and a 3-4-year-old comparison group ($N \sim 30$). We aim to determine if this novel task format reveals switching abilities typically masked by the constraints of the standard DCCS.

A17 Reading Between the Lines: Nonverbal Cue Integration Across Language Profiles in Early Childhood

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Bilingual children are known to compensate for smaller vocabularies by relying more on nonverbal strategies, such as gestures, and to develop heightened sensitivity to nonverbal cues in ambiguous situations. The COMMunicative Experience (COME) Perspective (Wermelinger et al., 2024) suggests that complex environments, such as those involving multiple languages or dialects, foster adaptive communication strategies. In the current study, we asked whether the increased complexity in bidialectal (two closely related language varieties), bilingual, and multilingual (more than two languages) children's environment results in more adaptive non-verbal cue integration. As part of a longitudinal study, this first measurement compares 320 children aged 2;9-3;3 with four language profiles: monolingual, bidialectal, bilingual, and multilingual. By including bidialectal and multilingual profiles, we move beyond a simple binary comparison to investigate how increasing communicative complexity, from monolingual to multilingual, gradually influences the integration of nonverbal cues. Using an adapted lab-based task (Yow & Markman, 2011), we assess nonverbal cue integration in a social interaction. Children are asked to identify a hidden marble using gaze or pointing cues that conflict with the interaction partner's body orientation. Data collection is ongoing (n = 220 at submission), and we anticipate presenting results of the full sample at the conference. Based on the COME Perspective and in line with previous studies, we hypothesise that the complexity of the communicative environment predicts children's reliance on nonverbal cues to infer the marble's location. We expect a linear progression, with children in more complex (multilingual) environments demonstrating greater cue integration than those in less complex (monolingual) environments. This graded approach allows for a deeper understanding of how diverse communicative experiences shape early social and language development.

A18 Neural correlates of infant visual habituation

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Habituation paradigms have revealed differences in visual processing between deaf and hearing infants (Monroy et al., 2019). Specifically, deaf infants have been shown to take longer to habituate to a novel stimulus compared to age-matched hearing infants. However, the neural mechanisms underlying these differences remain unknown. Our study aims to identify these neural mechanisms using electroencephalography. We hypothesize that neural markers of visual processing (including stimulus-locked P1 amplitude and theta-band activity) will change over time as infants habituate, and that these patterns may differ between deaf and hearing infants.

In our study, infants experience two visual habituation tasks. Here, we will present preliminary data from one of these two tasks, adapted from (Piccardi et al., 2020). Infants watch dynamic video clips from the Disney film *Fantasia* (four clips, 1.5 minutes each) while continuous EEG is recorded, using a BioSemi ActiveTwo System. A black-and-white checker image is flashed centrally on the screen for 100 ms at random every 2-4 seconds.

The planned analysis will focus on two measures of neural activity. First, stimulus-locked P1 amplitude is expected to reflect early visual processing. Amplitude is expected to decline over the course of the presentation as infants habituate to the checker. Second, time-frequency analyses will detect changes in theta-band power during the video clips to evaluate potential changes in information processing speed (Piccardi et al., 2020).

In this poster presentation, we will present preliminary analyses from our hearing cohort of 37 infants between 8-18 months of age (mean age = 11.98, SD = 3.03), as well as preliminary comparisons between deaf infants ($n = 7$) and age-matched infants ($n = 7$) drawn from the larger sample.

By combining ERP and time-frequency analyses, this study aims to distinguish whether differences in visual habituation are driven by early sensory processing or ongoing attentional dynamics, offering a more precise account of how early sensory experience influences cognitive development.

A19 The Development of Object Perception and Noun Generalisation by Shape

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There is great variability in the rate at which vocabulary develops during the first years of life. Some children show delayed vocabulary development for their age but they are later able to catch up with their peers, whilst other children never catch up and may go on to receive a diagnosis of developmental language disorder (DLD). What processes are at play in determining each child's vocabulary outcome? We are not yet able to predict which children will continue to exhibit language difficulties, and this may be because we lack a thorough understanding of the different processes that support language development early in life. A phenomenon known as the shape bias (paying special attention to the shape of objects rather than other dimensions such as texture) is one tool that children use to generalise newly learned nouns to new instances and quickly learn new words. Research testing the shape bias in children has consistently found that attention to shape is positively associated with the number of nouns in infants' vocabularies, and that children with atypical language development fail to show a shape-bias. However, there are several processes that may be at play in the development of the bias to attend to shape and we do not have a clear understanding of either the order in which they develop or how they interact. For this reason, the present study seeks to investigate and replicate the previous findings of 3 short tasks that assess different aspects of shape perception in toddlers: 1) Novel Noun Generalisation (Samuelson 2002), 2) Shape Caricature Recognition (Smith, 2003), 3) Part Shape/Relations (Augustine et al, 2011). Because data collection is ongoing, we will present the tasks, design and planned analyses.

A20 The Influence of Joint Media Engagement and Interactivity of Use on Children's Inhibitory Control Following Fantastical Media Use

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Children frequently encounter fantastical content and physically impossible events when interacting with screens. Exposure to fantastical content has been shown to exert immediate negative effects on young children's inhibitory control (Keşşafoglu et al., 2024), an effect often attributed to increased cognitive load required to process it (Li et al., 2018). However, there is limited research examining whether media context, such as joint media engagement (JME), defined as the shared use of digital media by a child and an adult, and interactivity, such as touchscreen use, might diminish these negative effects.

The present study employed a 2×2 factorial design to investigate these factors, assigning preschool-aged children to conditions based on joint media engagement (JME present vs. absent) and level of interactivity (active touchscreen use vs. passive viewing). Based on the psychological distance hypothesis, which suggests that digital engagement may reduce the cognitive load associated with fantastical content (Li et al., 2018), we expected (1) children in JME-present conditions to demonstrate better inhibitory control than those in JME-absent conditions, (2) children in touchscreen interaction conditions to exhibit higher inhibitory control than those in video viewing conditions, and (3) children in conditions combining JME presence and touchscreen interaction to show the highest performance.

The present study aims to recruit 128 children aged 4 to 5 years, as determined by an a priori power analysis. Children engage with fantastical content either in video viewing or touchscreen interaction conditions, with or without experimenter engagement, for 10 minutes. Then, they complete the Pencil Tapping and Go/No-Go tasks to measure inhibitory control. Data collection is ongoing; 100 participants have been recruited to date, and an additional 28 are anticipated.

Understanding how joint media engagement and interactivity influence children's inhibitory control following exposure to fantastical content may provide a more comprehensive understanding of distinct components of screen use and identify potential protective factors.

A21 The development of object manipulation affordances in infancy

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Affordances are opportunities for action available in the environment (Gibson, 1966; 1979). This study investigates how the infant brain encodes affordance information about objects, and how this information shapes emerging neural representations (Needham et al., 2016; Rocha et al., 2012). As grasping allows infants to directly alter their environment, it plays a key role in the acquisition of affordances (Loucks & Sommerville, 2012; Whyte et al., 1994). Here, we test how the neural basis of affordances emerges in 4-month-old infants as they gain early fine motor experience through grasping. Linking neural dynamics and affordance development with sensorimotor experience will reveal fundamental mechanisms of early cognitive functioning. We will present electrophysiological and behavioural data from $n = 10$ infants (mean age of 4 months 22 days; SD: 16.85; 4 girls), completing an object manipulation task using the “sticky mittens” paradigm (Needham et al., 2002). As infants at this age cannot yet reliably grasp objects (Wallace & Whishaw, 2003), this paradigm provides them with precocious grasping experience by wearing Velcro-covered mittens adhering to graspable objects (soft Velcro toy cubes). During a training phase, infants interacted with 6 objects in a random order: three graspable objects covered with Velcro and three visually matched control (non-graspable) objects covered with tape. Affordance condition was indicated by colour (white/black, counterbalanced across infants). Each object was first presented for 15 s, followed by 45 s of active exploration. If infants successfully grasped the object, it was removed from the mitten after 10 s. In a post-phase, infants were presented with two new objects (soft toy balls) and one familiar cube, each in both graspable and non-graspable versions – to assess affordance learning and its generalisation to new objects. Throughout the task, infants’ brain activity was recorded with electroencephalography to examine if graspable objects elicit distinct neural responses relative to control objects, such as increased mu suppression (Cuevas et al., 2014) and whether this generalises to new objects. In parallel, infants’ grasping and reaching behaviour was quantified using DeepLabCut (Mathis et al., 2018) to test if infants preferentially reached for graspable vs control objects. Our preliminary behavioural data show that infants equally often reached for graspable and control objects across the task ($p = .09$) but made more contact events with tape objects ($p = .01$). This suggests that infants increased their effort to pick up non-graspable objects, consistent with an emerging sensitivity to grasping affordances.

A22 Fetal and infant responses to audio-visual stimulation: Investigating the effects of prenatal e-cigarette nicotine exposure

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Although e-cigarettes are advertised as a safer alternative to cigarette smoking during pregnancy by the NHS in the UK, fetuses are prenatally exposed to nicotine during critical brain developmental periods (Bruin, Gerstein & Holloway, 2010). Given the rising prevalence of exclusive e-cigarette use, especially among individuals without history of smoking (Jackson et al., 2024), it is essential to investigate the specific effects of nicotine, rather than relying solely on comparisons to cigarettes (Bowker et al., 2021). The present study examines differences in cognitive functioning between fetuses exposed to e-cigarettes during pregnancy (e-cig exp) and those non-exposed (non-exp), using auditory and visual stimulation. Fetal responses to audio-visual stimuli are recorded via 4-Dimensional ultrasound scans at 32- and 36-weeks gestation. The Fetal Observable Movement Scheme (Reissland, Francis & Buttanshaw, 2015) will be used to code mouth movements and investigate if fetuses can imitate corresponding audio-visual vowel presentations. Frame-by-frame analysis of 40 ultrasound recordings from 20 participants (e-cig exp N=9, non-exp N=11), will also be conducted to assess the frequency and duration of eye opening, with the aim of providing evidence of early attentional processing. Maternal smoking was assessed via a self-report smoking habits questionnaire, alongside measures of saliva cotinine. Measures of maternal mental health were included, as evidence indicates this may influence fetal movement profiles (Reissland et al., 2018). Prenatal data collection is currently ongoing, in addition to a longitudinal post-birth follow-up of infants aged 10-weeks old, examining behavioural responses to familiar and novel audio-visual stimuli. It is hypothesised that fetuses and infants not prenatally exposed to e-cigarettes will demonstrate characteristic mouth movements when presented with repeated audio-visual stimuli, e.g., lip-puckering to the presentation of 'Mu', in comparison to the e-cigarette exposed group. We aim to present preliminary data from both prenatal and postnatal findings. This study addresses an important research gap, by examining for the first time the cognitive effects of e-cigarette exposure during pregnancy, particularly as e-cigarette exposed neonates are often reported to have birthweights comparable to neonates born to non-smoking mothers (Calder et al., 2021). Given the increasing prevalence of e-cigarette use, the current research investigates a significant public health concern, with implications for both fetal and infant developmental outcomes. Findings may help to inform clinical guidance and public awareness, potentially supporting reductions in nicotine consumption during pregnancy.

A23 Psychometric Evaluation of the Arabic ASQ-3 for Developmental Screening in Early Childhood

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Early identification of developmental delays is a central component of preventive child health and early education systems.

Research consistently demonstrates that children with developmental disabilities who access structured early learning environments show significantly better outcomes in language, cognition, social-emotional functioning, and adaptive behavior than those who do not (McGlade et al., 2023; Nelson et al., 2024).

In Saudi Arabia, the expansion of early childhood services has increased the demand for systematic developmental screening. Several internationally recognized parent-completed tools exist for this purpose, such as the Ages and Stages Questionnaire, Third Edition (ASQ-3), which includes five domains including communication, gross and fine motor skills. While an Arabic translation of the ASQ-3 is available, its utility in the Saudi population is constrained by several factors.

This study examined the psychometric properties of the ASQ-3, evaluating its reliability, and score distributions across age-specific forms.

The sample comprised 42,680 caregiver-completed ASQ-3 assessments of children aged 2 to 60 months, representing all age-specific ASQ-3 intervals. Internal consistency reliability was estimated using ordinal Cronbach's alpha. The internal structure of the ASQ-3 was evaluated using confirmatory factor analysis with a diagonally weighted least squares estimator appropriate for ordered categorical data.

Domain scores showed adequate dispersion across age-specific forms, with no evidence of floor or ceiling effects. Reliability estimates were within acceptable ranges across domains. Confirmatory factor analyses supported the proposed five-domain structure, with model fit indices indicating satisfactory fit according to conventional psychometric criteria.

This study provides evidence supporting the psychometric soundness of the Arabic version of the ASQ-3. The findings address a critical gap by offering large-scale validation of a widely used developmental screening tool. The results support the use of the Arabic ASQ-3 as a practical tool for early identification of developmental risk and contribute to ongoing efforts to strengthen early childhood screening systems.

A24 The Influence of Social Network Size on Preschool Children's Visual Perspective Taking and Non-Verbal Cue Understanding

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Exposure to diverse communicative situations fosters a broader, more flexible repertoire of communicative skills (Wermelinger et al., 2024). Children's social networks may constitute a meaningful, yet underexplored, contributing factor. Larger social networks involve more varied interaction partners, with whom children have less common ground (Bohn & Köymen, 2018). This may require children to rely more heavily on visual perspective-taking (VPT) and non-verbal cues (NVCs). In a cross-sectional study, we examined whether social network size (SNS) in preschool children ($N = 128$, $M_{age} = 4.06$, $SD_{age} = 0.29$) is associated with their VPT and NVC understanding. Children completed a Director Task measuring Level II VPT (Fan et al., 2015) and a Point-or-Gaze task (Yow & Markman, 2011) measuring understanding of subtle, ambiguous NVCs. Caregivers completed a SNS questionnaire (Burke et al., 2022), capturing the number of individuals and groups children interact with. Data were analysed using Generalised Linear Mixed Models (GLMMs).

When SNS was operationalised using the conventional weekly contact threshold as proposed by Burke et al. (2022), we observed no significant associations with the outcome variables. Furthermore, we conducted an exploratory, data-driven grid search with cross-validation to identify the contact-frequency cut-off that best predicts each outcome. This revealed diverging optimal thresholds across outcomes, suggesting that the relevant contact frequency might differ by developmental domain: VPT was positively associated with SNS calculated from 11 interactions per year (roughly monthly), replicating and extending earlier findings (Burke et al., 2023). This suggests that including less frequent contacts, with whom children may have less common ground, may better capture the communicative diversity relevant to VPT. For NVC understanding, the optimal threshold was about 4 interactions per week. At this threshold, social network size was negatively associated with task performance. One speculative explanation is that children in smaller, denser networks may become more sensitive to the NVCs of familiar partners, which extends to laboratory tasks. Children with larger networks may not develop the same sensitivity.

These findings show associations between children's social networks and pragmatic communication skills, but these associations are sensitive to how SNS is operationalised. Future research should examine which features of children's social

networks (e.g., frequency, diversity, and closeness) most robustly predict communicative development.

A25 Revisiting the Association Between Infant Attention and Later Executive Function and Effortful Control: A Longitudinal Study with Parental Moderators

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Cascading models of development propose that infant attention serves as a building block for more complex functions, such as executive functions and effortful control (Garon et al., 2008; Oakes et al., 2022). Although some findings support this claim, other studies report null results, potentially indicating moderating variables such as parenting behaviors, which are known to be closely associated with both executive functions and effortful control. The present study is the first to examine whether attention in infancy is related to executive functions and effortful control in early childhood while accounting for a range of parental behaviors as potential moderators.

At Time 1, 110 infants ($M(SD) = 11.9(1.4)$ months, range = 9.7-15.9, 47 girls) participated in the study and completed the anti-saccade task, the distractibility task, and a semi-naturalistic individual play session to assess sustained attention. Nineteen months later (range = 16-21 months), 75 children ($M(SD) = 31.1(1.8)$ months, range = 26.6-36.0, 35 girls) completed the Reverse Categorization Task, Spin-the-Pots Task, and Prohibition Task as measures of executive function. Additionally, mothers reported on children's effortful control using the Early Childhood Behavior Questionnaire. At both time points, maternal sensitivity, cognitive stimulation, positive and negative affect, and control behaviors were coded from ten-minute mother-child free play sessions using the C-CARES coding manual (Tamis-LeMonda, 1999).

Results showed that infant attention, as measured through both screen-based tasks and semi-naturalistic play, did not significantly predict later executive functions or effortful control, as assessed by both behavioral tasks and parent report. Furthermore, maternal behaviors at either time point did not significantly moderate the relationship between early attention and later outcomes. Consistent with more recent findings (e.g., Tu et al., 2022), these results call into question the proposition that early attention provides a foundation for subsequent executive functions and self-regulatory capacities.

A26 PRISMAL: The Pupil Response Information Scouting Method for Assessing Learning

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Much of what we know about infant cognitive abilities is based on research that uses habituation. Here, it is the decrease in interest to a specific stimulus (or set of stimuli) over repeated presentation that is indicative of habituation, followed by renewed interest in a novel stimulus. This renewed interest suggests that the decline was a function of learning, not mere fatigue. Researchers often use the 3-3-50% criterion approach to assess habituation, whereby average interest from the last three trials is less than 50% of average interest from the first three (Kucharský et al., 2022).

Commonly, total duration of looking to a stimulus event is the dependent variable in these paradigms. Because this method is not sensitive to temporal expression of interest within trials, pupil dilation has emerged as a useful, complementary approach to study information processing (Sirois et al., 2023). Moreover, there is a link between infant habituation and intelligence (Kavšek, 2004), and the dynamic properties of the pupil are related to mental load in adults (Marek & Noworol, 1984). It is conceivable that properties of pupil response could index fundamental aspects of information processing.

In this paper, I propose a method using dynamical properties of the pupil (velocity and acceleration) on the very first trial of a learning task to predict the interest of individual infants on the rest of the task. Four-month-olds ($n = 20$) and nine-month-olds ($n = 22$) took part in a 40-trial auditory oddball task. Peak velocity and acceleration were computed on the first trial. For each infant, a slope and intercept of interest over all 40 trials were computed. In 4-m-o infants, peak pupil acceleration was significantly correlated with intercept. At 9 months, peak acceleration correlated with the slope. Exploratory analyses examine 2nd and 3rd order polynomial alternatives to the slope as finer measures of interest.

These findings could be important for infancy research, given the high levels of attrition in such studies (Slaughter & Suddendorf, 2007). Attrition is an acute problem in longitudinal studies, where missing data from one visit can reduce statistical power. PRISMAL, which can be computed for every infant who completed one trial, would provide an information processing index when otherwise faced with a lack of data. Similarly, this index could be used to assess whether infants who failed to complete

the task differ from those who succeeded, given the problematic definition of fussiness, a common cause of attrition.

A27 Tiredness as an insight into infant cognition and learning

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Sleep and tiredness dominate the life of a young infant. consider two infants: both equally bright, both with attentive caregivers, both afforded the same opportunities. One infant is alert, just awoken from a nap, while the other tired, frustrated and fighting sleep. When each infant is exposed to a learning encounter of a new word, their attentional state will necessarily shape their learning – while the alert infant will catch cues, hear words, and attend longer to speech, the tired one might miss a key cue or tune out during processing of speech. Developmental researchers have long been aware that this is a factor implicitly, often scheduling testing around naps, or documenting dropouts due to “fussiness” but the effects as a source of individual differences have not been explicitly studied. Even as adults our attentional state has well-documented effects on our ability to attend to and attain information, yet in infants this has hitherto been ignored. Tiredness has been studied indirectly in studies looking at the effect of sleep, demonstrating that sleep in older children and adults has direct effects on memory, attention and executive functioning, but due to frequent naps infants can have poor nighttime sleep and still be alert.

We present the first data on the effects of tiredness on infant memory, attention and word learning. Caregivers completed the Durham Infant Tiredness Questionnaire (DITQ) and infants took part in a visual working memory task and word learning task with attentional cueing. Behavioural data was captured with eye-tracking while optical neuroimaging was collected with high-density diffuse optical tomography (HD-DOT).

Our results demonstrate working memory effects of tiredness that are distinct from the effects of nighttime sleep on tiredness, and heavily increased activation in the frontal cortex for more tired infants while doing the working memory task. In the word learning task, tiredness had a strong effect but only when the cue was absent, indicating the role cueing can play in overcoming attentional deficits due to tiredness. This pattern of results demonstrate the importance of considering tiredness both as a factor affecting cognition moment-to-moment in infants, but also demonstrate that the timing of interactions might be a crucial factor in determining the success of learning encounters.

A28 Bridging Digital & Familial: VR and Smart Home Pathways to Infant Emotional Security

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Digital technologies increasingly shape early caregiving environments critical for infant socioemotional development (0-4 years). This study tests the Technology-Based Family Resource Model (T-BFRM), integrating Conservation of Resources theory with digital affordances. We hypothesized dual pathways to family emotional intimacy—a precursor of secure attachment: (1) VR utilization via increased parenting self-efficacy (resource acquisition), and (2) smart home technologies via reduced parenting burden (resource conservation). Gender invariance was also examined.

Participants comprised 169 parent couples ($N = 338$, $M_{age} = 34.2$, $SD = 4.1$) raising children aged ≤ 5 years ($M_{child} = 2.8$ years), recruited from urban Korean families. Validated scales assessed VR/smart home utilization, parenting self-efficacy ($\alpha = .92$), parenting burden ($\alpha = .89$), and family emotional intimacy ($\alpha = .94$). Analysis utilized confirmatory factor analysis (CFA) and structural equation modeling (SEM) with 5,000 bootstrap resamples, controlling for digital literacy and SES. Semi-structured interviews ($n = 20$ dyads) explored phenomenological experiences.

The T-BFRM exhibited excellent fit ($CFI = .94$, $TLI = .93$, $RMSEA = .04$, $SRMR = .04$). VR significantly enhanced family intimacy through parenting self-efficacy ($\beta = .17$, 95% CI [.09, .26], $p < .001$), fostering relational mastery essential for sensitive caregiving. Smart homes enhanced intimacy via burden reduction ($\beta = .11$, 95% CI [.05, .19], $p < .001$), conserving emotional resources. Multi-group SEM confirmed full structural invariance across genders ($\Delta CFI = .002$, $p > .05$). T-BFRM establishes VR and smart homes as synergistic resources strengthening family emotional availability during critical infant attachment formation. VR builds parenting competence; smart homes preserve emotional energy for responsive caregiving—key predictors of secure infant attachment. Findings advocate technology-integrated interventions enhancing early socioemotional environments. Cross-sectional limitations noted; longitudinal validation needed.

A29 Gestural and Vocal Communication in Deaf and Non-Deaf Infants During Play with their Parent

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Communication begins early in infancy, long before the emergence of words. During this period, infants engage in prelinguistic communication - using gestures, vocalisation and gaze - that lay the groundwork for later language development. However, early deafness can disrupt prelinguistic communication and this may put children at risk of language delays (Lederberg et al., 2013). Kelly et al. (2020) found that deaf infants of hearing parents (DOH) produced fewer prelinguistic behaviours than hearing infants of hearing parents (HOH) during parent-infant interactions. In this pre-registered conceptual replication and extension of Kelly et al. (2020), which included children with mild hearing loss, preliminary results (N = 12) support Kelly et al. (2020), suggesting that DOH infants use a lower frequency of both prelinguistic and also linguistic behaviours. The extension including infants with milder hearing loss does not indicate any differences to HOH infants. Overall, this suggests both that prelinguistic communication is experience dependent and that therapeutic support is needed for hearing families with deaf infants from early in the first year.

A30 When Affective Touch Does Not Align: Maternal Touch and Children's Responses in At-Risk Families

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Affective touch is often conceptualized as a mechanism supporting early co-regulation in caregiver–child interactions. However, its regulatory function may not be uniform across contexts, particularly under conditions of psychosocial adversity that shape caregiving behaviors. Examining the quality of maternal touch, rather than its mere presence, may clarify how early interactional processes vary as a function of risk. This study investigated the association between maternal touch valence and children's behavioral responses, and whether maternal psychosocial risk predicts variability in both maternal touch and child responsiveness. The sample comprised 32 mother–child dyads (17 girls), with children aged 2–5 years ($M = 3.6$), recruited from services supporting families at psychosocial risk in Northern Portugal. Interactions were video-recorded in the home during three structured tasks: prohibition (“Don’t Touch”), free interaction (“Play Together”), and cooperation (“Clean-Up”). Maternal touch and child responses were micro-coded using the Caregiver–Child Affective Touch Assessment (CCATA) and its corresponding child response system (CCATA-CRV). Psychosocial risk was assessed with the Family Risk and Strengths Profile. Data were analyzed using chi-square tests and multinomial logistic regression models. A total of 1,492 touch episodes were coded. Maternal touch valence was strongly associated with child responses, $\chi^2(9) = 1323.28$, $p < .001$. Negative touch elicited predominantly negative responses (73.4%), whereas positive touch resulted in a more distributed pattern (35.2% positive; 34.1% negative; 30.7% no response). Neutral touch was most frequently followed by no response (58.8%). Psychosocial risk significantly predicted maternal touch patterns, $\chi^2(4) = 12.26$, $p < .05$, Pseudo- $R^2 = .016$. Mothers in medium-risk contexts were less likely to use positive (vs. neutral) touch ($OR = 0.46$, $p < .05$), and mothers in high-risk contexts showed a reduced likelihood of positive (vs. negative) touch ($OR = 0.53$, $p = .056$). Child responses were also associated with risk, $\chi^2(4) = 9.81$, $p < .05$, Pseudo- $R^2 = .013$. Children of mothers in medium-risk contexts showed increased odds of both negative ($OR = 1.34$, $p = .062$) and positive responses ($OR = 1.53$, $p = .057$) relative to no response, whereas high-risk contexts were characterized by reduced overall responsiveness. Despite small effect sizes, findings indicate that psychosocial adversity is linked to systematic differences in the micro-dynamics of tactile interaction. Specifically, higher risk constrains the use of positive maternal touch and alters children's responsiveness patterns. These results underscore the importance of targeting observable interactional processes in interventions aimed at promoting sensitive caregiving in at-risk populations.

A31 Parent–Infant Gesture Dynamics and the Role of Touchscreen Interaction

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Infants are growing up in rapidly evolving digital environments, which raises concerns about the potential impact on early social and cognitive development. Yet little is known about how young children use touchscreen devices, particularly how the pointing-like gestures (e.g., tapping and flicking) involved in these interactions relate to emerging communicative skills. Our aim was to map the developmental changes in parental and infant gestures and examine how touchscreen exposure may shape the infant trajectory.

In this study, infants and their parents ($N = 50$) participated in 15-minute semi-structured play sessions in their homes at 10- and 13-months. We coded showing, giving, and pointing gestures for both partners, and parents completed a questionnaire (adapted from Cristia and Seidl's (2015) touchscreen use questionnaire) detailing infants' touchscreen use, including frequency and the pointing-like gestures they produced (e.g., tapping, swiping). Parents' gestures were recoded based on pointing intentionally (i.e., imperative, declarative, expressive and informative) and showing motion (i.e., deictic and dynamic).

Results suggest that infants' showing, giving, and pointing gestures were developmentally interlinked. Ostensive gestures were closely related and early showing predicted later pointing. Parental pointing supported infants' subsequent pointing, whereas higher levels of parental dynamic showing reduced infants' later showing. Touchscreen frequency itself was not associated with gesture development. Infants' ability to produce specific touchscreen-related gestures (e.g., tapping) predicted later pointing, suggesting that certain interactive touchscreen actions may facilitate communicative skills. Notably, the positive influence of early parental pointing was reduced if infants produced tapping gestures during touch-screen interactions, highlighting a complex relationship between social input and digital experience.

A32 Caregiver report of literacy interests and engagement with literacy-related activities in early childhood

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Engagement with literacy activities in early childhood positively predicts educational outcomes for autistic (Boyle et al., 2019) and non-autistic children (Scarborough et al., 1991). However, we do not yet know how well caregiver-reported literacy interests correspond to engagement with literacy activities and conversation during caregiver-child interaction. This study examines the relation between caregiver reporting of literacy interests in autistic and non-autistic children and engagement in literacy-related conversation/activities during a 20-minute play interaction.

These data stem from a larger project focusing on autistic and non-autistic children's communication development. We asked caregivers to report their child's top three current interests. Here, we focused on a subset of participants for whom the caregiver reported a strong child interest in reading, books, or letters (N = 31), and 31 who were individually matched on autism status, age, gender, and caregiver-reported vocabulary on the MCDI (Fenson et al., 2007) for whom no literacy-related interests were reported (age range 24-70 months, mean age 46 months). Of the 62 included dyads, 28 were autistic and 34 were nonautistic. However, preliminary analyses showed no differences among autistic and non-autistic children, so we collapsed across them for the purposes of this abstract.

The caregiver and child engaged in a semi-structured play session with a variety of toys in their homes. Within these interactions, we recorded instances of literacy-related conversation or play. These segments included play with literacy-related objects (e.g., books, letter blocks) and discussions of reading, spelling, or letters (e.g., spelling words).

Only 5 of the 62 dyads engaged in literacy activities during the play session; 4 in the group whose caregiver reported a literacy interest, and 1 in the group with no reported literacy interests. A 2-tailed Fisher's exact test showed no difference in literacy activities between the groups ($p = .35$).

Our finding suggests that caregiver report of literacy interests does not necessarily result in literacy-related conversation during a designated parent-child interaction. However, we only had access to one 20-minute sample of play. Day-long recordings may offer insight into how pervasive literacy activities are for children with and without reported literacy interests.

A33 Consistency of Maternal Sensitivity in the First Year of Life and Children's Cognitive Development in Preschool Age

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Maternal sensitivity, defined as a mother's ability to perceive, interpret and respond appropriately and promptly to her infant's signals (Ainsworth, 1969), is widely recognized as a cornerstone of early socio-emotional and attachment development. The first year of life represents a particularly sensitive period, as infant-caregiver attachment is concurrently forming (Ainsworth, 1978) leading to the assumption, that infants are particularly receptive to caregiving quality during the attachment formation period. Nevertheless, only a few studies have examined direct effects of maternal sensitivity in the first year of life on later cognitive development, and those that did have yielding contradictory findings: while most report positive associations (e.g. Feldman & Eidelman, 2005; Salo et al., 2010), others found no effect or even negative associations (e.g. Page et al., 2010, Vogeli, 2017), leaving the nature of this relationship poorly understood.

Therefore, the present study examines whether the consistency of maternal sensitivity across the first year of life predicts children's cognitive development at four years of age, the timepoint at which reciprocal attachment is considered fully established. We distinguish two sensitivity trajectory groups: (1) consistent sensitivity (high sensitivity at both 6 and 12 months or low sensitivity at both time points), and (2) fluctuating sensitivity (high at one time point, low at the other). Mothers in the consistent group, regardless of the sensitivity level, are expected to provide a predictable interactional environment, potentially enabling infants to develop adaptive regulatory strategies. However, fluctuating sensitivity, characterized by unpredictable shifts in caregiver responsiveness across time, may prevent infants from adapting to their caregiver's interaction style, diverting cognitive resources away from exploratory engagement and resulting in lower cognitive scores at preschool age compared to the consistent sensitivity group.

A total of N = 91 German mother-child dyads participated at all three measurement points. Maternal sensitivity was assessed at 6 and 12 months during 5-minute laboratory free-play sessions and coded using the direct score of the Emotional Availability Scales (Biringen et al., 2008; high sensitivity: direct score ≥ 5.5 , low sensitivity < 5.5). Cognitive development was assessed at age four with the K-ABC (Kaufman & Kaufman, 1991), yielding two cognitive scores, a general intelligence and a skills score. Due to the restricted sample size, only group differences between consistently and fluctuating sensitive mothers will be examined via t-tests for both

cognitive outcomes. As data analysis is still ongoing, results will be presented at the conference.

A34 Initiating and Following Maternal Pointing Differentially Predict Infants' Pointing Development

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Infant pointing plays a central role in early social-communicative development (Choi & Rowe, 2025; Goldin-Meadow, 2007; Kirk et al., 2022), yet little is known how caregivers' coordinated behaviors support its emergence. The present longitudinal study examined how caregivers' initiating versus following pointing within interactions relates to infants' development of pointing across the first year of life. In 118 German mother-infant dyads (42% female), spontaneous pointing was assessed in a semi-natural elicitation procedure (Liszkowski et al., 2012) at 6, 10, and 14 months. Caregivers' pointing was coded as initiating (preceding) or following (responding to) infant's gestures. Results showed that maternal pointing was positively associated with infants' later pointing. Critically, maternal following pointing at 10 months was positively associated with infant pointing at 14 months, whereas initiating pointing showed a negative longitudinal association. Moreover, both forms of maternal pointing were positively related to infant pointing at 14 months. Maternal sensitivity predicted maternal initiating pointing at 14 months. These findings suggest that caregivers' temporally contingent responses to infants' communicative acts play a distinct role in supporting the development of pointing. More broadly, consistent with relational developmental systems theory (Carpendale et al., 2013; Rodríguez, 2009), the results highlight the importance of coordinated interactional processes for early communicative development.

A35 An fNIRS Hyperscanning Approach to Explore Mother-Infant Neural Synchrony
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Parent-infant interactions play a pivotal role in early socioemotional development, engaging both behavioral and physiological systems. Among these, affective touch constitutes a fundamental mechanism shaping emotional regulation and attachment within caregiver–infant dyads. Previous research has demonstrated increased inter-brain coupling, often referred to as neural synchrony and operationalized as inter-brain functional connectivity (i.e., the temporal correlation and time–frequency coupling of hemodynamic signals), in mother–infant dyads during naturalistic free-play interactions mediated by touch and proximity (Nguyen et al., 2021). However, the mechanisms underlying neural synchrony during ecologically valid, touch-mediated exchanges remain insufficiently understood. The present study aims to extend previous findings by examining how affective touch modulates inter-brain neural synchrony between mothers and their 6-month-old infants across distinct interaction contexts. This protocol is part of the larger “Baby Scientist” project at Mackenzie Presbyterian University, Brazil. Data collection is ongoing, with a target sample size of 65 dyads. Functional near-infrared spectroscopy (fNIRS) data are acquired simultaneously from mothers and infants during four experimental conditions manipulating the presence or absence of affective touch and face-to-face interaction. Bilateral regions of interest (ROIs) include the dorsolateral and ventrolateral prefrontal cortices, medial prefrontal cortex, temporoparietal junction, posterior superior temporal sulcus, and middle temporal gyrus. Data preprocessing pipelines are currently being developed in Python using the MILOB package developed at the University of Birmingham, UK. Analyses will be conducted at two levels: (1) intra-individual, assessing functional activation in response to social versus nonsocial conditions, and (2) inter-individual, examining neural synchrony between mother and infant across conditions. Neural synchrony will be quantified through comparisons of hemodynamic response function (HRF) patterns across ROIs. Additionally, Wavelet Transform Coherence (WTC) will be employed to characterize time-frequency dynamics of inter-brain connectivity. We hypothesize that neural synchrony will be enhanced during face-to-face interactions involving affective touch, relative to both non-face-to-face and no-touch conditions. Furthermore, we expect this effect to be particularly pronounced in prefrontal regions implicated in social engagement and

mutual interaction, including the dorsolateral, ventrolateral, and medial prefrontal cortices. Preliminary results will be presented at the conference. Overall, this study seeks to advance understanding of how affective touch shapes early social experiences through the emergence of brain-to-brain synchrony in early infancy.

A36 Bilingual children and their caregivers coordinate their language choices in everyday family interactions: Insights from French-English and Spanish-English families

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Bilingual children learn their languages through rich daily interactions with caregivers within dynamic family contexts (De Houwer, 2011; Byers-Heinlein et al., 2025). However, little is known about how families coordinate their two languages to support bilingual acquisition. This study examines alignment — the coordination of language choices between caregivers and children — across two interpersonal contexts (one-to-one and multi-party interactions) and two bilingual communities (French-English families in Quebec, Canada, and Spanish-English families in New Jersey, USA). We asked: (1) Are caregivers and children aligned in their language choices, and how does this vary across caregivers and interpersonal contexts? (2) Do alignment patterns differ between communities, reflecting different sociolinguistic contexts? (3) What individual factors predict alignment strength?

Thirty-nine children aged 18–35 months and their families were video-recorded during two 20-minute home play sessions: one with a primary caregiver only, one including additional household members. Utterances were coded for speaker and language. Alignment was examined using three metrics — overall, bidirectional, and moment-to-moment — compared to chance using Monte Carlo simulations.

Primary caregivers and children showed strong overall alignment across both communities in one-on-one ($r_s > .64$, $p_s < .003$) and multi-party sessions ($r_s > .60$, $p_s < .039$). Strong bidirectional alignment indicated mutual adaptation ($ORs > 19.05$, $p_s < .001$). Children's alignment was modulated by language exposure and age: higher exposure predicted stronger alignment in both communities, and the exposure-alignment relationship changed with age differently across communities — younger French-English children showed a strong positive relationship that weakened with age, whereas this decline was less pronounced in Spanish-English families. Caregivers' alignment decreased only when additional members were present. Turn-by-turn alignment exceeded chance in two-thirds of sessions, running 20–22% above baseline. By contrast, other family members aligned more weakly with children across all metrics (overall: $r_s < .39$, $p_s > .211$; bidirectional: $OR = 3.28$, $p = .104$).

These findings demonstrate that primary caregivers and bilingual children consistently coordinate their language choices across diverse family configurations and communities. Notably, community differences emerged not in overall alignment but in how individual differences shaped it, suggesting that sociolinguistic context may influence how alignment unfolds. Linguistic coupling may thus support bilingual development across varied interaction contexts, highlighting the central role of primary caregivers in early bilingual experiences across societies where bilingualism is and is not the norm.

A37 In Sync or Not: Is Mother and Infant Psycho-Physiology During a Social Stressor Task Associated with Dyadic Behavioural Synchrony or Maternal Anxiety?

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Self-regulation begins early in life, influenced by both neurological and environmental influences. Environmental influences on infants' regulation include the support of caregivers, typically mothers, in a process known as co-regulation. Co-regulation is multi-faceted relying on several interactive processes between the mother-infant dyad. Mother-infant behavioural synchrony involves the matching or coordination of relational behaviours, such as posture, gaze, facial expressions, vocalization, and movement. Research has demonstrated that behavioural synchrony can influence the co-regulation processes for mothers and infants, while mothers' and infants' psychophysiology varies according to the distinct regulatory demands of each dyad member (Feldman et al., 2011; Ostlund et al., 2017). The co-regulation process, where mothers initiate and maintain appropriate levels of behavioural synchrony for different situational demands, might be challenging for some mothers. A recent naturalistic study (N = 68) showed that psychophysiological and behavioural patterns between non-anxious and anxious mothers differed when regulating infants (Smith et al., 2022), implying potential variations in regulation patterns between anxious and non-anxious mothers. Further research is needed in situations where environmental stressors that provoke psychophysiological arousal are controlled. The present study therefore aimed to investigate the process of mother-infant co-regulation in infants' first year of life by examining mother and infant psychophysiology, dyadic behavioural synchrony, and maternal anxiety. The study involved 85 Australian mother-infant dyads (56.5% mother-son dyads) from diverse cultural backgrounds (White, 41.2%, East Asian, 27.1%, South-East Asian, 9.4%, South Asian, 8.2%, Other, 14.1%). Mean infant age was 9.5 months (SD = 2.6) and mean maternal age was 33.2 years (SD = 4.0). In the laboratory, participants completed in the Face-to-Face Still-Face paradigm, which is a task with a mild social stressor (Tronick et al., 1978). During this task, dyads were video-recorded so that behavioural synchrony could be coded (intraclass correlation coefficient with absolute agreement = .97), and psychophysiological electrodermal activity data were collected from mothers and infants. Maternal anxiety was self-reported via questionnaire (Lovibond & Lovibond, 1995). We examined whether infants and mothers electrodermal activity varied from baseline play to the social stressor (i.e., Still-Face phase) to the reunion play. Further, we examined whether mother or infant electrodermal activity varied by dyadic behavioural synchrony and/or maternal anxiety levels. Such investigations are crucial for unravelling the mechanisms by which mothers and infants co-regulate during times of stress, and further understanding the dyadic and individual maternal factors that may influence mother and infant regulation.

A38 Exploring the Influence of Maternal Mind-Mindedness and Infant Temperament in Shaping Infants' Socioemotional Wellbeing

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Mothers' capacity for mind-mindedness allows them to tune in to their infant's unique perspectives and internal experiences, and this attunement appears to play a meaningful role in early development. Indeed, higher levels of maternal mind-mindedness have been linked to more positive socioemotional outcomes. However, socioemotional development does not arise from parenting alone. For example, different infant temperamental profiles often predict divergent socioemotional trajectories. Although several studies independently explore temperament and parenting, research on both temperament and mind-mindedness are largely absent. The first aim of this study was to examine the influence of maternal mind-mindedness on infant socioemotional development. The second aim of this study was to explore the potential moderating role of maternal mind-mindedness on the relationship between infant temperament and socioemotional wellbeing. Participants comprised culturally- and socioeconomically diverse mother-infant dyads (N = 63; 52.38% girls) who were living in Australia. Infants were aged 4- (n = 32) or 8-months-old (n = 31). Mothers were aged 33 years on average (SD = 4.64, range = 19.53–43.46). Infant temperament was measured using the three temperamental sub-scales (negative affect, effortful control, and orienting) on the mother-reported Infant Behaviour Questionnaire–Revised Very Short Form (Putnam et al., 2014). Maternal mind-mindedness was coded from a free-play task with toys lasting 4 minutes. Speech was transcribed verbatim and subsequently classified whilst observing the videos according to the Mind-Mindedness Coding Manual (Meins & Fernhough, 2015) as not mind-related comments, mind-related appropriate comments, and mind-related non-attuned comments. Infant socioemotional wellbeing was measured via the mother-reported Ages and Stages Questionnaire: Social-Emotional (Squires et al., 2002). Results showed that temperamental effortful control independently predicted infant wellbeing, suggesting that infants higher on specific temperament traits (i.e., effortful control) experience optimal socioemotional development independently of mind-minded parenting. Results also showed that mind-mindedness moderated the relationship between negative affect and socioemotional wellbeing, whereby infants with higher negative affect who received higher appropriate comments had better socioemotional wellbeing than their lower negative affect counterparts. This highlights that for higher negative affect infants, appropriate comments are particularly influential in enhancing wellbeing. Non-attuned mind-related comments were not independently associated with infant wellbeing. These findings broaden research knowledge and advance understanding of the differential susceptibility hypothesis for

infant development. Overall, this study has shown how infant socioemotional wellbeing can be affected by the temperamental dispositions that infants bring into the world, as well as the parenting experiences that they encounter.

A39 The impact of tiredness on infant attention during shared reading tasks

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Shared reading in infancy is beneficial for future language development. Previous research shows that particular aspects of shared reading at 10 months, such as maternal questions and child interest, impacts later language skills at 18 months (Muhinyi & Rowe, 2019). Yet, little research has focused on infant attention and the inter-individual factors during this activity. Attention lays the foundation for language skills to develop and a disruption to this could have knock-on effects for future language development. Tiredness is ubiquitous in infancy and is likely disrupting attention. Therefore, tiredness may be influencing the effectiveness of shared reading in infancy by impacting attention. In the current study, we investigate the effects of tiredness on attention in two shared reading tasks. One with a physical book completed in a naturalistic lab environment (family room) and another using a screen-based book task (named the eBook task) in a controlled lab environment. For both tasks infants were aged 10-24 months and caregivers answered the Durham Infant Tiredness Questionnaire (DITQ), a purpose-developed questionnaire designed to capture infant tiredness. The physical book task was recorded with video cameras and later coded for looking, tiredness, gestures, book holding and talking. The eBook task captures infant looking patterns with eye tracking and brain activity with functional near-infrared spectroscopy (fNIRS). We have currently collected 56 participants for both tasks, of which 40 in eBook are fNIRS and 16 in physical book have been coded. Initial eye tracking results in eBook show that infants who are tired have worse fixation and spend less time visually exploring the book. Interestingly, higher tiredness seems to be related to shorter task runtime, indicating that parents are responsive to their infants' state. Whilst we are only at the initial stages of analysis for the physical book task we plan to present and compare results between the two tasks at the conference. Nevertheless, the eBook results, thus far, indicate that tiredness is having a damaging effect on attention, suggesting that shared reading is most beneficial when infants are not tired. This has implications for parents who decide to read only before bedtime indicating that shared reading should also be done throughout the day to maximise the benefits of this activity.

A40 Mother-Toddler Language Use and Language Mixing in At-Home Play Sessions

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Early multilingual experience unfolds within complex social interactions between children and their caregivers; yet, research has largely treated multilingual environments as shaped by caregiver input alone, typically measured through parental reports (Cattani et al., 2014; Unsworth, 2013) or day-long recordings (Orena et al., 2020; Marchman et al., 2017). This overlooks the bidirectional nature of interaction: in research studying monolingual communities, mothers adapt their speech in response to children's behaviour (Mimeau et al., 2019), yet limited work has examined how multilingual children and caregivers coordinate their language use across languages during interaction. Existing findings suggest that children and caregivers match each other's language during conversation, shaped in part by language dominance (Fibla et al., 2026; Slawny et al., 2025). Yet, focusing on matching alone provides an incomplete picture of interaction, as shifts between languages (i.e., code-switches) are central features of multilingual interactions (Kremin et al., 2022). It therefore remains unclear how moment-to-moment matching in conversation and code-switching jointly structure multilingual interaction, or how these patterns relate to the child's broader language experience.

The present study examined mother-child play interactions in 10 multilingual families from London (children aged between 28–39 months). Dyads participated in remotely recorded play sessions that were annotated for language use (e.g., proportion of time spent using each language) and code-switching (within- and between-utterance). We also used parental reports (Q-BEx; De Cat et al., 2022) to index children's broader language experience, including current exposure and children's reported proficiency.

Preliminary results show that mothers predominantly use a heritage language ($M = 72.9\%$), whereas children showed more balanced use (English: $M = 41.8\%$; Heritage language: $M = 51.2\%$). Maternal and child language use were strongly positively correlated for both English, $r(8) = .82$, $p = .004$, and the heritage language, $r(8) = .85$, $p = .002$. Children exhibited higher rates of between-utterance code-switching ($M = 29.8\%$, $SD = 10.0$) than mothers ($M = 17.2\%$, $SD = 14.1$), $t(9) = -2.32$, $p = .046$. Within-utterance code-switching was rare for both speakers (child $M = 2.27\%$, $SD = 2.48$; mother, $M = 2.65\%$, $SD = 1.88$). Ongoing analyses will examine how children's reported language exposure and proficiency relate to children's language use and how closely children match their mother's language use during conversations (e.g., whether

mothers respond in the same language used by their child from one utterance to the next and vice versa).

A41 PreNDD: Predictors of neurodevelopmental disorder diagnosis and functioning in early school age children in Malawi

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Neurodevelopmental disorders (NDDs) include autism, attention deficit hyperactivity disorder (ADHD), neuromotor impairments (NMIs), epilepsy, and intellectual disability (ID) (APA, 2013). Children in low-and-middle-income countries (LMICs) are at increased risk of adverse pregnancy events, infections, malnutrition, and environmental stress, predisposing to NDDs (Black et al., 2017). NDDs impact 18.3% <10yo globally (WHO, 2023), with >90% living in LMICs (Olusanya et al., 2018).

Most diagnostic tools are expensive, time intensive, and require specialised training. This impedes early detection, limiting opportunities for intervention when neuroplasticity is maximal, especially in LMICs (Lynch et al, 2024). Early detection is vital, with early interventions minimising social, behavioural, and educational impacts (Wertlieb, 2019).

The Scalable Transdiagnostic Early Assessment of Mental Health (STREAM) study team developed a novel tablet-based neurodevelopmental assessment tool for use by non-specialists in diverse settings (Williams et al., 2024). The STREAM tool was administered to n=2036 0-6yo in Malawi from March 2022-July 2024.

We aim to identify longitudinal predictors of NDD diagnosis and functioning in 5-8yo in Malawi, including scores on the STREAM tool.

We are conducting a single-site retrospective observational cohort study with n=430 5-8yo in Malawi from July 2025-September 2026. Participants were assessed 30 +/- 6mo previously in the STREAM study, at 2.5-6yo. We are administering diagnostic assessments for NDDs (autism, ADHD, NMIs, epilepsy, and ID), with final clinical diagnosis by a Paediatrician and Psychiatrist. We are assessing functioning with measures of school readiness and participation.

Primarily, evidence of the diagnostic accuracy (DA) of STREAM scores to predict NDDs will be provided. Secondary measures include DA for individual NDDs and predictive

validity (PV) for functioning. We are modelling exposure variables predictive of NDD diagnosis and functioning.

Interim analysis after 45% recruitment (n=193) of 53.4% male (n=103) at mean 6.7yo, identified 13.5% (n=26) on >1 assessment tool for autism, ADHD, NIMs, epilepsy, or functional impairment. The majority (n=167) were in primary education, with mean intelligence quotient 73.2 (SD=10.2). The DA of overall STREAM cut score of -1.03 for ASD and ADHD had an AUC of 0.79 (95% CI 0.65-0.94), with 0.62 sensitivity (95% CI 0.32-0.86) and 0.93 specificity (95% CI 0.88-0.96). Overall, STREAM scores were significantly correlated with IDELA z-scores ($r=0.46$, $P<0.001$) and participation ($r=0.23$, $P=0.001$).

The STREAM tool could offer a simple, affordable, standardised platform administered by non-specialists, to facilitate earlier identification of NDDs and functional difficulties - as well as early referral and intervention.

A42 Streamlining Children's Screen Media: Examining the Capacity Model's Predictions in Children's Comprehension

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Current screen recommendations for children under 5 years-old mostly emphasise the amount of time children spend watching screen media (Department of Education, 2026), placing considerable pressure on caregivers. However, the design of screen media, and whether or not it supports children's learning, is often overlooked in these guidelines. Fisch's Capacity Model for educational media suggests that closely aligning the narrative and educational content of screen media aids children's learning and comprehension (Fisch, 2000, Horgan & Kirkorian, 2020). The smaller the 'distance' between the narrative/ entertainment and educational content, the more cognitive resources can be used for learning. For instance, Eng et al., (2020) have found that when books were streamlined (by removing the irrelevant background information), children's comprehension and attention (measured by gaze shifts away from the text) increased when compared to the normal condition (the e-book as published). This may be due to the decreased 'distance' between the educational content and the visual narrative/entertainment information as described in Fisch's capacity model. The purpose of this study is to apply this method to dynamic stimuli, through an episode of children's educational television. N = 80 children (40 4-year olds and 40 7-year olds) will view an episode of Dora the Explorer, counterbalanced into either the 'normal' or streamlined condition, which has the visual background and music removed (speech intact). To quantify the video's visual complexity differences, the low-level features (such as edge density, edge orientation entropy, luminance and motion) will be calculated on a whole-frame level. Complexity will then be compared within and outside character-relevant bounding boxes, to empirically justify the streamlining manipulation. Whilst watching, EEG, ECG and eye-tracking data will be recorded. Immediately after watching, children will be asked 17 questions to examine their comprehension of the video. We hypothesise that (1) children's comprehension of the cartoon will be higher after watching the streamlined episode of Dora compared to the normal episode, and (2) children will overall have greater looking time to the screen during the streamlined episode of Dora compared to the normal episode. Exploratory analysis on arousal (ECG) and EEG are also being considered. If results align with those found by Eng et al., (2020) and therefore the Capacity Model (Fisch, 2000; Horgan & Kirkorian, 2020), it would suggest that the design of children's educational television can be improved to increase comprehension, possibly informing future policy recommendations to consider the design of content, not only time watched.

A43 Articulatory movement during speech processing in infancyCatherine Laing¹, Charlotte Blake², Mingtong Li¹, Florence Oxley¹, Kylan Smith¹¹University of York, York, United Kingdom, ²Ulster University, Coleraine, United Kingdom

Recent studies test the possibility that pre-linguistic infants activate their vocal articulators when processing speech. Choi et al. (2019) and Bruderer et al. (2015) infer this indirectly by inhibiting 6-month-olds' articulators during a speech processing task. When infants' lip/tongue movements were inhibited by a teether, they were unable to discriminate between similar-sounding consonants produced by the lips/tongue. When these movements were not inhibited, infants were able to discriminate between speech sounds. This may indicate that infants gain sensorimotor feedback from the speech articulators while listening to speech in early development, establishing the foundations of speech production months before word production begins. However, it remains unknown whether infants actually move their articulators during speech processing. We expand on this by directly investigating infants' articulatory movements during speech perception using lingual ultrasound. We compare this with articulatory movement while watching someone eating. We hypothesise that infants move their tongue more when attending to someone speaking compared to eating, relative to a baseline condition.

Four-to-six-month-olds (current $n = 28$) attend to videos of a woman saying nonsense sentences (speech condition), a woman eating a banana (eating condition), and a colourful moving orb with a two-note melody (baseline) while we collect lingual ultrasound data via Articulate Assistant Advanced (AAA; Wrench, 2022). We measure articulatory movement using tongue displacement (amplitude of tongue movement) in the speech/eating conditions relative to baseline. Normalized tongue coordinates for each speech/eating trial are compared with baseline trials to create a mean tongue displacement measure (MTD) for each trial type by infant. Positive MTD values indicate more tongue movement in the speech/eating trials relative to baseline. Data collection and analysis are on-going. Preliminary descriptive analysis indicates high individual variability in tongue movement across conditions.

This is the first work that we know of that tests dynamic tongue movement during speech perception in infancy, and extends ultrasound analysis to new questions surrounding sensorimotor feedback in development. Analysis of our full sample will clarify whether early tongue movements are more active with speech processing, and whether this supports later language development.

A44 The effect of multisensory training on representations of touch in 4-month-old infants

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Body representations provide a foundation for key socio-cognitive abilities, including the sense of self, making it crucial to understand how they develop. Multisensory integration is thought to play a central role in shaping these representations, yet the contribution of early sensory experience remains debated. The current study investigates whether multisensory experience with a novel action - reaching with the legs - can enhance 4-month-old infants' representation of touch on their feet across postures.

Previous research shows that 6-month-olds, but not 4-month-olds, exhibit a tactile localisation deficit when their feet are crossed (Begum Ali et al., 2015), suggesting a developmental shift from purely anatomical coding toward an attempt to integrate visual and tactile representations. This change may reflect multisensory experience gained as infants begin object-directed actions between 4 and 6 months.

The current study aims to empirically test the causal role of multisensory experience in body representations by systematically manipulating 4-month-olds' sensory experiences with novel leg actions. Infants are assigned to visuo-tactile, visual-only, or tactile-only training. During lab and home sessions, infants interact with a toy using their feet. The visuo-tactile group both sees their feet and receives vibrotactile feedback on contact; the visual-only group sees their feet without tactile feedback; the tactile-only group receives tactile stimulation without visual access. Effects of training are assessed using a tactile localisation paradigm with crossed and uncrossed legs, measuring behavioural responses and EEG indices of multisensory integration.

Preliminary behavioural data from the visuo-tactile group (N=11) show equivalent performance in the crossed ($M = 0.62$, $SD = 0.17$) and uncrossed ($M = 0.66$, $SD = 0.18$) leg conditions, $t(10) = -0.78$, $p = .45$, $d = -0.24$. Although a clear multisensory effect is not currently evident, recruitment is ongoing and expected to be complete before the conference. Findings will inform how early multisensory experience shapes body representation development and, more broadly, mechanisms underlying typical and atypical bodily self-experience.

A45 Screen Complexity in Context: Moment-to-moment associations between child arousal and screen unpredictability at home

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Prior research has linked excessive screen use in childhood with heightened arousal and difficulties in self-regulation (Porter et al., 2025). However, these have largely focused on global estimates of screen time such as duration or platform use (Lowe et al., 2023; Barr et al., 2023; Radesky et al., 2020; Harverson et al., 2025). These global measures are relatively blunt and do not account for characteristics of media content itself that may shape children's physiological responses, in particular the predictability of audiovisual and semantic input. Predictability is an important dimension because unpredictable input is known to elicit stress-related arousal responses as the brain works to update its expectations (Peters et al., 2017). Because children may be more sensitive to variance in input predictability due to immature predictive models and regulatory systems (Davis et al., 2024), variance of predictability of media content may represent a key mechanism through which screen exposure drives fluctuations in arousal.

The present study addresses these gaps by temporally aligning automated screen capture (using Open Broadcaster Software) with continuous wearable electrocardiogram (ECG) monitoring to examine the dynamic relationship between audiovisual and semantic features of screen content and changes in children's (target N = 60 children between 4- and 7-years-old) arousal during naturalistic day long home recordings.

Low- and high-level audiovisual features will be extracted from screen recordings to generate a continuous time series of media complexity (Labendzki et al., 2026). Low-level features include sensory properties such as visual flicker and spectral flux, whereas high-level features index the predictability and novelty of speech and visual content using large language models applied to audio transcripts and frame captions. The relationship between audiovisual features and arousal, corrected for motion (van de Ven et al., 2024), will be examined by modelling lagged associations to characterise dynamic coupling between media complexity and physiological responses.

We hypothesise that (1) within screen-time periods, dynamic fluctuations in media complexity will exhibit a forward lagged association with arousal (increases in complexity are followed by increases in physiological activation). Consequently, (2) children exposed to more complex screen content across the day will show higher

arousal, because repeated unpredictable stimulation has been associated with increased arousal (Peters et al., 2017) due to repeated unpredictable stimulation.

This approach moves beyond global parent-reported estimates of screen time to provide a dynamic understanding of how the audiovisual features of media watched by children affects their arousal, moment-by-moment, in real-world contexts.

A46 Bilingual preschoolers' communicative repertoire and flexibility

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The development of communicative skills differs between monolingual and bilingual children. This could be due to either their increased communicative flexibility, larger communicative repertoire of communicative means, or both. Communicative repertoire is the number of verbal (e.g., words, intonation) and non-verbal (e.g., gestures, gaze) communicative means available to the individual (Wermelinger et al., 2024). Bilingual children are more flexible in their communication compared to monolingual children. That is, they flexibly use more different communicative means to ensure effective communication. For instance, they take their interaction partner's visual perception more often (Agostini et al., 2024; Fan et al., 2015), and are more likely to adapt their communication to others' needs (Gampe et al., 2019; Genesee et al., 1975). They also have larger non-verbal communicative repertoires (Wermelinger et al., 2024).

The present study aims to disentangle the mechanisms behind the differences in communication between bilingual and monolingual children. Four-to-five-year-old children (N = 120) were first taught a study-exclusive communicative repertoire consisting of two verbal (pseudo-words) and two non-verbal (gestures) means, which they then had to use to communicate with novel interaction partners in two different communicative situations. In the first (non-challenging) situation, their partner understood all communicative means. In the second (challenging) situation, a different interaction partner did not understand the means (either verbal or non-verbal) that were the children's first choice of communication. To successfully communicate with them, children had to adapt and use only the means their interaction partner understood. We measured how flexible they were in switching to using only the understood means.

We found that both monolingual and bilingual children used more different means, and needed more turns and helping prompts, in the challenging situation than in the non-challenging situation. In addition, monolingual children were faster in adapting their communication in the challenging situation: they needed fewer turns and helping prompts, and used fewer non-effective means, than bilingual children. Thus, all children showed evidence of adapting their communication to a challenging situation, but monolingual children adapted their communication faster than bilingual children. When children's communicative repertoires were held equal in the study, monolingual children showed greater communicative flexibility than bilingual children. Our results

suggest that previously reported enhanced flexibility in bilingual children is likely due to their ability to use a greater communicative repertoire in everyday life.

A47 Desde el principio: Engaging Parents in Their Children's Learning

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Early caregiver–infant interactions play a foundational role in socioemotional development, communication, and the regulation of attention and affect during the first years of life. Shared musical activities may provide a particularly meaningful context for these processes by promoting responsiveness, coordinated interaction, and positive affect. However, relatively little research has examined these dynamics within naturalistic, community-based settings, particularly among culturally diverse families.

This study reports preliminary findings from *Desde el principio*, an ongoing mixed-methods project examining a culturally grounded infant–caregiver music program for families with infants aged 0–36 months. Developed in collaboration with The Ohio State University Community Music School, Center for Latin American Studies, and Columbus Metropolitan Library, the eight-week program primarily serves Latin American families while remaining open to families from all backgrounds. It uses bilingual instruction (Spanish–English), Latin American repertoire, movement, instrument play, and caregiver reflection to support family engagement and culturally meaningful musical participation.

Data sources include pre/post caregiver questionnaires, weekly diaries, semi-structured interviews, and video-recorded class observations. Findings presented here draw on the first two completed cohorts (Fall 2025 and Spring 2026); a third and final cohort is scheduled for Summer 2026. Quantitative analyses include descriptive statistics and pre/post within-participant comparisons of parental stress, home musical engagement, and caregiver perceptions of infant responsiveness, bonding, and mood. Qualitative data are analyzed thematically to identify recurring patterns in caregiver experience.

Preliminary findings from two pilot implementations and the first completed cohort, based on parental self-reports collected before, during, and after the program, suggest meaningful changes in caregiver–infant interaction across sessions. Caregivers report increased responsiveness to infant cues, greater shared engagement during musical activities, and more flexibility in adapting songs, movement, and routines to infants' needs. Many also describe a shift from viewing music primarily as entertainment toward using it intentionally to support soothing, transitions, shared attention, and everyday connection at home.

These findings suggest that culturally grounded musical programs may support early relational development not only through direct caregiver–infant interaction, but also by strengthening caregiver agency and meaningful home engagement. Ongoing analyses of observational data will further examine patterns of responsiveness and coordination during shared musical activities. This work highlights the value of ecologically valid, community-based approaches for understanding early development in diverse family contexts.

A48 Cortical responses to biological motion in infancy – a longitudinal fNIRS study with 5- and 7-months old infants

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The perception of biological motion is fundamental to the development of human social cognition from the earliest months of life. In adults, the right posterior superior temporal sulcus (rpSTS) is considered a key node of the “social brain” network and is strongly involved in processing the global configuration of human movement (Deen, Koldewyn, Kanwisher, & Saxe, 2015). However, we still know relatively little about how neural specialization for social stimuli, including biological motion, emerges and develops during infancy. In particular, the developmental trajectory of rpSTS specialization for biological motion remains unclear.

In the present study, we measured cortical temporal responses to the perception of biological motion in 7 and 5-month-old infants (N=32) in a functional near-infrared spectroscopy (fNIRS) longitudinal study. Brain activity was measured bilaterally (24 channels: 12 per hemisphere, symmetrically placed over the right and left posterior temporal regions) while infants watched coherent approaching point-light walkers and scrambled versions of these displays. We hypothesized that infants’ temporal responses would shift from a bilateral activation at 5 months (Lloyd-Fox et al., 2009) to a more right-lateralized response at 7 months (Lisboa, Miguel, et al., 2020; Lisboa, Queirós, et al., 2020), reflecting increasing neural specialization for the perception of human motion at this age. This developmental shift would also be consistent with previous behavioural findings showing that the ability to perceive the global human configuration in biological motion emerges in infancy (Bertenthal, 1993).

Preliminary results from our study appear to support our main hypotheses. At 7 months, infants showed a right-lateralized temporal response to biological motion. Analyses of the 5-month-old group are still ongoing. Overall, these findings offer an important step toward mapping the developmental trajectory of cortical specialization for social stimuli in infancy.

A49 Association between Maternal Characteristics and Infant Social PreferenceMichal Dvir Koren^{1,2}, Daphna G. Dollberg², Dana Lassri¹, Ronit Roth-Hanania²¹*The Hebrew University in Jerusalem, Jerusalem, Israel*, ²*The Academic College of Tel Aviv Yaffo, Tel Aviv, Israel*

Studies have demonstrated the role of parental psychological characteristics and behaviors in shaping the positive socio-emotional development of young children, including prosocial behavior (Eisenberg et al., 1989; Malti & Davidov, 2023). Regarding the development of prosociality in children, research indicates that the foundations of prosocial behavior emerge very early in development, as pre-verbal infants tend to prefer prosocial agents (helpers) over antisocial ones (hinderers; Hamlin et al., 2007). However, the developmental pathways underlying these early preferences, as well as the involvement of parental psychological characteristics, remain insufficiently understood. Particularly, parental mentalization (i.e., reflective functioning) is considered a key mechanism underlying the development of children's socio-emotional and interpersonal capacities, including in challenging parenting situations (Slade, 2005). Thus, parental reflective functioning has been associated with altruistic behavior in school-aged children (McGlade et al., 2025), yet its contribution to prosocial behavior during infancy or toddlerhood remains largely unexplored.

This study examines potential links between maternal characteristics, such as self-compassion, mentalization, and competence, and young infants' social preferences. Using ManyBabies4® protocols (Lucca et al., 2025), we coded the infant's choices (of helper or hinderer) and asked parents to complete questionnaires assessing parental reflective functioning (PRFQ; Luyten et al., 2017), competence (PSOC; Johnston & Mash, 1989; Gilmore & Cuskelly, 2024), and self-compassion (SCS; Neff, 2003). In addition, we coded moments of shared pleasure during parent-child free interaction (Purra et al., 2019). We also collected narrative data from parents regarding their daily lives and prosocial themes (Wang et al., 2024).

Preliminary results from 70 infants aged 5-10 months indicate significant associations between infants' social preferences and parents' reflective functioning, mainly in the sub-scale of parental interest and curiosity about their child's mental states. Findings from mutual story reading and analysis of parents' prosocial narrative suggest unique relations with infants' prosocial choice.

The findings propose a novel perspective on the role of parental reflective functioning in the development of infants' prosociality. Beyond advancing current knowledge of infant social development, they may inform interventions to promote early parent-child interactions.

A50 Nine-month-old Infants Discriminate Bodies on the Basis of Identity Information but Only with Upright and Headless Bodies

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Bodies provide a rich source of social information and there is mounting evidence of infants' ability to discriminate bodies based on structure, size of body parts, and even attractiveness. However, there are no known studies of infants' discrimination of bodies based on identity. Infants can discriminate facial identities early in the first year and recognising familiar people is important for infants' sense of security. When facial information is obscured, can infants recognise identities from bodies alone? Six and 9-month-old infants saw pairs of faceless identities in upright and inverted orientations to assess for an inversion effect. They also saw headless figures (bodies without heads) and whole figures (bodies with heads) to assess the role of heads. In each condition, infants were familiarised to an identity, which was subsequently paired with a novel identity. Looking times to the images were measured using eye tracking and novelty preferences to the novel identity were calculated in each condition (upright headless, inverted headless, upright whole figure, and inverted whole figures). The 6-month-old infants' preferences for the novel identities were at chance level in all four conditions, but the 9-month-old infants demonstrated a significant preference for the novel identity only when the bodies were headless and in an upright orientation. Eye tracking data revealed that infants' looking proportions to bodies were longest in the headless upright condition. Despite the absence of facial features, looking to heads was longest in the upright whole figure compared to the inverted whole figure condition. Therefore, heads continue to dominate infants' preferential attention at 9 months of ages, and as the infants only discriminated upright bodies, their representation of bodies at this age is likely orientation-specific and tuned to a typical orientation. Infants also looked longer at the feet of inverted stimuli compared to the upright stimuli suggesting that infants have an upper bias when presented with human figures. Heads support adults' body discrimination, but are instead a source of distraction for infants. In adults, the body inversion effect is diminished when heads are absent, but with infants they discriminate bodies better when heads are absent.

POSTER SESSION 2



B1 Curiosity-based resolution in infancy and toddlerhood

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Curiosity can be stimulated when we want to learn more, leading to exploratory behaviour. By observing curiosity in early childhood, we can understand more about what interests them and how this influences their behaviour. The current study examines whether young children seek to resolve their curiosity or prefer to engage with something novel.

Previous research has demonstrated that adults (Nicki, 1970) seek to resolve their curiosity, induced by blurred images, by pressing a button to reveal resolution images significantly more than novel images. However, these curiosity resolution behaviours have not been replicated in infancy research, as no significant difference was found between 8-month-olds' fixations at clear resolution and clear novel images (Chen et al., 2022). However, these images were presented simultaneously onscreen, so infants' seeking to resolve curiosity potentially conflicted with novelty preference.

The current study stimulates infants' (8-10-months) and toddlers' (22-24-months) curiosity by presenting them with a blurred image. Using gaze-contingent eye-tracking, children then choose what to see next: the clear resolution of the previously blurred image or a clear novel image.

Our first hypothesis is that toddlers will choose to perceive clear resolution images more than clear novel images. We predict toddlers will make this choice significantly more than infants. Our second hypothesis is that infants and toddlers will have a significantly shorter latency for choosing the clear resolution images than the clear novel images. We also predict infants and toddlers higher on trait curiosity will choose resolution images significantly more than novel images.

Preliminary findings are presented, with data from approximately 60 participants. Firstly, comparing on average how many times infants and toddlers 'trigger' the presentation of the clear resolution compared to the clear novel images. Secondly, comparing on average how long it takes them to 'trigger' either the clear resolution or clear novel image. Finally, examining how trait curiosity influences these looking behaviours, measured by a parental report questionnaire (Altmann et al., 2025).

B2 Curiosity-based exploration in infancy.

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Curiosity arises when we seek to learn more about the world around us, motivating exploratory behaviour as we gain new knowledge and sensory experience. Previous research found young children engaged with both onscreen characters, despite one being more rewarding (Blanco & Sloutsky, 2021). This is compatible with learning progress theories, where we engage with stimuli to keep learning more, evidenced in research with 8-month-old infants (Poli et al., 2020). Findings also showed 10-12-month-olds' exploration was generally exploitative, being more likely to engage with stimuli from the same category rather than switching to another, although overall most infants explored information from both categories (Altmann et al., 2025).

The current study examines whether infants explore or exploit their environment more when perceptual curiosity is induced, to see whether infants continue to engage with stimuli from one category or prefer to switch between them. Infants (aged 10-12 months) will be presented with an image, partially covered with tiles, and then have a choice, using gaze-contingent eye-tracking, to reveal more about this image or to reveal the presentation of a new image.

We predict infants will demonstrate a novelty preference, in line with theory and research. Moreover, we predict infants who reveal tiles will be more likely to in subsequent trials to maximise learning progress, in line with previous findings on the exploitation-exploration trade-off. Finally, based on the dimensions of the Infant and Toddler Curiosity Questionnaire (Altmann et al., 2025) we predict infants higher on Investigative Type curiosity will reveal tiles significantly more, whereas those higher on Sensory Type curiosity will choose novel images significantly more

We will analyse how many times infants choose to reveal tiles compared to new images, their pattern of choices across trials and the influence of trait curiosity on these behaviours.

B3 The Influence of Popularity on Children's Curiosity

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Prior research has shown that curiosity can direct children's knowledge acquisition, learning and retention (Ackermann et al., 2020, 2024; Shah et al., 2018). One of the strategies children use to acquire information about the world around them is social learning. While there is a wealth of literature focusing on caregiver input (Ishikawa & Itakura, 2024; Tamis-LeMonda & Masek, 2023), the role of peers remains heavily understudied. There is some evidence to suggest that children pick up preferences (toys, clothing, dietary choices) from peers but rely on adults for learning new skills (Wood et al., 2013). Children are also known to align their preferences with their peers (Hennefield & Markson, 2017), but most studies on social conformity have used perceptual judgement tasks with a correct and incorrect answer (Haun & Tomasello, 2011; Hellmer et al., 2018), and adult models (Hennefield & Markson, 2016; Hu et al., 2013), potentially confounding the motivation behind children's behaviour. This highlights a gap in our understanding of how peer preferences can influence a child's curiosity. In adults, Dubey et al. studied the effect of popularity on adults' curiosity for everyday scientific questions, using the number of upvotes (as on the online platform Reddit) as an indicator of popularity (Dubey et al., 2021). Drawing from this, our primary aim is to understand children's socially mediated curiosity by manipulating the popularity of a stimulus, where social information is presented as an aggregated opinion (Oktar & Lombrozo, 2025). We conducted a tablet task where children (3–5-year-olds, $n=56$, data collection ongoing) had a choice to view either a more popular or a less popular image. Their curiosity was operationalised by their choice and the duration they looked at the image (dwell time). To explore potential individual differences, we also collected parent reports of children's sociability. Initial analyses revealed that children consistently show a significant preference for the more popular image ($Est=0.724$, $p<.001$), which is unaffected by age or social personality traits. To get a richer understanding of their curious behaviour, we intend to analyse the dwell time. We are also planning to conduct a follow-up study with a waiting time cost for viewing the images, along with getting children's ratings for each image, to analyse trial-by-trial curiosity. Our preliminary results strongly support the possibility that even children as young as three are influenced by aggregated opinions and use this social information to guide their curiosity.

B4 Navigating Knowledge: Effects of State Curiosity on Children's Word Learning and Information Seeking

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Early learning takes place within complex, multimodal environments where curiosity plays a critical role in guiding exploratory behaviours and supporting cognitive development. While trait curiosity shapes children's early learning experiences, state curiosity is context-dependent fostering early learning, in-part, through information seeking behaviours. Here, we describe our pre-registered report which will explore whether state-induced curiosity can influence exploratory behaviours and facilitate word-learning within a multimodal search task that mirrors the complexity of real-world learning environments. Children (2.5- to 4-year-olds) will be introduced to a series of novel objects and labels via a storybook. After exposure to each novel object, participants will locate the target object (i.e., a sticker depicting the novel object), hidden within one of ten boxes uniformly distributed across a real-world space. Unbeknownst to participants, the target will only be hidden within a single hemispace. In the "High-Curiosity" condition, the storybook should elicit greater curiosity, whereas the "Low-Curiosity" condition will present novel words in a context that should invoke lower levels of curiosity. Following the search task, participants will complete a forced-choice word learning task. Findings are expected to provide insights into whether and how curiosity facilitates word learning in rich, multimodal contexts and how this relationship can be impacted by children's explorative strategies, including their sensitivity to environmental statistics.

B5 From rapid reorienting to sustained exploration: developmental change in the burst dynamics of infant head movements

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How do infants organise their access to a world that is too rich to take in all at once? From a dynamic systems perspective, early exploration can be understood as an emergent, self-organising process shaped by changing constraints across attention, posture, locomotion, and the environment. Head-mounted cameras have transformed our understanding of what infants see, but less is known about the temporal structure through which infants sample visual information. Here, we treat infant head movement as a temporal event system and ask how its burst dynamics change across the first two years of life.

Head-mounted inertial measurement unit data were collected from 83 infants during unconstrained free exploration in the home. Discrete head-movement events were extracted from three gyroscope-derived signals (pitch rate, yaw rate, and overall gyroscope magnitude) using adaptive thresholding. The temporal organisation of these events was quantified using burstiness, memory, event rate, burst duration, and the distribution of inter-event intervals, with developmental change modelled using generalised additive models.

Across all three movement signals, infant head movement was consistently non-random. Burstiness was positive for pitch, yaw, and gyroscope magnitude, indicating temporally clustered movement events, and memory coefficients were also positive, indicating sequential dependence between successive intervals. Inter-event interval distributions were best described by log-normal rather than exponential models for every infant and every signal, showing that head-movement timing was heavy-tailed rather than memoryless. Developmental effects were strongly nonlinear. Burstiness showed significant smooth age-related change across all three signals, with elevated clustering in the earliest months, reduced clustering around 8–12 months, and later stabilisation or rebound. Event rate and mean burst duration also showed robust age-related change: older infants produced fewer discrete movement events, but these were organised into longer-lasting bouts. Developmental change in temporal memory was weaker and less consistent.

These findings suggest that infant exploration does not begin as random motor activity that gradually becomes organised. Instead, the temporal architecture of head movement is structured from early in life. Development is better characterised as the nonlinear reorganisation of an already structured exploratory system: from frequent, brief, clustered reorienting events in early infancy toward fewer, longer, and more

sustained bouts of visual sampling. More broadly, the study shows that the IMU signal in head-mounted recordings provides a powerful but underused window into how infants construct experience over time.

B6 ManyBabies 7: A new Project to disentangle Drivers of Curiosity early in Development

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Curiosity is fundamentally involved in how we explore the world and structure our own learning and has been linked to positive life outcomes (for review, e.g., Grossnickle et al., 2016) and better information encoding and retention (e.g., Gruber et al., 2014; Jepma et al., 2012). Despite a recent renewed interest in curiosity in early development, there is limited consensus on how to operationalize curiosity, especially in pre- and non-verbal populations and across early development (for review, e.g., see Kidd & Hayden, 2015; Forss et al., 2024). In particular, studies have different operationalizations of key information characteristics that trigger curiosity, e.g., novelty, predictability, uncertainty, and ambiguity, making it difficult to ascertain how these factors guide curious exploration across age, culture, and possibly species. Our project will develop a new study to tease apart the role of these factors in triggering curiosity across development, using complementary observational and/or experimental procedures (e.g., via repeated sampling from different information sources as conceptualized in Altmann et al., 2025b). This approach will allow us to maximize participation from labs with differing means and backgrounds, and to be able to generalize our findings across more ecologically valid and more experimentally controlled settings. With the support of the ManyBabies community, this project will generate cumulative progress on a fundamental question with broad implications for the growing field of curiosity research, but also for infancy studies more generally.

B7 What will my Baby be Like? Investigating the Factors Influencing Mothers' Predictions about their Baby's Personality: Exploratory Study

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Temperament characteristics are thought to emerge in the early days of life and remain stable throughout the life (Kagan, 1994). Some researchers consider that temperament is driven by genetics as newborns show different adaptation process to the postnatal environment (Brazelton, 1990). Similarly, some studies have found various genetic polymorphism related to specific character traits (De Luca et al., 2001). As these early differences in temperament appear without or very little environmental exposure, some researchers suggest that temperament is driven by nature and independent from the environmental influences (Buss and Plomin, 1975).

On the other hand, environmental influences on temperament development are often overlooked. For example, it has been found that negative maternal emotional experiences (Sameroff et al., 1982) has been related to less positive infant temperament. Similarly, individual fetal activity levels both show continuity across pre-and post-natal periods (Eaton & Saudino, 1992) and correlate with maternal predictions of infant temperament (DiPietro et al., 1996). Furthermore, prenatal perception of infant temperament were found to be the best predictor for postnatal temperament (Zeanah et al.1987).

In the present study, we investigate how parental predictions on infant temperament are influenced by several environmental factors, including foetal movement, maternal emotional experiences, fetal and maternal bond, and gestational age. Mothers completed a 30-minute fetal movement recording, the Perceived Stress Scale (Cohen, 1983), positive and negative affect scale (Watson and Clark., 1988), the PAI-R Bonding Scale (Muller et al. 1993) and an adapted version of Bates' (1979) Infant Characteristics Questionnaire. We conducted the analysis with 50 participants.

There was a significant positive correlation between Dullness temperament construct and gestational age ($r = .30, p = .04$). There was also a significant negative correlation between Dullness and anticipation scores ($r = -.30, p = .03$). Partial correlation controlling for the other predictor indicated that gestational age remained significantly associated with dullness when controlling for anticipation subscale $r(47) = .33, p = .02$. Similarly, when we control gestational age for anticipation subscale, anticipation subscale remained significant $r(47) = -.34, p = .02$. Thus, both gestational age and anticipation subscale interact with Dullness independently. Further, regression analyses showed a similar pattern.

Overall, these findings indicate that maternal predictions could be shaped by different developmental and cognitive factors. This study highlights that early formation of temperament related expectations is already present before birth and challenges the interpretation of temperament development as direct reflections of genetic characteristics.

B8 Examining Attention Bias to Socio-Emotional Stimuli in Infancy and Early Childhood Using the Dot-Probe Task

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Affect-biased attention refers to the tendency to focus on emotional stimuli, particularly emotional faces over neutral faces (Todd et al., 2012). Levels of this bias are associated with mental health (Bar-Haim et al., 2007; Clauss et al., 2022; Dadds & Frick, 2019); but their emergence early in life remains poorly understood (Burris et al., 2019; Fu & Pérez-Edgar, 2019). Models suggest that affect-biased attention is either: innate and stable across development (Field & Lester, 2010); innate but shaped by individual factors resulting in diminished affect-biased attention over time (Field & Lester, 2010); not innate, but emerges across childhood (Field & Lester, 2010); or influenced by both innate individual factors as well as reactive attentional systems over time (Morales et al., 2016). The first aim of the present study was to examine the presence in attention bias to socio-emotional stimuli using the dot-probe task when measured across infancy and into early childhood (i.e., from T1, when children are aged 7-months on average, to T3, when children are aged 24-months on average). Additionally, the second aim was to examine whether children's rankings for attentional patterns to emotional faces were stable over time. Australian children were assessed at approximately 7-months-old (T1, n = 151; 48% girls), 14-months-old (T2, n = 335; 50% girls), and 24-months old (T3, n = 82; 32% girls). Children in the baseline sample were culturally and ethnically diverse, with 27% sample reporting that their child was White, 20% Middle-Eastern, 19% South Asian, 17% South-East Asian, 6% Polynesian/Melanesian, 5% African/African American, 3% Hispanic/Latino, 1% East Asian, 1% Aboriginal/Torres Strait Islander, and 1% missing. Results showed evidence for attention bias towards happy faces that emerged with development. In contrast, infants showed relatively little preferential attentional engagement to angry relative to neutral faces at all time points. Thus, it does not appear that attentional engagement to angry relative to neutral faces is innate nor emerges across childhood. Findings for angry faces do not support any of the proposed developmental models of affect-biased attention. Additionally, there was little evidence that infants' rank order of attentional patterns within the sample were

stable from T1 to T2 or from T2 to T3. Specifically, there were only two significant results across the 18 rank order correlations examined. This study therefore suggests that maybe it is more functional to prioritise attention to the positive things in life early in development, than to be concerned with the negative.

B9 Beyond Words: The Role of Parental Expressed Emotion in Children’s Emotional and Behavioural Problems

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Parents are the primary source of emotional information for young children, and in the early years of life shape the emotional and behavioural development of their child, in part through its influence on the family emotional climate. Expressed Emotion (EE)—a measure of this climate—reflects the emotional quality of attributions parents have towards their child and the habitual patterns of affective interaction in a parent-child dyad. Across three interrelated studies, we examined how different aspects of the maternal emotional environment contribute to child psychopathology in a high-risk sample, where half of mothers reported clinically relevant symptoms of anxiety or depression, and two-thirds of children presented with severe emotional or behavioural difficulties.

In Study 1, we investigated the role of maternal EE in the transgenerational transmission of psychopathology in children aged 4–7 years (N=247; 70.7% male). EE, coded using the Five-Minute Speech Sample (FMSS), was strongly associated with both maternal and child psychopathology and emerged as the most robust predictor of children’s internalising and externalising symptoms.

Study 2 extended these findings in a sample of 134 children (aged 4-7; 68.7% male) by exploring maternal facial expressivity during the FMSS, examining whether incongruent or overly negative facial expressions might further explain the severity of child outcomes. Results showed significant associations between maternal mental health, EE, facial expressivity, and child symptoms. Notably, reduced expression of anger expressivity was the strongest predictor of both emotional and behavioural problems in children, alongside EE.

In Study 3, we examined how the maternal emotional environment impacts children’s facial emotion recognition (FER) abilities—in a sample of 416 children (aged 4-7; 72.63% male). Two key FER metrics were assessed: discrimination accuracy, or the ability to distinguish between emotional facial expressions, and response bias, or a tendency to perceive certain emotions more readily. Children exposed to high EE showed poorer discrimination of negative facial expressions, suggesting underdeveloped emotion recognition skills. Furthermore, elevated EE was the strongest predictor of these deficits, implicating EE as a potential mechanism by which emotional modelling is disrupted.

Together, these studies underscore EE as a transdiagnostic risk factor in child psychopathology and highlight the critical role of mothers as emotional models. Findings offer valuable insights for developing targeted interventions aimed at enhancing emotional development in at-risk children.

B10 Infant Temperamental Negative Affect and Maternal Distress Modulate Attentional Disengagement in Four-Month-Old Infants

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By seven months of age, infant attention is biased toward threat (Peltola et al., 2009). Specifically, infants exhibit difficulty disengaging attention from fearful relative to neutral faces. It has been hypothesized that infant temperament and maternal mental health influence the development of this threat bias, contributing to the emergence of attentional patterns in childhood associated with anxiety (Morales et al., 2016). Understanding what shapes this bias before it emerges is important to understand normative development and identify risk. Therefore, we examined whether infant temperamental negative affect and maternal distress are associated with attentional disengagement from fearful and neutral faces at four months of age.

Eye-tracking data were collected from 71 four-month-old infants using a modified version of the Overlap task (Peltola et al., 2009) in which infants viewed central neutral and fearful faces that were subsequently joined by a peripheral distractor. Attentional disengagement was indexed as the probability of shifting gaze from the face to the distractor. Infant negative affect was measured via maternal-report questionnaire (Infant Behaviour Questionnaire-Very Short Form). Maternal distress was a composite of validated anxiety, stress, and depression questionnaires.

A significant interaction between face type, infant negative affect and maternal distress was observed ($b = 0.44$, $p = .026$). Infants were significantly less likely to disengage from fearful relative to neutral faces when maternal distress was high and negative affect was low ($OR = 0.31$, $p = .024$). This pattern was driven by increased disengagement from neutral faces rather than reduced disengagement from fearful faces: when maternal distress was high, lower negative affect was associated with a greater likelihood of disengaging from neutral faces ($b = -0.51$, $p = .041$), while neither factor was significantly associated with disengagement from fearful faces.

These findings suggest that fear biases in attentional disengagement may emerge as early as four months in the context of high maternal distress and low infant negative affect, and that these factors may interact to shape early attentional processes underlying threat biases. Notably, effects were driven by responses to neutral faces, highlighting the role of baseline attentional processes in threat bias emergence. These findings have implications for understanding how temperament and maternal mental health shape attentional trajectories and early life pathways to anxiety.

B11 Infant Temperamental Negative Affect and Maternal Distress Modulate Attentional Engagement in Four-Month-Old Infants

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By seven months of age, infant attention is biased toward threat (Fu & Pérez-Edgar, 2019). More specifically, infants exhibit rapid engagement with fearful relative to neutral faces. It has been hypothesized that infant temperament and maternal mental health influence the development of this threat bias, contributing to the emergence of attentional patterns in childhood associated with anxiety (Morales et al., 2016). Understanding what shapes this bias before it emerges is important to understand normative development and identify risk. Therefore, we examined whether infant temperamental negative affect and maternal distress are associated with attentional engagement with fearful and neutral faces at four months of age.

Eye-tracking data were collected from 71 four-month-old infants using a modified version of the Overlap task (Peltola et al., 2009). We indexed engagement by calculating the probability of infants shifting their gaze from a central stimulus to a peripheral fearful or neutral face. Infant negative affect was measured via maternal-report questionnaire (Infant Behaviour Questionnaire-Very Short Form). Maternal distress was a composite of validated anxiety, stress, and depression questionnaires.

A significant interaction between infant negative affect and maternal distress was observed ($b = -0.42$, $p = .017$). When maternal distress was high (>1.28 SDs), lower negative affect was associated with a greater likelihood of engaging with fearful and neutral faces ($ps < .05$), whereas when maternal distress was low (< -1.55 SDs), higher negative affect was associated with a greater likelihood of engaging with fearful and neutral faces ($ps < .05$). There was no significant effect of emotion condition.

These findings suggest that biased engagement towards fearful faces has not yet emerged at 4 months, but that maternal distress and infant temperamental negative affect may interact to shape early attentional processes underlying threat biases. Notably, effects did not differ between neutral and fearful faces at this age suggesting maternal distress and infant negative affect may affect engagement with faces in general rather than with threat faces specifically. These findings have implications for understanding how temperament and maternal mental health shape attentional trajectories and early life pathways to anxiety.

B12 Mothers' Math Language to Toddlers in U.S. Mandarin Families During Everyday Home

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Chinese and Chinese-American children outperform their European-American peers in mathematics by preschool, with disparities widening over time¹. Notably, already by toddlerhood, exposure to math language—that is, words that reference number, shape, space, magnitudes, and quantities—predict current and later math skills. Thus, characterizing the input that Mandarin heritage parents provide their toddlers is needed. To date, research on Mandarin families is limited, just as are studies of toddlers' exposure to math words in the natural home setting, with most studies focused on U.S. English-speaking families². We quantified toddlers' exposure to math language in Mandarin-speaking U.S. homes, asking: (1) how many math words and which types of math words do mothers direct to their toddlers, (2) what are the contextual cues (i.e., referents of talk) and social cues (e.g., gestures) that accompany math words?

We recorded 1-hour of everyday home interactions in 15 Mandarin-speaking mother–toddler dyads in New York, and transcribed videos using Datavyu (datavyu.org). We coded five categories of math language: number words, spatial features (e.g., circle), spatial relations (e.g., up), magnitudes (e.g., big), and quantifiers (e.g., more). We also coded the referents of math words (e.g., cookies when counting cookies) and social cues (e.g., pointing to cookies while counting).

Math words were prevalent in maternal speech, even when interacting with toddlers. Still, individual differences were striking. Mothers averaged 992.6 utterances per hour ($SD=299$), with 18.04% ($SD=6.41\%$) of utterances containing at least one math word, corresponding to $M=185.06$ math utterances ($SD=88.67$, range=47–327). Because some utterances contained more than one math word, mothers directed $M=225$ math word tokens per hour to toddlers ($SD=119.39$, range=57–459). Spatial relation terms (e.g., up, down) were most frequent (46.43%). Social cues accounted for 70% of math words. This level of exposure to math words exceeded that of English-speaking families by 38%, where toddlers heard 163 math words per hour. We are currently observing additional dyads from Mandarin ($N=100$) and English ($N=100$) families and testing associations to toddlers' understanding and production of math concepts.

B13 Speaker variability and the role of consonants vs. vowels in minimal pair learning

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The positive effect of speaker variability on infants' ability to learn minimal pairs has been previously proven in several studies (e.g. Rost & McMurray, 2009; Höhle et al., 2020). However, Crespo et al. (2023) failed to find evidence in support of the facilitative effects of speaker variability in a recent study with older, 5–8-year-old mono- and bilingual English-speaking children.

Based on these earlier findings, this experiment aims to test whether the beneficial effects of speaker variability are shown in 4–5-year-old mono- and bilingual German-speaking children. In addition to the speaker variability, the division of labor hypothesis is to be tested. In regard to the latter, Nespor et al. (2003) proposed, there is a categorical distinction between consonants and vowels, with vowels providing cues to grammar and consonants having a bigger effect on lexical processing.

To further understand the importance of variability in the input and how this affects language acquisition in early childhood, we therefore hypothesized that (1) minimal pair learning is improved by a multiple speaker compared to a single speaker presentation and (2) learning consonant minimal pairs is easier than learning vowel minimal pairs.

Four sets of bisyllabic pseudowords were paired with familiar objects, differing by one vowel or consonant. A cross-situational word learning task in a within-subjects design comparing multiple- versus single-speaker variability was implemented. Learning of minimal pairs with vowel versus consonant mispronunciations was integrated into a between-subjects design.

Subsequently, continuous attention performance, sentence apprehension and non-word repetition are tested to determine correlations between these cognitive functions and minimal pair learning.

The data collection process is still ongoing. The analysis will be concluded by August 2026. Depending on the outcome, we wish to propose a way to transfer the findings into practices of language support.

B14 The role of innate biases in the acquisition of prosodic form-meaning mappings: A cross-linguistic approach

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Preverbal infants systematically vary prosody to express communicative functions¹, yet the mechanisms underlying this ability remain unclear. We investigated how infants acquire early prosodic form-meaning mappings, focusing on pitch. We hypothesised that infants initially rely on innate biases captured in the Biological Codes², with this reliance gradually decreasing with age. The Biological Codes concern physiological conditions underlying pitch production and their language-independent interpretations in human and animal communication. For example, smaller vocalisers produce higher pitch, which conveys meanings like ‘questioning’ (the Frequency-Code); more articulatory efforts lead to a larger pitch range, which conveys meanings like ‘emphatic’ (the Effort-Code).

Forty-one monolingual infants participated in semi-structured mother-infant play sessions twice-monthly at 3-, 5-, and 7-months. We compared infants acquiring Dutch (n = 13), Swedish (n = 12), and Bahasa Indonesian (n = 16), as these languages differ substantially in their alignment with the Biological Codes regarding the use of pitch to signal questionhood and emphasis in their prosodic grammar. Sessions included four play conditions: mother-infant interaction with a familiar toy (c1), an unfamiliar toy (c2), no toys (c3), and the infant alone (c4). Audio was segmented in Praat. Using silent video in ELAN, all speech-like vocalisations were subsequently coded as requests or comments, representing presence and absence of questionhood (analysis-1); and the comments as produced with familiar versus unfamiliar toys, representing different degrees of emphasis (analysis-2). Mean pitch (analysis-1) and pitch span (analysis-2) were extracted per vocalisation, while pitch contour shape for analysis-1 was determined via functional data analysis. Effects of communicative function, language, and age were examined using linear mixed-effects models.

Statistical analysis of 5,323 vocalisations showed that across languages, infants used higher pitch ($p < .001$) and rising contours ($p = .007$) for requests, and lower pitch and falling contours for comments, throughout the developmental period, providing robust evidence for innate biases (i.e. the Frequency-Code) in early communicative pitch use. Comments while handling familiar versus unfamiliar toys were, however, not distinguished in pitch, contradictory to the Effort-Code. Future research can explore alternative procedures for eliciting different degrees of emphasis in comments to further illuminate the role of the Effort-Code.

B15 Are toddlers sensitive to native language statistics?

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Languages contain statistics relevant for word segmentation, such as transitional probabilities (TPs) across adjacent syllables. Infants can track TPs in artificial languages, and this ability correlates with vocabulary size in toddlerhood (Frost et al., 2020). However, the extent to which learners track TPs in their native language (NL), and whether doing so supports language learning, remains unclear.

We examined whether British-English-learning toddlers aged 2-4 (N=61) track NL TPs using a repetition task, and whether performance relates to native language proficiency. If toddlers track NL TPs, they should more accurately repeat real English words with high-TPs (HTP) versus low-TPs (LTP), and nonwords containing attested English TPs (TP) versus unattested TPs (TP-0). We expected this pattern to be related to higher NL proficiency.

Toddlers repeated two-syllable HTP and LTP real words, and TP and TP-0 nonwords, matched for bigram frequency. TPs were calculated from child-directed British-English speech in the CHILDES corpora (ENG-UK corpora, CHILDES database: MacWhinney, 2000). Toddlers' repetitions were coded for accuracy at the word level and the syllable level. More accurate repetition of HTP real words and TP nonwords reflected stronger sensitivity to NL TPs. Receptive vocabulary was measured using the British Picture Vocabulary Scale. and productive language using mean length of utterance (MLU) calculated from the child's utterances during a naturalistic play session.

Repetition was most accurate for HTP words, regardless of age. However, greater accuracy for LTP sequences (not HTP) was related to larger vocabularies and longer MLUs. These results suggest that although HTPs support NL segmentation, sensitivity to weaker statistical patterns may explain variability in language proficiency.

B16 Semantic Transparency in Mandarin Math WordsHuanhuan Shi¹, Guoxi Zhang², Catherine Tamis-LeMonda¹¹*New York University, New York, United States*, ²*New York, New York, United States*

Unlike nouns, which map onto concrete referents and are often supported by perceptual cues (such as the cylindrical form of cups), words for various math concepts (e.g., number, shapes, spatial relations, magnitude) are highly ambiguous. For example, “three” can refer to apples or sneezes, and “more” can refer to cookies or blocks. Thus, math words pose challenges for toddlers to learn. Notably, languages differ in how they encode math words: Some languages provide more transparent cues to meaning than others. For example, unlike English, Mandarin words for shape specify the number of sides/angles and tag on the taxonomic category of shape to the word (“triangle” = “three-corner-shape”). Similarly, Mandarin encodes many math concepts in everyday (non-math) words (e.g., thigh=big-leg; calf=small-leg). In addition to such linguistic cues, toddlers may benefit from frequent exposure to math words by parents during everyday interactions. Thus, we examined toddlers’ exposure to math words at the intersection of frequency and linguistic transparency in NYC Mandarin-speaking families. We video-recorded 1-hour Mandarin–English speaking mother–infant dyads (N=15 thus far; 100 will be seen in our ongoing study) during everyday home activities. Bilingual researchers transcribed mother utterances using Datavyu. We annotated five categories of math words/phrases—number, spatial features, spatial relations, quantities, and magnitudes. We quantified toddlers’ exposure to math concepts encoded in non-math words. Math language was frequent in mothers’ speech, with M=224.87 tokens per hour, and 73% of mothers produced all five categories, although individual mothers differed in their input to toddlers (range=53 to 459). Words referencing spatial relations were most frequent, followed by number and magnitude. We identified 14 non-math words (196 tokens in aggregate) that encoded math concepts (e.g., giraffe [long-neck-deer]; pinky [small-finger]; octopus [eight-claw-fish]). We also identified 8 classifiers (133 tokens)— ‘tags’ that marked the spatial features of common objects (e.g., long tagged onto words for objects like snakes, noodles, and ropes; flat for objects like paper and a table surface). Comparisons to English-speaking mother–infant dyads (N=50) reveal that Mandarin toddlers were exposed to 38% more math words than English-speaking toddlers and may benefit from the semantic transparency and the encoding of math concepts in the names of common objects. In ongoing work, we are testing whether differences in exposure within and across language communities relate to toddlers’ math cognition and their own use of math words in everyday interactions.

B17 Language, mind, and body: Associations of age and embodied verb learning

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Around the world and across languages, many children's early productive vocabulary consists of more nouns than verbs (Bornstein et. 2004; Hanson, 2017).

Developmental psychologists have theorized that verbs are more challenging to learn due to their relational, ambiguous, and often fleeting nature (Gentner, 1982).

Nonetheless, young children's verb production increases rapidly from month to month (Frank et al., 2021).

Prior research suggests that young children leverage both linguistic and experiential (i.e., social, emotional, sensorimotor) information to learn verbs across exposures (Andrews et al., 2009; Chen et al., 2025; Monaghan et al., 2015). On the linguistic side, children employ syntactic bootstrapping mechanisms to constrain possible verb meanings (e.g., Gillette et al., 1999; Gleitman, 1990). On the experiential side, more imageable verbs are typically acquired earlier in development (Coffey et al., 2024; Maguire et al., 2006). Recently, Sidhu and colleagues (2014) introduced the construct of verb embodiment, how closely a verb's referent relates to the human body.

Capturing both physical actions and emotional experiences traditionally considered abstract, embodiment has been shown to predict adults' verb processing better than imageability. However, it is unclear whether embodiment predicts early verb learning or how this association may change across development.

Applying Explanatory Item Response Theory (de Boeck & Wilson, 2004), we examined the associations between a verb's embodiment and the likelihood of a child producing that verb (indicated by the MB-CDI Words and Sentences Long Form; NVerbs = 103; Marchman et al., 2023) among 4,448 monolingual English-speaking North American children ages 16-30 months old (Frank et al., 2017). Verb embodiment ratings were collected from 25 American adults on Prolific and made publicly available on OSF.

We found a strong positive association of verb embodiment and likelihood of production, even after controlling for verb imageability. Interestingly, this association changes across development. The most positive association occurs around 2 years of age, a period in which children undergo rapid physical development that may enable them to establish more embodied representations of verb meanings (De Klerk et al., 2021). This association weakens slightly among older children, indicating that they may be drawing on other sources of information to learn verbs.

Our findings highlight the importance of accounting for changes in children's mental word representations over the course of physical, conceptual, and linguistic development. Furthermore, they suggest that early verb learning may be supported by grounding vocabulary instruction in physical and emotional experiences.

B18 Is the shape bias a word learning strategy in children born preterm?

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Children born preterm (i.e., before 37 weeks of gestation) are at increased risk for early language delays, including smaller vocabularies (Brösch-Fohraheim et al., 2019; Kern & Gayraud, 2007). Delayed word learning has been linked in late talkers and autistic children to the absence of a common word learning strategy, the so-called 'shape bias' (Jones, 2003; Tek et al., 2008), which is the tendency to extend names of objects to other objects of similar shape. The current study therefore investigates whether preterm children aged 24-48 months show a shape bias and, if so, whether it is comparable to that of chronological-age-matched full-term children. Furthermore, it explores whether children's shape bias strength might be related to their vocabulary size, their Theory of Mind, or their categorization ability.

The present preliminary sample includes 27 children born preterm (M gestational age=32.7 weeks; M chronological age=32.6 months) and 12 born full-term (M gestational age=39.2 weeks; M chronological age=36.9 months). The groups are matched on background variables (e.g. SES and gender). Children completed a noun generalization task assessing shape bias, alongside standardized measures of verbal non-verbal cognitive ability (Wechsler Preschool and Primary Scale of Intelligence WPSSI-IV, Wechsler, 2012), a Theory of Mind (ToM) battery (a combination of a ToM test for 2.5-year-olds by Setoh et al. (2016) and the Wellman scale; Wellman & Liu, 2004), and a categorization test (based on that by Williamson et al.; 2010). Parents filled in background questionnaires.

Preterm children started producing words (M=16.7, SD=5.9) later than full-term children (M=13.1, SD=4.0), Welch's $t(27.6)=-2.18$, $p=.038$. But both participant groups showed a robust shape bias, with percentage of shape-based responses significantly above chance preterm M=65%, SD=25.3%; full-term M=65%, SD=21.9%), and no differences between groups (see Figure 1). The shape bias was positively correlated with chronological age, $r(39)=.54$, $p<.001$. But after controlling for age, shape bias was not related to gestational age, $r(38)=.11$, $p=.528$, WPSSI receptive, $r(39)=.23$, $p=.163$, or production vocabulary, $r(39)=.09$, $p=.613$, or categorization ability, $r(39)=.05$, $p=.789$. However, shape bias was related to ToM, $r(38)=.35$, $p=.033$.

Our preliminary findings suggest that early gestational age does not lead to a weaker shape bias strength, despite later language onset. Also, at the age tested, children's shape bias strength was not related to their vocabulary size or categorization ability, but to their ToM.

B19 Distinct Language Profiles of Children with Regressive vs. Non-Regressive Autism

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Autism is characterized by various onset patterns, commonly categorized as non-regressive and regressive. In non-regressive autism, autistic characteristics are typically observed early in life. Regressive autism involves typical early development followed by significant loss of previously acquired skills like language and social abilities, usually occurring during the second year of life, with an average onset age of 19.8 months. This study investigates differences in overall and domain-specific language abilities (form and content) between children with regressive autism (ASD-R) and non-regressive autism (ASD-NR).

Clinical records were reviewed at rehabilitation centers across Flanders for children aged 3–10 years. Participants were grouped as regressive or non-regressive autism based on history and the Early Development Questionnaire (ASD-NR: $n = 105$; ASD-R: $n = 35$). The mean regression onset age was 26.32 months. Receptive and expressive language abilities were assessed using a combination of different standardized instruments including the Clinical Evaluation of Language Fundamental- 5th edition (CELF-5), Clinical Evaluation of Language Fundamental-Preschool-2nd edition (CELF-Preschool), language domain of Bayley Scales of Infant and Toddler Development-3rd edition (BSID-III), Reynell Taalontwikkelingsschalen (RTOS), Nederlandse Non-Speech Test (NNST) and the Schlichting Language Test. The scores of language form and language content were calculated by combining scores on syntax, morphology, semantics, and lexicon.

One-way MANOVA revealed significant group differences. ASD-R demonstrated significant lower scores in language domains (receptive and expressive language) as compared to ASD-NR (Pillai's Trace = 0.11, $F(1, 133)=7.29$, $P = <0.001$). The expressive language scores ($M = -2.05$) are significantly low as compared to receptive language scores ($M = -1.66$) of ASD-R group with medium effect (.09). The significant difference was also extended to language dimensions (Form and Content) in ASD-R group as compared to ASD-NR group (Pillai's Trace = 0.11, $F(1, 101)=6.27$, $p = .0027$). Language form scores were significantly lower in the ASD-R group, showing a large effect size (0.12), while language content scores were also low, with a medium effect size (0.09).

Children with regressive autism exhibit with more pronounced difficulties across all language domains and dimensions, suggesting distinct developmental trajectories in

comparison to non-regressive autism. These findings may inform tailored assessment and intervention strategies for this group.

B20 How do autistic and neurotypical children's stimulus preferences influence their novel word learning?

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Many autistic children are delayed in developing vocabulary, which previous research has attributed to potential differences in how they learn words. Children pay attention to certain stimuli more than others during word learning; identification and retention of meaning may be facilitated when referents are preferred and thus more attentionally engaging. Autistic children can show differences in attention, including restricted interests and perseveration towards specific focal points. This can influence their ability to intake informants from the environment during learning contexts. Examining how autistic children's object preferences influence their word learning is necessary to understand how attentional biases may influence their vocabulary development. We investigated whether autistic children with delayed language development and neurotypical children matched on receptive vocabulary differ in accuracy when learning words associated with liked and disliked novel objects. Seventeen autistic (Mage = 94.82 months; Mage receptive vocabulary = 60.24 months) and seventeen neurotypical (Mage = 52.12 months; Mage receptive vocabulary = 61.29 months) children completed a referent selection task using a touch-screen computer in which they fast-mapped novel words to unfamiliar objects that were liked or disliked (preference conditions were administered on different days). Prior to completing the word learning tasks, children completed a preference task that established which objects were their most and least preferred. Novel word retention was assessed after 5-minutes and 24-hours. Neurotypical children mapped novel word-object associations with greater accuracy than autistic children. However, after 5 minutes and 24 hours, autistic and neurotypical children retained object names with comparable accuracy irrespective of stimulus preferences. Fast mapping accuracy predicted subsequent retention accuracy, indicating a relationship between short- and long-term word learning processes. However, after a 24-hour delay, sleep did not consolidate novel object labels in either population. Crucially, neither population demonstrated an advantage for learning words associated with preferred objects at any word learning stage. These findings suggest that idiosyncratic preferences relating to conventional experimental stimuli do not influence autistic or neurotypical children's attention enough to impact their novel word retention. Rather, longstanding interests associated with specific semantic categories (e.g. special interests) may have a stronger influence on autistic children's attention and related vocabulary acquisition. Importantly, when expectations are based on receptive language ability, autistic children can retain novel words as effectively as neurotypical peers. We conclude that delays in vocabulary

development are not attributable to differences in the fundamental mechanics of how autistic children learn words.

B21 Promoting children's early language development in socioeconomically vulnerable areas

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Children growing up in areas of low socioeconomic status (SES) are at risk of delayed and alternative language development trajectories compared to their peers from more advantaged backgrounds. This disparity has been observed as early as at 18 months old and can in turn lead to long-term disadvantages affecting academic outcomes, social development and overall well-being, perpetuating cycles of socioeconomic disadvantages with negative consequences on public health and societal equity. Previous research has shown that disparities in language development can be mitigated through early interventions, but no such evidence-based intervention is currently offered in Sweden. The current project has therefore been designed to evaluate a new intervention targeting the facilitation of early language development through a parent-focused interactive book-sharing program offered to families living in vulnerable areas. The main aim of the project is to evaluate the interventions effect on language development and later cognitive development, as well as under what conditions and for whom it is most beneficial.

The intervention will be evaluated through a randomized controlled parallel-group trial (RCT) with parent-infant dyads ($n \approx 200$), recruited from the pre-existing extended home visit programme in Stockholm County, randomly assigned to either an intervention or control group. Participating families will receive informative material on either interactive book sharing (intervention) or screen time (control), integrated into the existing child healthcare services with additional materials provided bi-weekly between baseline and post-assessment. Assessments on language acquisition using MacArthur-Bates CDI (short form) will be conducted by trained health care nurses during regular home visits at 8, 12 and 17 months. Background characteristics, reading habits as well as intervention adherence and experience will be collected through parental reports, while long-term development will be followed up to 6 years of age through registry data.

The project provides an innovative approach to promote equitable developmental outcomes among children with insight from psychology, public health research and the health care system. The results contribute to a greater understanding of early factors for early language development and will help inform the best practices for large scale implementation of interventions aimed at low-SES communities, taking steps towards a more equitable society.

B22 Neighbourhood socioeconomic status and early vocabulary acquisition: a systematic review and meta-analysis (prenatal to 4 years)

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Early vocabulary acquisition is a robust predictor of later literacy and cognitive development. While family-level factors are well-studied, neighbourhood socioeconomic status (SES) shapes language environments in ways that extend beyond the home. Neighbourhood SES encompasses area-level poverty, unemployment, and deprivation, each of which may constrain the quality and quantity of language input children receive. Grounded in Bronfenbrenner's bioecological model, which situates development within nested environmental systems, this project addresses a critical gap: existing syntheses have not yet examined neighbourhood-level SES as a distinct predictor of receptive and expressive vocabulary during the earliest years of life.

This pre-registered systematic review and meta-analysis aims to: (1) synthesise evidence on associations between neighbourhood SES and early vocabulary (receptive and expressive) from the prenatal period to age 4; (2) estimate pooled effect sizes across multiple SES operationalisations, including income/poverty levels, area deprivation indices, parental education, and composite neighbourhood measures; and (3) identify moderators such as child age, vocabulary domain, SES indicator type, and country, which may account for heterogeneity across studies.

A systematic search will be conducted across PsycINFO, MEDLINE, ERIC, and Web of Science. Studies will be included if they: (i) involve participants aged prenatal to 48 months; (ii) include a quantified neighbourhood SES measure; and (iii) report receptive or expressive vocabulary as an outcome. Random-effects models will be used to compute pooled effect sizes (Fisher's r -to- z). Moderator analyses will be conducted via meta-regression, and risk of bias will be assessed using the Newcastle–Ottawa Scale.

This meta-analysis will offer a quantitative synthesis of neighbourhood SES effects on vocabulary development from prenatal to 4 years. By disaggregating effects by SES indicator and vocabulary domain, findings will clarify which dimensions of neighbourhood disadvantage matter most and at which developmental stages. Results will carry direct implications for targeting early language interventions in high-deprivation communities, informing policy for health visitors, early years practitioners, and local authorities.

B23 Word learning in playful social interactions

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During everyday free play interactions with caregivers, children acquire substantial knowledge about word-objects mappings (Chen et al., 2021; Toub et al., 2018). In these dyadic settings, children shape their own learning through behaviors such as looking, touching, pointing, and shifting between objects (Lucca & Wilbourn, 2019; Yu & Smith, 2013; Yurkovic et al., 2021), while caregivers often provide labels that follow in on the child's current focus of attention (Chen et al., 2021; Schroer & Yu, 2023). Beyond individual naming moments, McMurray's (2016) multiple-timescale account can be interpreted in exploration-exploitation terms: children must explore by creating new labeling opportunities and exploit by revisiting partially learned mappings to broaden and strengthen their word knowledge. In line with Murayama's (2022) reward-learning framework, curiosity might then foster exploration and thereby children's knowledge acquisition (Altmann, 2024; Fandakova & Gruber, 2021; Jirout & Klahr, 2020), and since knowledge acquisition is intrinsically rewarding, it will reinforce exploration over time. In this context, the present study examines how children's curiosity is related to individual differences in exploration behavior and word learning success in dyadic free play.

Three- to four-year-old children and their parents will play together with ten animal figures, five familiar and five novel to the child, in the center of an otherwise empty room. During the free play session, both children and caregivers will wear head-mounted eye trackers, while five cameras will additionally record the interaction. Following the free play, children will complete a sorting task with their parent in which they are asked to place the animals onto labelled locations, serving as a measure of word-learning success. Additionally, caregivers will complete the Early Childhood Curiosity Questionnaire (Altmann et al., 2025). Video and eye-tracking data will be used to quantify, for each child, the frequency, timing, and duration of looks and touches directed at each animal and across all animals, as well as the sequence in which animals are approached to examine exploration and exploitation pathways.

We hypothesize that children's learning success is predicted by an interaction between children's parent-rated curiosity scores and children's exploration behaviours with higher curiosity scores and higher number of exploration behaviours leading to better word-object encoding. Furthermore, over the time of the study, children with higher curiosity scores might tend to explore more than to exploit

compared to children with lower curiosity scores. Data collection is about to start and will be completed by the end of July 2026.

B24 Sound Symbolism as Referential Support in Early Word Learning

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The bouba kiki effect is a sound symbolic correspondence in which rounded sounding forms such as bouba are associated with rounded shapes, whereas sharper forms such as kiki are associated with angular shapes (Köhler, 1947; Bremner et al., 2013; Ćwiek et al., 2022). Such non arbitrary form meaning mappings challenge a strictly arbitrary view of the linguistic sign (Hockett, 1960). Building on the sound symbolism bootstrapping hypothesis (Imai & Kita, 2014), this ongoing study asks whether sound symbolic cues can support early word learning by providing an additional cue to referential mapping under challenging learning conditions. We test English learning infants aged 12 to 16 months, when infants are increasingly sensitive to native language phonotactics. Previous work suggests that, in ordinary or less supportive contexts, 12-month-old English learning infants may have difficulty accepting phonotactically illegal forms such as ptak and svet as object labels because these forms violate English phonotactic expectations (MacKenzie et al., 2012; MacKenzie et al., 2014).

We use a modified Switch Task (Werker et al., 1998) with an initial pre-exposure phase. Infants first view rounded and spiky shapes paired with sound symbolic word forms that are either congruent or incongruent with the shape. Immediately afterward, all infants are habituated to two novel objects paired with arbitrary phonotactically illegal labels, ptak and svet. At test, infants receive a Same trial, identical to habituation, and a Switch trial, in which the word object pairing is reversed. Successful word object mapping is expected to produce recovery of attention on the Switch trial relative to the Same trial.

This design separates the sound symbolic phase from the later arbitrary label learning phase, allowing us to test whether sound symbolism can scaffold subsequent word learning rather than simply elicit an immediate cross modal matching response. Data collection is ongoing. Current participants include 12 infants in the congruent condition and 7 in the incongruent condition in the 12-to-14-month group, and 9 infants in the congruent condition and 3 in the incongruent condition in the 14-to-16-month group. Given the preliminary and uneven sample sizes, results are interpreted descriptively. Early patterns suggest a possible advantage for congruent pre-exposure, whereas incongruent pre-exposure may not provide the same support. Taken cautiously, these findings are consistent with the possibility that sound symbolism provides limited but meaningful referential support in difficult word learning contexts.

**B25 Development of Theory of Mind and Inferential Skills in Children Aged 3 to 6:
An Evolutionary Block-Based Study**

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This study examines the development of Theory of Mind (ToM) and inferential skills in children aged 3 to 6 years, aiming to identify significant differences between consecutive age groups and determine the period of greatest developmental change. The sample consisted of 67 children from a school in the Community of Madrid, divided into four age groups (3-, 4-, 5-, and 6-year-olds). An ad hoc assessment composed of 20 items was administered, organized into five blocks: first-order false beliefs, second-order false beliefs, understanding of non-literal communication (irony and sarcasm), emotional inference, and contextual inference.

Results revealed a progressive increase in overall performance with age. A one-way ANOVA showed significant differences in total scores across age groups ($p < .001$). Post hoc comparisons indicated significant differences between 3–5, 3–6, 4–5, and 4–6 years, but not between 3–4 or 5–6 years. These findings suggest that the most substantial developmental shift occurs between ages 4 and 5.

Block-level analyses showed that first-order false belief understanding improved notably with age, particularly between 4 and 6 years. Second-order false belief tasks were the most challenging, with significant differences found only between 3- and 6-year-olds. Understanding of non-literal communication and emotional inference demonstrated gradual improvement, although without significant differences between consecutive age groups. In contextual inference tasks, significant differences emerged between 3–5 and 3–6 years.

Overall, the findings support the gradual and sequential nature of Theory of Mind development during the preschool years, highlighting ages 4 to 5 as a critical period of consolidation. The potential moderating role of language development and family context in explaining individual differences is also discussed.

B26 Evaluation of the Linguistic Profile in Children with Dravet Syndrome Aged 0 to 6 Years

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Dravet syndrome (DS) is a severe early-onset epileptic encephalopathy, commonly associated with mutations in the SCN1A gene, and characterized by drug-resistant seizures and progressive cognitive, motor, and communicative impairments. Despite growing interest in its neuropsychological profile, research focusing specifically on early language development in this population remains limited.

The aim of this study was to evaluate the linguistic profile of children with DS aged between 0 and 6 years. A descriptive case study design was employed. The sample consisted of six Spanish-speaking children diagnosed with DS, one of whom also presented comorbid autism spectrum disorder (ASD). Language and developmental abilities were assessed using the Battelle Developmental Inventory, the Reynell Developmental Language Scales III, the Peabody Picture Vocabulary Test (PPVT-5), and the MacArthur-Bates Communicative Development Inventories adapted for children with intellectual disabilities.

Results revealed a significant delay across all developmental domains, particularly in motor and communicative areas. All participants showed language abilities markedly below their chronological age, with expressive language more severely affected than receptive language. Vocabulary comprehension was also consistently below expected levels. Notably, considerable variability was observed across cases, ranging from relatively preserved communicative skills to severe impairments, including absence of verbal production in some children. Gesture use emerged as a compensatory communication strategy, especially in more affected participants.

These findings are consistent with previous literature, confirming that DS is associated with a global developmental delay and a distinctive linguistic profile characterized by greater impairment in expressive language. The results highlight the importance of early identification and intervention, as well as the need for individualized, multidisciplinary approaches that include speech and language therapy.

In conclusion, this study contributes to the limited body of research on language development in young children with DS and underscores the necessity for further research with larger samples and longitudinal designs to better understand developmental trajectories and optimize intervention strategies.

B27 Sentence Repetition as an Early Marker of Language Development in Spanish-Speaking Children: A Longitudinal Study

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Sentence repetition tasks (SRTs) have been used in both clinical and research settings due to their reliability, ease of administration, and efficiency in assessing language abilities. Performance in these tasks has been identified as a clinically relevant marker for detecting language difficulties. However, there is a lack of instruments designed for young Spanish-speaking children.

This study presents a 20-sentence repetition task (20-SRT) administered to 24 Spanish-speaking children, aged between 25 and 38 months at the initial assessment (T1). This longitudinal design examines task performance and its ability to predict language outcomes six months later (T2). In addition, the examiner's expressive scale of the Merrill-Palmer-R Developmental Scale is administered.

The results show: (1) the task is sensitive to developmental differences in early language development, as reflected in increased accuracy and a reduction in errors between T1 and T2; (2) performance on the 20-SRT was associated with baseline linguistic ability and captured longitudinal change in language development; and (3) error analysis revealed a predominance of omissions affecting both content and function words.

Overall, these findings indicate that 20-SRT is a robust and sensitive tool for assessing early language abilities, with clear potential for developmental monitoring in both clinical and research contexts.

B28 Nurturing Speech: Family Characteristics and Home Environments of Term vs. Preterm Toddlers

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Language skills of preterm children tend to be lower than those of term children, even in the absence of major disabilities (see meta-analyses in Barre et al., 2011; Loeffler et al., 2025; van Noort-van der Spek et al., 2012). While neurobiological vulnerabilities and a lack of language stimulation in the first weeks of life (i.e. for hospitalized children) have been shown to play a role in these differences (Caskey et al., 2014; Filippa et al., 2023; McMahon et al., 2012; Vandormael et al., 2019), family risk factors have received less attention. In particular, few studies (De Leeuw et al., 2024; Suttora et al., 2020) have examined parental characteristics and the language-learning opportunities they provide on a day-to-day basis. There is a need for studies with larger samples, matched controlled groups for preterm children, and a wider analysis of family characteristics and environmental conditions.

Since preterm birth is linked to family history (Koire et al., 2021), poorer educational and professional outcomes in adulthood (McHale et al., 2022), and is more common in disadvantaged communities (Ahmed et al., 2024; Khanolkar et al., 2015; Taylor-Robinson et al., 2011), the home language environment for preterm children may differ in ways that shape their early language development.

Our on-going study examines the cross-sectional relationship between family characteristics of term and preterm toddlers (20 to 30 months) and their productive vocabulary, using an online questionnaire filled in by 250 mothers in each group. We compare age-matched groups with respect to: maternal vocabulary skills, maternal preterm status, maternal speech input and time spent with the child, maternal education, income, as well as maternal depression status. We test whether parental input is associated with children's vocabulary and whether the mother's vocabulary is associated with children's vocabulary in both groups. Lastly, we test whether preterm children have lower vocabulary skills and, if they do, whether differences can be explained at least partly by family characteristics. In this poster, we present preliminary results based on data collected by the time of the conference.

Our study contributes to the growing body of research on preterm children's early language development by clarifying the role of family-dependent factors on differences in language skills between preterm and term children.

B30 Evaluating 4.5-month-old infants' preference for self-vocalisations during vocal play

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Infants' babble production, and the resulting sensorimotor feedback, shapes their attention to incoming speech, potentially influencing their first words (McCune and Vihman 2001). The onset of sensorimotor mapping may occur during 'vocal play', around four months, when infants begin to explore and experiment with pitch, volume variation, and vowel-like sounds (Vihman 2014) in their vocalisations. Around this age, infants also preferentially listen to vowel vocalisations made by infant-like vocal tracts compared to adult-like vocal tracts (Polka et al. 2022), suggesting that they have begun to form sensorimotor mappings of their own vocalisations. They also attend differently to their own vocalisations and those of an age-matched peer (Legerstee et al. 1998), which indicates that they are familiar with self-generated vocalisations, consequently paying greater attention to peer-generated vocalisations. However, existing research has not explored whether infants' preference for other infants' vocalisations over their own is shaped by the spontaneous, pre-linguistic (versus involuntary, non-linguistic) nature of the vocalisation itself.

The current study examines whether infants' preferential attention to vocalisations made by either themselves or same-age peers varies as a function of the voluntary nature of the vocalisation. Specifically, we examine whether (1) infants preferentially listen to voluntary, pre-linguistic vocalisations (vowel-like vocalisations in vocal play), over involuntary, reflexive sounds (coughs); and (2) infants attend differentially to self-produced vocalisations compared to peer-produced ones.

Sixty families with infants between 4-5.5 months first complete a day-long audio recording, from which we capture the vowel-like vocalisations and coughs. They then participate in an online listening preference study, where they are presented with 16 trials of the previously recorded audio stimuli (self- and peer-coughs and vocal play vocalisations; 4 trials each). Infants' attention is indexed via their duration of looking towards a moving shape on the screen during each trial.

Preliminary results from 34 infants suggest that infants (1) listen longer to vocal play compared to coughs overall, and (2) attend more to self-vocal play vocalisations compared to peer-vocalisations. This could indicate that voluntary vocalisations play a more important role in early development than expected, perhaps due to salient

sensorimotor feedback obtained during vocal exploration. Additionally, the preference for self-produced vocal play vocalisations over peer vocalisations could suggest that infants may be attending to and learning from their own vocal play in early development, which in turn implies that sensorimotor feedback may shape learning from the very first spontaneously produced voluntary vocalisations.

B31 “It’s on the tip of my tongue...”: Do infants’ earliest experiences of producing consonants influence the course of perceptual narrowing?

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Infants undergo perceptual narrowing during their first year of life, becoming increasingly attuned to native speech sound contrasts while losing sensitivity to non-native ones. At 4 months, infants reliably discriminate between all speech sounds the human vocal tract can produce; by 6-8 months, their ability to recognise non-native sounds begins to wane as their developing phonological systems specialise to their ambient languages; by 12 months, infants are little more able to discriminate non-native contrasts than adults (Werker & Tees, 1984). This progression of perceptual narrowing is well-documented, but the underlying processes and mechanisms are not yet understood. In particular, the role of early speech sound production and the sensorimotor feedback gathered through this is under-examined.

Most research to date has focused on plosives, but the timing and trajectory of perceptual narrowing may vary with the manner of articulation. Dutch-acquiring infants show a U-shaped curve in their sensitivity to non-native vowel contrasts (de Klerk et al., 2019), Korean-acquiring infants’ sensitivity to native fricative contrasts sharpens rather than simply maintains over the first year (Shin et al., 2018). Crucially, obstructing specific articulators during speech perception selectively disrupt discrimination of sounds produced by those same articulators (Bruderer et al., 2015; Choi et al., 2019), pointing to sensorimotor feedback as a key mechanism. Plosives tend to be the first speech sounds infants reliably produce, whereas fricatives and vowels—requiring more precise articulatory gestures—are acquired later (DePaolis et al., 2011). This suggests that perceptual narrowing may proceed more quickly for consonants infants have already begun to produce.

We will present preliminary results (current n=24) from a looking-preference experiment conducted via Zoom, examining how babble production influences perceptual narrowing. We compare monolingual English-acquiring 7-10-month-olds’ responses to non-native plosive (/da/-/ɖa/) and fricative contrast (/sa/-/ʂa/) with a native contrast (/pa/-/ba/), taking into account the sounds produced in the infants’ babble. Since babble predominantly features plosives, we expect earlier effects of perceptual narrowing for the non-native plosive contrast than the fricative contrast. That is, we expect infants may reliably discriminate /sa/-/ʂa/ sounds but not /da/-/ɖa/ sounds, given that we expect infants to have experience of producing /da/-like sounds in babble, leading to the establishment of an English /da/ category, i.e. perceptual narrowing. Similarly, we expect infants to discriminate /pa/-/ba/ given that these sounds form two categories in English.

B32 Unfamiliar accent processing in monodialectal and multidialectal infantsDarya Klymenko¹, Nina Kazanina², Jeremy Goslin¹, Caroline Floccia¹¹*University of Plymouth, Plymouth, United Kingdom*, ²*University of Geneva, Geneva, Switzerland*

This study investigates whether 17-month-olds who hear more than one accent in their environment are better at understanding familiar words in an unfamiliar native accent than those who only hear one variety of English. Research to date shows that monodialectal infants do not spontaneously recognise words in an unfamiliar accent until 19 months of age (Best et al., 2009; Mulak et al., 2013; van Heugten & Johnson, 2014; van Heugten et al., 2018) but can adapt to an accent in certain conditions (van Heugten & Johnson, 2014; Potter & Saffran, 2017). Multidialectal infants, however, are constantly exposed to accent-related variability, which may improve their ability to cope with novel speech variants (Durrant et al., 2015). Twenty-six infants from the Plymouth area completed a preferential looking paradigm task where the target word was named either in a familiar South-West accent, or an unfamiliar South African or New Zealand accent. Parallel data collection is ongoing online where the same paradigm is being presented using Gorilla experiment builder. Parents also complete a questionnaire detailing the child's linguistic environment and submit voice recordings of their own accents. These are used to calculate the child's percentage of South-West and non-South-West accent exposure. The analysis of the in-person eye-tracking data is underway using mixed linear models and growth curve analysis. Rather than using distinct groups, multidialectism is operationalised as a continuous predictor. We predict that when the target word is named in an unfamiliar accent, higher percentage of non-South-West accent exposure will predict higher proportion of looking time to the target word, as well as quicker gaze shifts to the target word post-naming. The same analysis will be applied to the online data, followed by an exploratory model that will combine both samples with mode of data collection as an additional predictor. Discussion points include the ongoing methodological and theoretical challenge of defining South-West accent exposure (what happens when a parent defines their accent as "neutral"? How pronounced does an accent have to be to be classed as South-West?) and methodological feasibility of combining data collected in person and online.

The pre-registration of the study can be found here: <https://osf.io/m34dz/overview>

B33 The impact of interactive book sharing on behavioral and neurophysiological measures of language development in infancy: A randomized controlled trial

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Parent-focused book-sharing interventions are well established as effective tools for promoting early language development, primarily by equipping caregivers with strategies to enhance communication during shared reading. However, their impact on preverbal infants remains insufficiently understood. In parallel, limited research has examined the neural mechanisms underlying early vocabulary acquisition. Event-related potentials (ERPs), derived from EEG recordings, offer a sensitive method for assessing infants' neural responses to language input. In particular, the N400 component is widely interpreted as an index of lexical–semantic processing and emerging word comprehension in early development (Junge et al., 2021).

The present randomized controlled trial (RCT) evaluates the effects of a brief, caregiver-focused book-sharing intervention on both behavioural and neural indices of language development in 10-month-old infants (N = 115). Parent–child dyads were randomly assigned to either an intervention group or an active control group. The intervention was based on the Mikhulu Trust book-sharing programme and delivered over five weeks. The active control condition was designed to match the intervention in terms of researcher contact and group participation, thereby isolating the specific effects of the book-sharing strategies.

Intervention effects on children's receptive and expressive vocabulary will be assessed using caregiver reports collected at baseline, immediately post-intervention, and at two follow-up time points. Neural processing will be indexed via the N400 component, with mean amplitude measured at baseline and post-intervention. In addition, associations between vocabulary size and N400 mean amplitude will be examined across assessment points.

We hypothesize that (1) infants in the intervention group will demonstrate greater gains in receptive and expressive vocabulary compared to the control group at post-intervention and follow-up assessments; (2) the intervention group will exhibit enhanced N400 responses following the intervention, reflecting more robust lexical–semantic processing; and (3) vocabulary size will be positively associated with N400 mean amplitude.

Exploratory analyses will further assess potential moderators of intervention effectiveness, including parental education, intervention fidelity, and the home literacy environment at baseline. Together, this study aims to advance understanding

of both the behavioral outcomes and neural mechanisms associated with early language interventions in preverbal populations

B34 Penguin: A New Screening Tool for Welsh–English Bilingual Language Development

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Children growing up in Welsh–English bilingual contexts experience variable language exposure shaped by family structure, community use, and socio-economic factors. Early identification of Speech, Language and Communication (SLC) needs is essential for timely support; however, few validated screening tools are designed for bilingual populations, and none specifically target Welsh–English bilingual children. Prosiect Penguin aims to evaluate and validate the Penguin language screening tool for monitoring early language development in bilingual Welsh–English children across Wales at 15, 27 and 42 months. Here we focus on the standardisation of the tool by establishing validity through comparison with gold standard assessments and reliability through test–retest and inter-rater analyses.

Participants are recruited via public-facing channels, early years networks, social media, and NHS professionals to ensure socio-economic, geographic, and linguistic variety. Families take part in home visits involving parent-report questionnaires and naturalistic observation, together constituting the Penguin tool, which is administered in Welsh, English, or both, depending on the child’s language exposure. At 27 and 42 months, children also complete an independent SLT reference assessment conducted by a different assessor. Reference measures include tests such as the Preschool Language Scales–5, CDC Milestones, and the New Reynell Developmental Language Scales.

Data collection is ongoing, with recruitment for the 42-month group underway. At 15 months, 94 children have been assessed (English n=39; Welsh n=11; bilingual n=44), including 26 from low socio-economic status (SES) backgrounds. At 27 months, 97 children have been assessed (English n=34; Welsh n=15; bilingual n=48), including 24 from low SES backgrounds. Developmental concerns from gold standard assessments were identified in 15 children at 15 months and 14 children at 27 months. Planned analyses will examine agreement between Penguin outcomes and SLT reference assessments, alongside exploratory analyses of bilingual exposure and socio-demographic factors.

This study will provide robust evidence for the validity and applicability of the Penguin tool for early language screening in Welsh–English bilingual children. Strengths include a large, diverse sample and independent reference assessments.

Findings have the potential to inform early identification practices, support equitable provision, and advance research in minority-language bilingual development.

B35 Is 4-year-olds' language learning driven by prediction errors? Evidence from eye-tracking

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The role of prediction errors in language learning is unclear (Ryskin & Nieuwland, 2023). To clarify their role in English 4-year-olds' developing comprehension of sentence structure, we focus on double object datives (DOs); sentences in which the recipient of a transfer action (e.g., giving) precedes the theme (e.g., the given object), e.g., "Marshall will give the elephant [recipient] an apple [theme]". Recently, in a between-participants design, Gambi & Messenger (2023, hereafter GM) found tentative evidence that 4-year-olds (N=53) exposed to sentences encouraging generation of stronger incorrect linguistic predictions (more predictable condition, n=28) showed greater improvement in comprehension of DOs (measured by "acting out" the sentence, Mpre accuracy=46%, Mpost=64%) than those exposed to sentences that did not encourage strong predictions (less predictable condition, n=25, Mpre=45%, Mpost=48%). Here, we attempted to replicate this finding in a higher-powered study (N=85 4-year-olds, <https://osf.io/v5pzb>). We used sentences with animate themes (compared to those with inanimate themes) in pre- and post-tests (which showed the greatest pre-post improvement in act-outs in GM) and additionally measured predictive processing using eye-tracking. Unlike GM, we did not find more improvement in DO understanding for those in the more predictable (n=42, Mpre=25%, Mpost=35%) compared to the less predictable (n=43, Mpre=39%, Mpost=50%) training condition (non-significant interaction [pre-test accuracy*condition] predicting post-test accuracy, $b=-0.08$, $SE=0.12$, $z=-0.66$, $p=.508$). However, eye-tracking data showed that children who made stronger incorrect predictions that they then revised (predict-and-revise score, see Reuter et al., 2019) showed greater improvements in DO understanding relative to their peers ($b=0.07$, $SE=0.03$, $t(70)=2.11$, $p=.039$). Moreover, in a more direct replication of GM (current n=81, target N=90, pre-registration: <https://osf.io/rfq6u/>) where test sentences include animate and inanimate themes (as in GM), we observed the same pattern of results: no greater pre- to post-test improvement in the predictable condition (n=41, Mpre=56%, Mpost=67%; unpredictable, n=40, Mpre=53%, Mpost=61%), but strong evidence from eyetracking that children making and revising stronger incorrect predictions show greater improvement. This provides the first explicit evidence of the role of prediction error in sentence structure learning, demonstrated across two studies.

We will discuss these novel findings and their implications for error-driven theories of language acquisition. We will also preview ongoing work investigating error-driven learning across language domains (structures and words) and over time (testing learning 24h and one week after exposure) in a design optimised for studying individual differences (target N=95, current n=18, accepted Stage 1 Registered Report, preprint: <https://doi.org/10.31234/osf.io/9es5a> v2).

B36 Not so hard: Young children can predict appropriate sentence completions following negation.

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The prediction of upcoming linguistic content is central to mature language processing,¹ however less is known about this ability in young children. In naturalistic, correlational paradigms, children's behavioral and neural responses show sensitivity to predictive constraints.^{2,3} However, controlled experimental designs are crucial to understanding which constraints young children incorporate into their predictions. For example, negation, a linguistically-universal logical operator which reverses meaning, may present particular problems for children's language prediction because it requires cognitive skills like inhibitory control.⁴ Indeed, 4–5-year-olds anticipate affirmative continuations even after hearing 'not,' suggesting they find it difficult to inhibit salient affirmative alternative predictions.⁵ The current study uses negation to investigate the bounds of children's explicit incremental predictive processing.

We investigate whether 4.5–6.5-year-old children make accurate sentence completions, and whether negation makes doing so more difficult. Children (N=48) produced verbal completions to 40 sentence fragments (20 affirmative-polarity, e.g.: 'pushing people on the playground is very...', 20 negated-polarity, e.g.: 'pushing people on the playground is not very...'). We coded their responses as fitting the affirmative or negated polarity fragment, or neither.

Participants generated appropriate predictions for both affirmative and negated sentence fragments (74% and 60% accuracy respectively). However, accuracy was lower for negated fragments ($\beta=-0.80$, $SE=0.11$, $Z=-6.97$, $p<.001$). We investigated participants' errors to further explore this pattern. Reverse-polarity errors— responses to one condition which are more appropriate for the other—were more common in response to negated fragments ($\beta=1.04$, $SE=0.14$, $Z=7.51$, $p<.001$). These errors decreased as age increased ($\beta=-.45$, $SE=0.14$, $Z=-3.25$, $p=.001$).

These results demonstrate that young children are sensitive to how negation changes upcoming sentence content. The reverse-polarity results suggest they may struggle to inhibit initial affirmative predictions. This difficulty reduces with age, potentially reflecting executive function development. These findings facilitate future work investigating younger children's explicit negated predictions.

B37 The relationship between gesture use in parent-infant interactions and word learning: Insights from head-mounted cameras

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Parent-child interactions play an important role in early development, allowing infants to learn and develop their skills. Social communication is multimodal so, although busy environments can make it difficult for infants to attend to relevant information, caregivers use additional cues that support infants' learning. One key cue is gesture, which has been found to help infants attend to referents, and is particularly important for vocabulary development. However, observational work in naturalistic settings provides limited insight into how gestures support vocabulary acquisition, and controlled eye-tracking research investigating the attentional mechanism has limited ecological validity. We therefore aimed to bridge this gap between free play observations and controlled laboratory research by investigating the influence of gestures in parent-child interactions on novel word learning. 45 10- to 24-month-old infants and their caregivers took part in two interactions, one with toys and one with novel objects in which caregivers were instructed to use two novel words for the objects. Head-mounted cameras were used to record the interactions from participants' perspectives, allowing us to explore the influence of caregivers' gestures on infants' attention and word learning. Following the interactions, caregivers asked infants to give them one of the novel objects, allowing us to determine whether they learned the words and investigate whether this was influenced by gesture use and attention in the interactions. Results indicated that infants were more likely to look at an object during the interactions after their caregiver pointed at it, whereas before pointing occurred they were more likely to look at their caregiver's face, suggesting that pointing gestures redirect infants' attention in real world environments. In the test phase, results also suggest that infants were more likely to look at the correct object, and thus have learned the word, when their caregiver used more pointing gestures in the novel interaction but only when the infant also displayed greater attention to the objects. This supports eye-tracking findings that demonstrate that using pointing gestures to indicate objects is associated with infants' word learning, and builds upon observational work by suggesting that the redirection of attention to objects is the mechanism by which this learning occurs in the real world. These findings highlight the importance of caregiver gesture for word learning, and further our understanding of the mechanism behind the relationship by bridging a gap between naturalistic observations and controlled eye-tracking research.

B38 The Impact of Labelling on Infant's Manual Exploration and Subsequent Object Recognition

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Parents frequently label objects while infants are holding and manipulating them (West & Iverson, 2017). Notably, infants' object processing seems to be influenced by both manually exploring 3D objects (e.g. Slone et al., 2018) and hearing labels for objects (e.g. Xu, 2002), indicating that such moments of labelling during manual manipulation could be particularly useful for infants' learning. Shape information may be of particular importance here, with labels drawing attention to shape and elements of manual exploration also supporting recognition of objects from sparse shape information (James et al., 2014). However, it remains unclear how such moments of labelling during object manipulation influence infants' object recognition, and whether hearing an object label impacts infants' manual exploration behaviours. This study will aim to explore whether hearing a label influences how 8- to 12-month-olds and 18- to 24-month-olds manually explore objects, and how both labelling and infants' exploratory behaviours influence subsequent recognition of novel objects and their shape caricatures. In this study, infants will be allowed to freely manipulate a set of novel 3D objects, with half of the infants hearing labels for these objects during their exploration. Video recordings will be coded to determine whether hearing object labels impacts infants' manual exploration of objects, and an object recognition task using an eye-tracker will test their recognition of these novel objects and their sparse shape caricatures. The results of this study should tell us more about how infants interact with and learn about 3D objects in the world around them.

B39 When Looking Masks Learning: Test Context and Individual Differences in Cross-Situational Word Learning

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The Cross-situational word learning paradigm has been extensively studied as a framework for understanding how infants learn word–object associations across ambiguous situations. To investigate the mechanisms underlying this process, we applied the neurodynamic model WOLVES (Bhat et al., 2021). A key prediction of WOLVES is that the test context influences observed evidence of learning: during autonomous visual exploration, at the point when the word cue is presented, participants may already be looking either at the target or at the distractor. This changes what they must do to demonstrate learning -- maintain gaze on the target or switch to the distractor -- and can mask word learning. We examined model behaviour in a version of the test in which infants are first cued to the centre before the test word is played. Simulations suggested this produces more consistent evidence of learning.

To test this prediction, three empirical studies are presented. The first reproduced the original paradigm of Smith and Yu (2008), providing a baseline condition. Two further experiments introduced a central cue before test, differing in cue duration. In the second experiment, the cue disappeared after fixation, whereas in the third it remained on screen for a total of 2 seconds. Eye-tracking data were collected in all three experiments from 225 infants aged 11 to 32 months.

Training conditions were kept constant across experiments with the exception of Experiment 1 where we had two training orders (we simplified this in Experiments 2 and 3). The same cluster analysis procedure, applied independently to training gaze dynamics within each experiment, identified clusters of infants who showed more or less learning during training. Cluster membership was then used to predict test performance via a GLMM approach. Both the second and third experiments showed interactions between training cluster membership and temporal dynamics during test trials. In addition, the second experiment revealed a main effect of cluster membership on overall test looking behaviour. These findings suggest that central cueing can stabilise fixation and improve detection of learning-related differences. More broadly, the results indicate that evidence of infant learning depends not only on acquired word–object associations, but also on how test conditions shape visual exploration, with gaze dynamics during training predicting later test performance.

B40 A caregiver-led intervention to encourage vocalisations and facilitate word learning in children with Down syndrome

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For typically developing infants, experience in speech sound production may facilitate early word production (McGillion et al., 2017). Infants with Down syndrome (DS) vocalise less (Parikh & Mastergeorge, 2018) and are at risk for language delay (Zampini & D'Odorico, 2013). Targeting early vocalisations may support earlier word production in infants with DS (e.g. Peter et al., 2025).

We developed BabblePlay, an app-based caregiver-led intervention designed to encourage vocalising in infants with DS through contingent, visual feedback (Daffern et al., 2020). This study reports findings from a feasibility randomised controlled trial (RCT) of the intervention.

UK-based families with infants with DS (7-15 months) were randomised to either a control group, who used a mirror for 3 weeks, then BabblePlay for 3 weeks, or an intervention group who used BabblePlay for 6 weeks (split into 2, 3-week periods). Families completed questionnaires and home audio recordings (8-15hrs) at baseline and after activity periods. Adherence and acceptability were measured through app data, audio logs, and caregiver feedback.

Recruitment and retention targets were exceeded: 51 families consented, with 40 completing the study. Adherence was high: 92% of audio logs returned and 88% of audio recordings ≥8 hours. Caregivers reported the intervention was acceptable.

The feasibility RCT supported progression to a definitive RCT, which is now underway. If successful, BabblePlay may fulfil a real need, as Speech and Language Therapy provision for infants with DS is often limited in the UK.

B41 Infant vocal production as a window into the autonomic nervous systemJeremy Borjon¹, Manash Sahoo², Katherine Rhodes², Valerie Bambha²¹*University of Houston, Houston, United States and Heidelberg University Hospital, Heidelberg, Germany,* ²*University of Houston, Houston, United States*

Producing speech is a protracted developmental achievement that recruits multiple cognitive, linguistic, and motor systems. Infants learn to speak iteratively, generating vocalizations that train the vocal apparatus and articulators before culminating in the emergence of recognizable words. While much research has focused on the coordination of the orofacial articulators, far less is known about the extended physiological systems supporting vocal production, despite the fact that vocalizing simultaneously recruits motor and autonomic processes. The muscles recruited to produce a vocalization interact dynamically with the baroreceptor reflex to produce rhythmic oscillations in heart rate and blood pressure. Such emergent autonomic oscillations are known to influence behavior; nonhuman primates time contact calls to fluctuations in heart rate. Whether comparable coupling exists for human infant vocalizations has not been established.

We measured 34 infants between 18 and 27 months of age during naturalistic play with a caregiver while simultaneously recording their heart rate using a mobile electrocardiogram. A total of 2,708 vocalizations were produced, with each vocalization independently scored by four naive listeners as recognizable or unrecognizable as a word. Heart rate was converted to percentiles to control for individual differences in resting heart rate and then transformed into phase angles, with 0 degrees corresponding to the local peak and 180 degrees to the local trough. Phase was divided into six bins, and randomly permuted bootstrapped significance tests evaluated clustering beyond chance.

Infants were most likely to vocalize at the peak and trough of heart rate fluctuations. Vocalizations produced at the peak, when heart rate had completed its rise, were longer than expected by chance. Functionally, vocalizations produced near the end of heart rate deceleration, just before the trough, were significantly more likely to be recognized as words by naive listeners. The percentile value of heart rate did not predict duration or recognizability; rather, the dynamic phase of cardiac activity carried this information.

These findings implicate the autonomic nervous system in early language production. The coordination required to vocalize may be facilitated by the quiescence of decelerative heart rate or the energetic support of acceleration, with recognizable words emerging preferentially during deceleration. Because the autonomic system reorganizes substantially across development, disruptions in autonomic state,

whether from stress, poverty, or trauma, may contribute to cognitive and language delay. Understanding the coupling between autonomic activity and vocal behavior is therefore a critical avenue for characterizing the physiological emergence of language and its developmental risk factors.

B42 The Ecology of Human Vocal Learning: A Child Network Approach

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Vocal learning is a key foundation of language development, involving the gradual acquisition of language-specific speech sounds through exposure to surrounding speech. Although children's language development is strongly shaped by their social environments, research has focused mainly on individual caregivers rather than broader social networks (Goldstein, King & West, 2003; Athari, Dey, & Rvachew 2021). Features of a child's social network, including the number of close relationships and the diversity of speakers, may influence speech perception and production, suggesting a complex link between social interaction and vocal learning (Okocha, Burke & Lew-Williams, 2024; Casillas, Brown & Levinson, 2020). Current evidence is inconclusive and most of the research is on indirect parental measures focusing on receptive skills (word comprehension, vocabulary), with little research assessing infants' language skills directly and expressive language. 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 (Bulgarelli & Bergelson, 2023).

We hypothesize that individual differences in the social diversity of interactions of 11-month-old infants relate to the maturity of their 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 recruited thirty families with monolingual Norwegian infants, i.e., exposed to 90 percent of Norwegian. Parents provided, in an online interview, information about the child's social network that was used to compute the speaker diversity measure, through Shannon's entropy formula (Shannon, 1948). Parent-child play interactions were recorded at home, with an average duration of 15 min. The analysis of the recordings identified infants' vocalizations and classified them into canonical, non-canonical, and other. Mixed-effects regression models will assess the relationship between social network diversity and vocalization maturity. Data analysis is ongoing and will be presented at the conference.

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 language development.

B43 Late talking in young children in Saudi Arabia: Identifying key risk factors

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The development of language skills is critical to the academic success and overall well-being of children. Research shows that late talking, defined as delayed expressive language development in toddlers, negatively impacts future language and literacy skills. The early identification of children at risk of late talking can significantly improve long-term outcomes in language development. However, data on late talkers among Saudi children are scarce. The present study aimed to address this gap by examining the prevalence and risk factors of late talking among Saudi toddlers, focusing on biological and environmental factors and the influence of socioeconomic status (SES) on home literacy environment (HLE) practices. A sample of 270 children aged 16–36 months participated. Expressive vocabulary size was measured using JISH Arabic Communicative Development Inventory: Words & Sentences–Short Form (JACDI: WS-SF), a Saudi Arabic adaptation of the MB-CDI. Caregivers completed a home-screening questionnaire that assessed various family and child variables, including SES, family history of language disorders, birth conditions, HLE practices, screen use, and parental self-efficacy in nurturing language development. The findings revealed that 11% of toddlers were at risk of late talking, with hearing or vision issues as key biological risks. While engagement in HLE practices significantly reduced the likelihood of late talking, excessive screen time increased such risks. The study did not find a significant association between SES factors, such as maternal education and household income, and participation in HLE practices. These insights have implications for researchers, clinicians, and policymakers in early childhood education and health.

B44 Investigating prenatal speech processing in fetuses

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Infant-directed speech (IDS) is characterised by exaggerated prosody, and neonates discriminate IDS from adult-directed speech (ADS), often showing a preference for IDS, suggesting a sensitivity to IDS (Cooper and Aslin, 1990). However, accounts emphasising innate basis for IDS preference may overlook the contribution of prenatal environmental factors, particularly the maternal emotional environment. The present study investigated whether fetal sensitivity to IDS is shaped by the maternal emotional environment during late gestation. Fetuses (N = 89; 32–35 weeks' gestation) were exposed to IDS, backwards IDS (B-IDS), and ADS. Fetal responses were indexed using heart rate (FHR) and behavioural measures of head movement using 4D ultrasound. Maternal emotional experiences were assessed using questionnaires; Perceived Stress Scale (PSS), Positive and Negative Affect Schedule (PANAS), and Dispositional Positive Emotion Scale (DPES).

We hypothesised that fetuses would show increased arousal to novelty, indexed by elevated FHR and head movements in response to B-IDS relative to IDS and ADS. We further expected differential responses to IDS relative to ADS consistent with early emerging IDS preference. Also, we predicted that higher maternal negative emotion scores would be associated with reduced fetal sensitivity to speech discrimination, whereas higher positive emotion scores would be associated with greater differentiation between conditions.

Results indicated that B-IDS elicited significantly greater FHR reactivity compared to IDS and ADS. Maternal emotional factors moderated fetal responses: higher negative affect was associated with increased FHR reactivity to IDS but reduced reactivity to B-IDS and ADS, whereas higher positive affect was associated with reduced FHR responses to IDS and increased responses to B-IDS. Behaviourally, fetuses showed reduced head movement relative to baseline across conditions, suggesting motor suppression. However, during the first 60 seconds, ADS elicited the highest motor suppression, whereas in the second 60 seconds ADS showed the lowest suppression relative to IDS and B-IDS. In first 60 seconds, while higher negative maternal emotion scores linked to increased head movement to IDS and B-IDS, higher positive maternal emotion scores were linked to decreased head movement to IDS and B-IDS. In second 60 seconds, while higher Negative affect was linked to higher head movement in IDS and B-IDS, the trend was opposite for higher DPES scores.

Overall, findings suggest that prenatal maternal emotional environment shapes fetal sensitivity to language and prosody, challenging strictly genetic accounts of early IDS

preference and highlighting the role of early experiential context in speech perception development.

B45 Investigating Neonatal Speech Processing: Do Newborns Really Prefer Baby Talk?

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Even before birth, infants are sensitive to prosodic information. At the last trimester, fetuses can discriminate their mums' voice from stranger female's voice and their native language from unfamiliar language, (Kisilevsky et al., 2009; Kisilevsky et al., 2003). At birth, these early prenatal auditory experiences provide a foundation for early perceptual preferences. Newborns also recognise their mum's voice and prefer their native language over unfamiliar languages (e.g. DeCasper and Fifer, 1980; Nazzi et al., 1998). These early prosodic discrimination abilities are thought support early preferences. For instance, intonational and rhythmic features could be key features of infants' preference for infant directed speech (IDS) over adult directed speech (ADS) (Fernald and Kuhl, 1987).

IDS often used by adults when interacting with infants and characterised by exaggerated pitch (Saxton, 2008). In many studies conducted with infants and newborns, IDS preference over ADS has been found, even with minimal postnatal exposure (Cooper and Aslin, 1997). Thus, many suggested that IDS preference is primarily driven by prosodic characteristics of IDS, suggesting an predisposition to attend to acoustic properties of IDS such as exaggerated prosody. Here, we use backwards infant directed speech (B-IDS) to investigate if IDS preference can be explained by general preference for acoustically salient stimuli.

Additionally, early environmental factors might shape early experiences and influence early preferences. For example, maternal emotional environment has been linked to variations in language exposure both prenatally and postnatally (Hernandez-Reif et al., 2018; Kaplan et al., 2009; Palato-Oliviera et al., 2021). Thus, we also investigated whether variance in maternal experience of emotions, both positive and negative, predict variability in neonatal sensitivity to IDS.

We used adapted version of a visual fixation-based auditory preference procedure (Cooper and Aslin, 1990) and conducted the analyses with 27 neonates. There was no significant differences in looking time to checkerboard across conditions. However, looking patterns were similar in IDS and ADS condition compared to B-IDS, possibly reflecting novelty. Further, neither positive nor negative maternal postnatal emotional experiences significantly predicted speech preference.

We discuss the methodological sensitivity of visual fixation paradigms as in our study we used predetermined trial duration and number, which differs from infant

controlled paradigms that used in prior research (Cooper and Aslin, 1990). Overall, these findings contribute to understanding the early foundations of speech perception from both innate and environmental perspectives.

B46 The effect of acoustic salience on consonant discrimination: An MMR study with German-learning toddlers

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The subtle acoustic differences between speech sounds make early language acquisition a challenging task. The discrimination of consonants is particularly crucial for the acquisition of words and morphosyntax (Christophe et al., 1997; Morgan & Demuth, 2014). In German, for example, verbal agreement is expressed with the suffixes /-n/, /-s/ and /-st/ at verb stems. Discrimination of these relies on subtle differences in acoustic salience: /-st/ and /-t/ have a less salient spectral peak at higher frequencies (HF), /-n/ has a more salient spectral peak at lower frequencies (LF) (e.g., Lazarus et al., 2007; Steffens, 2016). We investigated whether salience affects discrimination on the neural level—and whether frequency-specific acoustic enhancement of less salient HF consonants (Saripella et al., 2011) benefits discrimination.

We tested n=15 children (1;6-2;6 years; target sample size n=40) in a passive-listening auditory oddball paradigm, employing electroencephalography (EEG) and the mismatch response (MMR) as an index of auditory discrimination (Näätänen et al., 2004). Stimuli consisted of monosyllabic German pseudo-verbs that were presented in oddball blocks: first, with the standard stimulus mah-t (occurrence probability of 83%) and the HF deviant mah-st in versions with (8.5%) and without (8.5%) acoustic enhancement (Saripella et al., 2011) in randomized order; and second, the standard stimulus together with the LF deviant mah-n in versions with and without acoustic enhancement.

Linear mixed models will test for the modulation of neural discrimination (MMR) by consonant type (HF vs. LF consonants), acoustic enhancement (with and without enhancement), and the interaction of these factors. We predict a main effect of consonant type, with the more salient LF deviants eliciting larger MMR amplitudes than the less salient HF deviants relative to the standard. In addition, we expect acoustic enhancement to increase perceptual salience, leading to MMR amplitude differences within both consonant categories, with potentially stronger effects for HF consonants.

Our findings bear clinical relevance, as children with sensorineural hearing loss often have reduced access to acoustic information in high spectral frequencies. This can impair perception of verbal agreement morphology in hearing impaired children (e.g., Penke et al., 2016). Evidence of effects of acoustic salience and acoustic

enhancement on neural discrimination of speech sounds may thus contribute to improving auditory rehabilitation strategies.

B47 Visual priors in toddlers' hands yield a natural axis for object-centered representations

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Shape perception is integral to both recognition and categorization and depends on perceiving abstract shape – and this implicates some coordinate system intrinsic to the object. We conjectured if an object-centered frame of reference is discoverable, bottom up, in the 2D images generated by toddlers. If so, actively selected object views should align with well documented visual edge sensitivities, in particular longer over shorter extents, and with the cardinal orientations. In addition, the relation that creates the momentary view of the object and the projected 2D shape, should be biased towards maximal extent of the major axis of elongation, a property assumed to support an object-centered frame of reference.

This study analyzed $N = 3664$ toddler generated images, taken from a corpus of head-camera videos, captured by 12- to 36-month-old children, as they actively manipulated novel objects. Four objects were selected, that varied in aspect ratio, and 3D object pose coded. We computed two measures from object pose: angle with line of sight (from foreshortened to perpendicular – where the major axis is maximally extended); and orientation, relative to the vertical in the picture plane. We also measured two properties that only consider the projected 2D image: the main axis' orientation of the second-moment ellipse fit to the projected shape; and the distribution of local edge orientations.

The key finding is this: the problem of recovering the 3D orientation of the object is greatly reduced because the momentary proximal 2D image is an almost perfect prediction of the major axis' orientation. First, toddlers oversample views in which the major axis is near maximal extent, and oriented towards horizontal or vertical, a small region of the full range of possible views. Second, the projected image is consistent with the oblique effect. The best-fit ellipse main axis is biased to horizontal or vertical, and so is the distribution of local edges. When combined, toddlers create a correspondence between an intrinsic property of the 3D object, its major axis, and a momentary property, the main axis, of the projected 2D shape: the frame-by-frame correspondence of the major axis and the main axis, within the picture plane, yields an extraordinarily high correlation, Spearman's correlation $r_s(3662) = 0.924$, $p < .001$.

We discuss these findings in terms of how the infant's first-person visual experiences are likely teaching generalizable principles of shape that can be applied to other geometrically similar things.

B48 Development of alpha oscillations in humans over the first year

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Alpha oscillations are the dominant brain rhythm during resting. They are considered as reflecting a genuine mechanism for regulating neural activity. Given the protracted developmental trajectory, a better understanding of the onset of alpha activity is needed. Although well studied in adults and children, alpha oscillations have remained underexplored in awake infants, as most research has focused on sleep and anesthesia.

To delineate the developmental trajectory of alpha oscillations during awake resting states in infancy, we recorded the EEG in infants at the age of 2 (N = 54), 5 (N = 59), 8 (N = 77), 11 (N = 53) months (N = 243 in total) employing an infant-adapted resting-state paradigm. The EEG was recorded in two conditions, either with lights-on and with lights-off (in a dark room) for 3 minutes each. We analyzed both oscillatory activity in the alpha frequency range (3–8 Hz) and the offset and exponent of aperiodic EEG activity.

Alpha oscillatory activity over occipital channels changed in both amplitude and peak frequency across the first year. No distinct alpha peak was detectable in 2-month-olds, whereas a gradually emerging peaks were observed in 5-, 8-, and 11-month-olds. In parallel, peak frequency increased from around 5 Hz at 5 months, to 6 Hz at 8 months, and to 6.5 Hz at 11 months. Furthermore, the typical alpha synchronization when visual input is removed (lights-off condition) did not emerge before the age of 5 months.

An analysis of the aperiodic activity indicated that 2-month-olds showed steeper slopes compared to 5-, 8-, and 11-month-olds. The aperiodic offset increased from 2- to 8-months and then slightly but significantly decreased in 11-month-olds.

In sum, the observed changes in both periodic and aperiodic EEG activity suggest ongoing maturation of neural circuits across infancy. The result that alpha synchronization in darkness did not emerge before the age of 5 months suggests that towards the second half of the first year in life neural circuit activity during rest takes sensory input into consideration.