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ABSTRACT BOOK



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S1.1.1 - Diverse approaches and populations in research on early attention development

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Summary

Attentional development is influenced by social and cultural contexts. This symposium examines this phenomenon through caregiver-child dynamics, children's curiosity, and environmental distractions. The first talk compares parental guidance during play in Hispanic and non-Hispanic families, emphasizing the impact of culture on attention development. The second talk highlights cultural disparities in attention trajectories between the U.S. and Japan, attributing differences to unique caregiver narratives. The third talk explores children's curiosity across South Korea, Turkey, and the U.S. identifying cultural differences and similarities. The fourth talk addresses the effect of distractions on attention and task performance in children from lower socioeconomic sectors. Together, these studies emphasize the interplay between parenting behaviors, culture, and early experiences.

S1.1.2 - Early joint attention across hispanic and non-hispanic families

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Details

Attention development, a foundational skill for early cognitive and language development, is rooted in infants' social interactions (Salley & Colombo, 2016). Joint attention (JA), in particular, is regarded as a prominent component of this attentional foundation, serving as a precursor to broader developmental milestones (Brooks & Meltzoff, 2005; Mundy & Gomes, 1998).

Recent studies have examined the role of parents, especially their use of gaze, verbal cues, and object handling, in guiding and extending infants' attention during play (Suarez-Rivera et al., 2019; Yu & Smith, 2016). However, the exploration of how these dynamics differ across cultures, especially between Hispanic and non-Hispanic families, is still limited. Importantly, previous observational studies highlight distinct patterns and practices that characterize Hispanic families' play interactions (Cabrera et al., 2006). We hypothesize that parental influence on attention varies across different cultural contexts.

Accordingly, the present study examined the influence of parental verbal cues and object manipulation on JA during play. Drawing from a sample of Hispanic and non-Hispanic families with infants aged 6 to 18 months, the study employed head-mounted eye trackers during play sessions. This technology allowed us to capture each JA moment that coincided with parental verbal cues and/or object handling interactions. Trained coders annotated these target behaviors for subsequent analyses.

The preliminary results suggest multiple routes through which culture impacts JA experiences. Specifically, JA experiences are moderated by culture and language factors. Such differences not only

underscore the dynamic and influential role parents play in guiding attentional development but also the importance of taking family background into consideration.

By highlighting the interplay between parental interactions and cultural contexts, this research provides information about developmental pathways through which families from diverse backgrounds shape early attention development.

S1.1.3 - Development of attention in two cultures: The role of caregiver-child interaction

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Details

Visual attention plays an important role in social and cognitive development. Traditionally, developmental research has predominantly focused on documenting age-related changes from participants living in Western, Educated, Industrialized, Rich, and Democratic (WEIRD) cultures (Henrich et al., 2010; Nielsen & Haun, 2016). Furthermore, the biological or maturation explanations of child development, instead of social contexts shaping child development, are still dominant in the current literature. Despite the widespread interest in understanding the mechanisms of development, the current literature focusing on change remains limited (Gauvain, 2002; Miller, 1993; Siegler, 1996). Cultural analyses can elucidate a nuanced and comprehensive understanding of cognitive development by examining the diverse social contexts in which development occurs (Keller, 2017; Miller, 1997; Rogoff, 2003; Wang, 2017). In the present research, we focus on changes in children's attention in two cultures, with an emphasis on the constitutive role of collective meanings in culturally variable psychological processes. We attempt to connect the narratives constructed during caregiver-child interaction (i.e., learning episodes) to the precise changes in children's attention.

Study 1 examined the role of caregiver-child narrative construction on the development of visual attention among 3- to 4-year-old children in the United States (predominantly non-Hispanic Whites) and Japan (predominantly Asian) (N = 60 mother-child dyads, 29 girls, 31 boys). The findings revealed that caregivers directed children's attention to culturally sensitive information, with U.S. caregivers focused mostly on objects and their properties such as color and shape (e.g., There is a rabbit. He has large ears that are pink), while Japanese caregivers focused on interactions among objects (e.g., The rabbit is saying hello to the mouse). Patterns of gaze fixations were measured via an eye-tracker, and cross-cultural differences in attention emerged only after interacting with caregivers. Specifically, the Japanese children shifted their attention to both objects and backgrounds after they interacted with their caregivers. Furthermore, caregivers' narratives related to social interactions among objects, and not the object-oriented narratives, mediated cross-cultural differences in visual attention measured via an eye-tracker.

In Study 2, we examined the socialization practice of moral development in 3- to 4-year-old children and their parents in the U.S. and Japan. Children and parents watched emotion-laden scenarios, in which two cartoon characters engaged in prosocial or antisocial actions. We also analyzed socialization

practices in the child-caregiver dyads (N = 57). The results indicated that US caregivers cued children to attend to the agent (e.g., actor of prosocial or antisocial actions), while Japanese caregivers cued children to attend to emotion of the victim.

We will discuss the role of narratives and the construction of collective meanings in understanding cultural differences in the development of attention in young children.

S1.1.4 - The early multidimensional curiosity scale across cultures: new insights about the structure and focus of children's curiosity in South Korea, Turkey, and the United States

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Details

In a world full of information, what drives the focus of children's attention and curiosity? Understanding the structure and function of children's early curiosity is critical for identifying the mechanisms that support children's ability to learn about the world around them (Lee et al., 2023). To date, little is known about (1) the underlying structure of children's curiosity (i.e., whether it is multidimensional, and comprised of multiple distinct subtypes, similar to adult curiosity, Kashdan et al., 2018), and (2) how this might be similar and/or different across diverse cultural contexts. Culture is a powerful influence in shaping caregivers' socialization goals (Pearson & Rao, 2010), which may in turn, shape both the focus of children's curiosity and the way it is expressed (Yow et al., 2022). The goal of this study is to examine cultural similarities and differences in children's curiosity in South Korea, Turkey, and the United States.

Participants with children aged 3-6-years-old completed the Early Multidimensional Curiosity Scale ("EMCS"; $N=347$; $n_{US}=157$, $n_{Turkey}=100$, $n_{Korea}=90$). The EMCS uses parent report to assess a range of different types of curious behaviors in young children across a variety of settings (Lee et al., 2023). Items ask about children's interests in learning about other people (e.g. How much does your child enjoy interacting with new adults?), learning about the physical world (e.g. How likely is your child to explore many, versus a single, toy?), persisting through challenging tasks (e.g. How motivated is your child to keep trying when completing a difficult task?), and attitudes toward novelty (e.g. How often does your child ask questions/talk about new things?).

Exploratory Factor Analyses were conducted to identify the underlying factor structures of curiosity within each culture. Across three cultures, four subfactors sharing broader conceptual themes were found, with some item-level variations: Social Curiosity, Novelty-Seeking, Broad Exploration and Persistence. Two additional factors were found in Korea: Information-Seeking and Flexibility (Fig 1A). To examine cultural differences in the shared four subfactors, mean scores for each of the four factors were calculated using the overlapped items across all three cultures and a between subjects ANOVA was conducted (Fig 1B). The results revealed that Korean children had significantly higher Persistence scores ($M=3.31$, $SD=0.54$) than children from the US ($M=3.14$, $SD=0.50$, $p=.05$) and Turkey ($M=3.09$, $SD=0.60$, $p=.01$), but lower Social Curiosity ($M=3.35$, $SD=0.86$) and Novelty-Seeking scores ($M = 4.42$, $SD = 0.64$) than children from the US ($M_{SC} = 3.74$, $SD_{SC}=0.78$, $p=.001$; $M_{NS}=4.74$ $SD_{NS}=0.39$, $p<.001$) and Turkey ($M_{SC}=3.89$, $SD_{SC}=0.69$, $p<.001$; $M_{NS}=4.85$ $SD_{NS}=0.29$, $p<.001$). There was no significant difference in the Broad Exploration factor across three countries ($p>.05$).

Together, these results highlight new cross-cultural similarities and differences in children's curiosity in South Korea, Turkey, and the United States. Factors that were robust across cultural contexts include Social Curiosity, Broad Exploration, Novelty Seeking, and Persistence. Individual items were most consistent in the Social Curiosity dimension - highlighting that an interest in learning about other people is a robust component of young children's curiosity across cultures.

S1.1.5 - Examining the effects of distraction on attention and task performance in a Title 1 school

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Details

Attention is a complex construct with many facets (Colombo, 2001). The current research focuses on endogenous attention, top-down, voluntary attentional control, analogous to colloquial constructs like distractibility and attention span. Previous research has shown that distraction impedes performance and attention during the preschool (O'Toole & Kannass, 2021) and teen years (Pool et al., 2003), but little is known about how distraction as background television may affect attention in early elementary school aged children. This project investigated the effects of background television on task attention and task performance in kindergarteners and 2nd graders. Notably children from lower income families engage in more screen media use than children from higher income families (Common Sense Media, 2020). The participants were students at a Title 1 School, which means it serves students from a lower socioeconomic area (50.84 percent free and reduced lunch), contrasting with past research using middle and upper middle class samples.

Seventy-nine kindergarteners and 2nd graders worked on paper and pencil math and phonics tasks during two 4-minute trials (1 task per trial) in a classroom. Sessions were recorded via zoom. Participants were randomly assigned to either a distraction or no distraction condition. In the distraction condition ($N = 38$), a PBS kids television show played continuously on a laptop in front of the child. Coders recorded looking to the task for all participants and looking to the TV show for the distraction condition. Performance on the math and phonics worksheets were scored.

A preliminary Condition x Grade ANOVA on the total looking to the task revealed significant condition and age differences, with participants in the no distraction condition looking significantly longer at the task than participants in the distraction condition, $F(1, 76) = 60.81, p < .001, \eta_p^2 = .44$, and 2nd graders looking significantly longer than kindergarteners, $F(1, 76) = 9.62, p = .003, \eta_p^2 = .11$. The Condition x Grade ANOVA on the average length of individual looks revealed a significant interaction, $F(1, 76) = 4.31, p = .04, \eta_p^2 = .05$. In the no distraction condition 2nd graders ($M = 44.44, SE = 3.78$) had significantly longer average length of individual looks to the task than did kindergarteners ($M = 25.74, SE = 3.88$). In the distraction condition, 2nd graders' average length of individual looks ($M = 9.06, SE = 3.69$) did not differ from kindergarteners' ($M = 6.07, SE = 3.78$). Separate preliminary analyses on z-scores of the math and phonics performance showed that math performance was more susceptible to distraction than was phonics performance.

In sum, attention to the task decreased during distraction, and math performance was more susceptible to distraction. The current results have implications for environments that best support children's

attention and have implications for everyday activities in the classroom, such a Workshop approach to learning and rotating activities where adjacent children work on different learning activities. For example, a child working on an iPad activity may pose a distraction to the adjacent children working on writing or worksheets.

S1.2.1 - The living, the non-living, and the once-living: children's developing sense of natural phenomena across different cultures

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Summary

This symposium includes three studies focusing on children's understanding of natural phenomena, which undergoes major changes from early to middle childhood. The first speaker will present a study examining how children from Tana Toraja, Indonesia, evaluate bodily and cognitive functioning after death. The second speaker will present a study examining how children contemplate seemingly contradictory views regarding death and the beginning of life on earth. Lastly, the third speaker will describe a study investigating how children evaluate different types of explanations regarding inanimate natural phenomena. We will end the symposium with a discussion provided by an expert in this domain.

S1.2.2 - A gradual death: children's perceptions of the body, mind, and soul in Tana Toraja, Indonesia

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Details

Children's understanding of biological death develops during middle childhood. Around this developmental period, children begin to receive testimony about what happens after death, and the content of testimony varies across cultures. Research on children's understanding of biological death has found that children from many cultures understand death to involve the cessation of bodily functioning. Furthermore, as children get older, research shows that they adopt religious and cultural views of the afterlife from their communities. Many of these afterlife views include belief in continued psychological functioning. The culture of Tana Toraja, Indonesia, presents a unique context to examine the interaction of culture and cognitive development. In Torajan culture, children hear a discourse about death in which a recently deceased individual is referred to as "sick" and not dead until after the funeral has occurred and the body is placed in the tomb. For many Torajans, deceased relatives will remain in the house until the funeral for up to two years. In this talk, we will present the results of a study examining what Torajan children and adults think happens after death. Seventy-two children ages 7-12 (divided into two age groups: younger and older) and 31 adults in Tana Toraja were presented with three vignettes in which a character has died, with each vignette presenting a different context (in the hospital right after death, in the home before the funeral, and in the tomb after the funeral). After each vignette, participants were

asked about the functionality of the character's body, mind, and soul, after death. Overall, participant responses varied by narrative condition, question type, and age group and responses for narrative and question type depended on age group. Participants viewed overall functions continuing more in the hospital narrative than in the home or tomb narratives ($F(2, 190) = 3.20, p = 0.043$). Participants responded that after death the body is least functional and the soul is most functional ($F(2, 190) = 94.6, p < 0.001$). Overall, younger children (7-9-year-olds) responded that all functions stop at death more often than older children (10-12-year-olds) and adults ($F(2, 95) = 25.1, p < 0.001$). Adults responded more than older children that functions would continue after death. Younger children answered similarly across narratives that functions would cease. Older children attributed more functionality across all narratives ($F(4, 190) = 3.88, p = 0.005$). Adults attributed the most functionality to the hospital narrative. Regarding question type, younger children viewed the soul as more functional than mind or body, but at a lower level than older children and adults. On average, older children and adults viewed the body as non-functional, the mind slightly functional, and the soul as functional after death ($F(2, 190) = 15.29, p < 0.001$). Together, these results suggest that Torajan views of death differ across development and across context.

S1.2.3 - A matter of life and death: children's evaluations of scientific and religious approaches to death and to beginning of life

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Details

As they age, children increasingly recognize that death is inevitable and irreversible for all living things, and involves the cessation of all bodily functions (Menendez et al., 2020). However, while they acknowledge this biological stance towards death, children are also exposed to religious claims regarding the possibility of an afterlife, implying the continuation of certain processes after death (Harris & Giménez, 2005). In a similar vein, children encounter contradictory claims regarding the beginning of life on earth: They are taught that humans gradually evolved from other living things, but they also hear that God created all living things, including humans (Evans, 2001). Although seemingly contradictory, scientific and religious explanations can coexist in people's mind without an apparent tension. Indeed, children and adults can switch between the two stances effectively based on the context (Legare et al., 2012), but it is currently unknown if such coexistence thinking persists when children are explicitly confronted with conflicting explanations.

To address this question with respect to developmental trajectory and religious background, we asked 80 younger children (6- to 8-year-olds, $M = 7.31, SD = 0.81$), 71 older children (9- to 11-year-olds, $M = 10.25, SD = 0.99$), and 115 adults ($M = 39.42, SD = 4.72$) from the USA to evaluate conflicting scientific and religious claims about death and the beginning of life made by a pair of characters. For the death scenario, the character with a scientific stance argued that people cannot see or remember things after they die whereas the character with a religious stance argued that they can. For the beginning of life scenario, the character with a scientific stance argued that people and animals changed a lot since life

on earth began whereas the character with a religious stance argued that they did not change at all. Participants indicated whether they agree or disagree with each character.

The results revealed that secular participants were more likely than religious participants to endorse the scientific stance towards death, $b = 1.08$, $SE = 0.45$, $p < .05$ (Figure 1). Although age had no effect on the judgments of secular participants ($ps \geq .3$), older religious children and adults were less likely to endorse the scientific stance as compared to younger religious children, $b = -2.04$, $SE = 0.74$, $p < .001$, and, $b = -1.39$, $SE = 0.55$, $p < .001$, respectively. Religious Background influenced the stance taken towards the beginning of life as well (Figure 2); secular participants were more likely than religious participants to endorse the scientific stance, $b = 2.05$, $SE = 0.47$, $p < .001$. Lastly, adults were more likely to endorse the scientific stance as compared to younger children ($b = 1.37$, $SE = 0.51$, $p < .01$).

Overall, these findings show that when confronted with seemingly conflicting scientific and religious claims, children and adults mostly eschew coexistence thinking. Instead, they endorse one claim over the other rather than endorsing both, with their endorsement primarily guided by their background, be it secular or religious.

S1.2.4 - Children's sensitivity to scientific ways of explaining natural phenomena and the role of science identity

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Details

Children's theories of the world are informed by the explanations elicited from others. To gain an explanation, children often ask "why" (Hood & Bloom, 1979)—a form of question that is inherently ambiguous as to the kind of explanatory response it requests (Kelemen et al., 2005). Thus, even if a scientist might view a causal-mechanistic answer as the only acceptable kind of explanatory response to a "why" question about non-living natural phenomena (e.g. rocks), a non-scientist might repeatedly view another explanatory form (e.g. teleological) as appropriate for many reasons (e.g. religious factors) (e.g. Kelemen, 2012).

Do children who are exposed to adults using causal-mechanistic explanations rate the quality of those kinds of explanations as higher compared to children who are recurrently exposed to other unwarranted explanatory types (teleological or non-explanations)? Is there a predictive relationship between age and explanatory quality ratings, and are children's perceptions of explanation quality for any explanation type related to their sense that science is part of their own personal identity—an internalization that might promote greater valuing of a causal-mechanistic explanatory norm?

We assigned 5-to-8-year-old science museum visitors ($n = 145$, $M_{age} = 7.03$, 68 girls) to 3 conditions in which they repeatedly heard an adult provide variants of one kind of explanatory form (causal-mechanistic, teleological, or circular non-explanatory) about a series of non-living natural phenomena. Children completed several measures including rating the quality of the informant's explanatory

statements, their own feelings of belongingness in science (self-science identity) and sense that others perceived them to belong in science (other-science identity).

Children in all 3 conditions rated the explanatory type they heard higher than chance (all p 's < 0.05). Children in the causal-mechanistic and teleological conditions gave higher explanatory quality ratings than children in the non-explanatory condition but children in the causal-mechanistic and teleological conditions differed only marginally ($ps \leq 0.05$). Age negatively predicted children's ratings of explanatory quality in the non-explanation condition but also in the causal-mechanistic condition and was non-predictive in the teleological condition. Science-museum children's evaluations therefore showed only some degree of alignment with scientific norms, and there was no age-based improvement in their ability to recognize that teleological explanations are scientifically unwarranted explanations for non-living natural phenomena. Finally, children's mean explanatory quality ratings were positively predicted by other-and/or self-science identity. However, this was true in every condition thus science identity did not facilitate rejection of scientifically unwarranted explanations or enhance recognition of scientifically normative ones.

Even in a science-museum sample, young children show only fragile sensitivity to the quality of different kinds of warranted and unwarranted explanations for non-living natural phenomena. Age increases discernment of certain kinds of scientifically unwarranted explanations (nonexplanations) but not teleological explanations, whose attraction stays constant across 5-to-8-year-olds. Finally, enhancing science identity does not appear to be a pathway to increasing children's abilities to discern scientifically normative vs. unwarranted explanations.

S1.3.1 - An understudied outgroup: children's cognitive and behavioral attitudes towards disabled Peers

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Summary

This symposium summarizes recent work on the cognitive and behavioral attitudes of non-disabled children towards disabled peers, who represent one of the world's largest and yet most understudied minority groups. The first presentation compares U.S. children's attitudes about disability to their attitudes about national and ethnic differences. The second presentation investigates adult testimony as one source of U.S. non-autistic children's negative attitudes towards autistic peers. The third and fourth presentations report on children's beliefs about how disabled people ought to be treated in U.S. and German contexts, respectively. Together, these presentations provide insights into how children reason about disabled peers and provide implications for improving children's disability-related attitudes.

S1.3.2 - The development of nationality and disability concepts: a comparative approach

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Details

Children and adults readily draw generalizations about people based on limited exposure. Such normative psychological processes support quick and efficient predictions about how others will behave and form the basis of behavioral modifications that characterize social interactions. For example, young children draw inferences regarding people's food, dwelling, and dress based on salient perceptual information such as a foreign accent and modify their speech in relation to these inferences. Such generalizing tendencies are sometimes described as "spreading," in which perception of a single physical or behavioral characteristic (e.g., an utterance indicative of speech disorder) triggers attributions of broader deficits (e.g., reduced intelligence or physical prowess). In turn, these inferences may act as important contributors to the expression of prejudice since perceivers may come to relate to individuals with a disability as *fundamentally* disabled.

Despite the relevance of spreading to the expression of disability prejudice, only a handful of studies have explored how such generalizations emerge in childhood. The present work is the first to: 1) systematically compare children's generalizations based on foreignness and disability cues, and 2) assess how these generalizing tendencies relate to the expression of stigma and peer rejection.

In a first study, we compared North American children's (N = 163, Mage = 5;9, SD = 1.6, range = 3:9) assessments of three speech categories (neurotypical North American-accented English, neurotypical Spanish-accented English, and North American-accented English produced by children with autism spectrum disorder) and four illustration categories (children who are: able-bodied typical North American appearance, able-bodied foreign appearance, typical North American wheelchair-bound appearance, and typical North-American amputee appearance) along several key dimensions (national origin, dependence, competence, interest in friendship and intelligibility for speech). Encouragingly, children's responses displayed developmental change in ability to distinguish cues to disability versus foreignness but limited evidence of expression of prejudice, and no measurable developmental change in that regard.

In Study 2, we assessed North American children's (N = 143, Mage = 5;4, SD = 1.8, range = 3:11) associations between speech variability and visual appearance: children listened to one of the three speech conditions while looking at two illustrations side-by-side (one of a typical American child, the other depicting a foreign child or a child with a disability) and were asked to select the child who was talking. Children displayed age-related improvement in selectively associating foreign-accented speech with foreign appearance. We observed a trending developmental tendency among children with enhanced metacognitive abilities to selectively associate speech produced by children with ASD with physical disability (but not foreign appearance).

This work advances understanding of children's developing perception of, and attitudes toward, individuals with disabilities and is informative of children's folk sociology more generally. The findings also highlight complex ways in which conceptual representations of the social world relate to the expression of prejudice, even in childhood.

S1.3.3 - The effects of language on non-autistic children's attitudes and dehumanization towards autistic peers

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Details

Autistic adults and children are commonly described in dehumanizing ways. They are said to be incapable of knowing their own or others' minds, to lack the capacity for close social relationships, or to lack agency. Unfortunately, by middle childhood, non-autistic children already express prejudiced attitudes towards autistic peers. Some of these negative attitudes may reflect non-autistic children's reactions to autistic children's unusual behaviors. But they may also be influenced by the way they hear autism and autistic people described.

In two studies, we investigated how adult testimony influences non-autistic children's attitudes about autistic peers. Eight- to 10-year-olds in the U.S. (total $N = 225$) heard about two autistic peers. One peer was introduced in a way to suggest that they lacked fundamentally and uniquely human characteristics (e.g., "There's something missing in Dakota's brain that makes it hard for him to look at other people and talk to them"). This "status quo" description was adapted from popular children's books that include an autistic character. The other peer was introduced in a way to suggest that their differences were just that-differences (e.g., "Harper's brain is different from other kids', which makes him think and act differently from other kids too"). We refer to this as our "difference" description.

Strikingly, participants rated children introduced with the status quo description as less human than children introduced with the differences description (Figure 1, panels A and B). As Figure 1C shows, participants also expressed less support for educational inclusion for "status quo" children than "differences" children. Finally, as Figure 1D shows, when they thought that a minor transgression had been intentional, they recommended harsher punishment for status quo than differences children. Clearly, deficit-focus language that is commonly used in children's books to describe autistic characters leads to more negative attitudes than language that highlights autistic children's differences as value-neutral.

Two ongoing studies (which will be completed by January 2024) will further contextualize this work. The first ongoing study involves a content analysis of 64 of the most popular books for middle childhood published since 2000 that feature an autistic character. These books are being coded for dehumanizing stereotypes (e.g., whether the autistic character was portrayed as having empathy, agency, and/or close social relationships) in order to quantify how common dehumanizing themes and language are in children's literature that includes autistic characters. The second ongoing study is a conceptual replication of the completed studies but compares actual passages from an award-winning children's book (status quo) to adaptations to those passages that are more humanizing.

Together, these studies show that the ways adults describe an autistic child to non-autistic children can have important consequences for children's attitudes toward autistic peers. Disturbingly, many of the existing sources of information available to children (in the form of children's literature) evoke dehumanizing stereotypes about autistic children, which contribute to children's perceptions of autistic peers as less than fully human. Our work shows that a difference rather than deficit framing can mitigate children's dehumanization and instead promote humanizing and inclusive attitudes towards autistic children.

S1.3.4 - Children's reasoning about the fairness of school accommodations for children with disabilities

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Details

Approximately 1 in 6 children in the United States has been diagnosed with a developmental disability, and most attend school with typically-developing classmates (Koller et al., 2018; Rose & Gage, 2016). In inclusive classroom settings, students with disabilities may need and may receive a number of accommodations (e.g., completing less or different classwork, leaving the classroom at unexpected times, use of special technology). Many K-12 teachers feel ill-prepared or underqualified to teach or even address disability-related topics in their classrooms (Ware, 2001), so these accommodations often go unaddressed or unexplained to observing, typically-developing students, even though these children may be noticing and curious about them (Lalvani, 2015). Sensitivity to fairness among young children emerges early (Geraci & Surian, 2011), with children increasingly emphasizing equity (as opposed to equality) in late childhood, around 8 years of age (Smith & Werneken, 2016). In a pre-registered study (https://aspredicted.org/Y3P_QF9), we explored how 5-, 7-, and 9-years-olds reasoned about school accommodations provided to children with disabilities. Participants ($N = 122$) were randomly assigned to hear stories about children whose "brains work different than most kids' brains" (cognitive disability) or to hear stories about children whose "legs work different than most kids' legs" (physical disability). In each scenario, participants were told about a different child making use of an accommodation in the classroom. Half of these accommodations pertained to a learning disability (e.g., doing less classwork, using a computer to read); the other half pertained to a physical disability (e.g., playing soccer with their hands). Participants were asked to reason about "why" the child was using the accommodation, and rated the extent to which the accommodation was fair. Responses to the "Why?" questions were coded for use of common categories of reasoning (e.g., mentioning the child's disability, attributing negative traits/motives to the child). Results revealed age-related trends in children's fairness ratings of accommodations; the oldest children (9 years) judged accommodations to be significantly more fair than children in the two youngest age groups (5 and 7 years). There were also significant developmental trends in children's reasoning, with the oldest children using disability-related reasoning to account for accommodations significantly more than younger children for physical accommodations (but not cognitive accommodations). "Disability-related reasoning" included references to limitations using specific language (e.g., "Because his legs") or by generally alluding to a pertinent limitation (e.g., "Mind

gets tired”). Disability-related reasoning was most common when explaining why people with *physical* disabilities were making use of *physical* accommodations; children seemed to account for the role of disability in accommodations more often for characters with a physical disability than cognitive when those characters received disability-specific accommodations. As well, negative correlations exist for the frequency participants use disability-related reasoning to account for *physical accommodations* for characters with a *physical or cognitive disability*, and their associated fairness judgments: the more disability-related reasoning was used, the more *fair* participants judged accommodations to be.

S1.3.5 - Preschool children’s resource allocation towards and reasoning about exclusion of agents with disabilities

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Details

Disability is a human condition that involves both the person who has the disability and the environment that perceives the disability as such (Schneidert et al. 2003). Societies that subscribe to principles of inclusivity and individual rights rely on individual understandings of what is fair in the context of disability. Resource distribution and social inclusion are fundamental topics of fairness that have been addressed by developmental theories (Hoffman, 2001; Piaget, 1932/2015; Turiel, 1983) and experimental studies (Essler et al., 2020; Paulus, 2014; Rizzo & Killen, 2016). The current study contributes new evidence on children’s fairness behavior and perception of disability by examining resource allocation and social inclusion decisions.

We assessed 4-7-year-old children’s (N=82) fairness behavior and reasoning by three measurements. First, participants allocated two types of resources to mixed pairs of agents with a physical, a behavioral or no disability. We investigated whether they distributed resources unequally compensating for the respective disability and how they justified their decisions. Second, we examined how participants decided on whether agents with disabilities should participate in group activities that afford additional help for them. Then, they were asked to evaluate the teacher’s decision to exclude agents with disabilities and to justify their evaluation. Third, we presented WHO’s disability concept in simple language and explored whether participants attributed this to agents (World Health Organization, 2008).

Results showed that participants’ allocation behavior advantaged agents with disabilities over agents without disabilities, particularly if the resource compensated limitations. With increasing age, they justified their allocations increasingly with referencing to inequalities between agents. Participants rejected the exclusion of a protagonist with any disability even when an authority emphasizes additional effort and supports exclusion. In addition, they justified their evaluations mainly with moral arguments referring to concepts of equality. All results have to be seen against the background that participants attributed the presented disability concept specifically to the agents with disability, demonstrating that they are aware of the differences between the agents.

Our results suggest that preschool-aged children differentiated for whom a resource was necessary or luxury, depending on individual’s differences in functioning. They appreciate disability as a reason for

equity distribution beyond equalizing numerical inequality. Our findings show that children of this age evaluate inclusion to be right, exclusion to be wrong, even against pragmatic reasons and suggestions of an authority. This indicates that children uphold inclusion as a moral principle (Turiel, 1983; Smetana, 2006). Overall, our study provides evidence that preschool-aged children advocate for justice for persons with disabilities on two different layers. They distribute resources equitably in order to compensate functional limitations but also demand equal treatment in terms of group membership. This emerging sense of justice among humans with different ability status needs to be valued and further enriched by educational environment as a key competence in societal development. Our findings pave the way for programs fostering inclusivity from early on by demonstrating that preschoolers can appreciate forms of inclusive action.

S2.1.1 - Diverse pathways to number knowledge

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Summary

Many of our theories of how number words are acquired are grounded in evidence from English-speaking learners of a base-10 counting system, which is just one of many historically attested solutions to symbolically representing number. But relatively little is known about how diversity of languages, cultures, and counting practices impacts number word learning. In this symposium, we present research on children who lack a counting system (Talk 1), studies that teach pre-counters novel number words (Talk 2) and counting rules (Talk 3), and studies of the impact of rules on numerical thinking (Talk 4). These talks present new insights into the effects of linguistic and cultural diversity on early development of number knowledge, and shed light on diverse pathways to numeracy.

S2.1.2 - Number word learning in a language without a natural number system or counting routine

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Details

Children begin to acquire meanings of number words through language and cultural experience before formal schooling. The developmental trajectory of symbolic numeracy is thought to be similar across groups whose languages and culture vary substantially, although there are substantial differences in the rate with which individuals in different contexts move through the characteristic stages (e.g., Marusic et al., 2016; Piantadosi et al., 2014, Sarnecka et al., 2023). However, research to date has mostly studied the development of symbolic number learning in groups whose numerical input reflects a system of natural numbers and a counting routine for exact enumeration. We studied numerical development in monolingual Mundurukú children (N=44, 4-10 years), members of an isolated Amazonian indigenous

group whose language has a restricted numerical lexicon and lacks a commonly practiced counting routine (see Crofts, 1973; Pica et al., 2004). We ask how number word knowledge develops in this context, including analysis of which aspects of their numerical development match the established trajectory in the literature and which aspects may be unique. Preliminary results from a Give-N task in Mundurukú suggest several commonalities between number word learning in Mundurukú children and those growing up in environments with natural number system and counting. Specifically, Mundurukú children learn exact meanings for smaller Mundurukú number words (i.e., for one, two, three, four) and they also appear to learn these small number words in order. However, less systematicity was seen for learning words for larger numbers. Plural number words in Mundurukú, including larger number words, are constructed from the combination of two smaller number words (e.g., pûg pûgbi xep xep bodi = “one hand (5) and two (2) on the side” to refer to a collection of 7 items). In contrast to smaller number word constructions, larger number constructions are only really mastered by experts with substantial exposure to the Portuguese number words and Portuguese counting and, as such, can be considered less familiar to monolingual children. When children were presented with these less familiar constructions, they did not associate them with large exact (or even approximate) cardinal values. Instead, many children systematically gave only the part of the construction they had already mastered (e.g., gave 2 items when asked for 5 & 2 items). Also somewhat different, children learning in other contexts with natural number systems and counting also encounter unfamiliar number words (e.g., twenty-two) and, to our knowledge, are likely to attribute exclusivity to the smaller part of the construction they know (i.e., two) and infer that the less familiar construction means a quantity different and larger than the words they already know (i.e., their knower-level). Together our results suggest learning exact meanings for particular small(er) number words is not dependent on having a culturally-available count list or natural number system and neither is their order of acquisition. However, they also suggest that the count list might aid children in granting additional properties (e.g., exclusivity) to number words, thereby further facilitating learning.

S2.1.3 - Pre-number-knowers fast-map verbal labels onto sets of objects

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Details

Infants can represent the exact quantities of small sets of individual objects without counting (Feigenson, Dehaene, & Spelke, 2004). However, it takes years for children to learn the meanings of the words “one”, “two”, and “three” (Wynn, 1990; 1992). The protracted acquisition of the meanings of number words contrasts with the early emerging ability to rapidly learn the verbal labels for sortal objects (e.g., “cup”) after minimal exposure to exemplars, a phenomenon called “fast mapping”. Identifying the referent of a word like “two” requires a) mapping a label to the *quantity of items in a set* rather than an individual object in the set, and b) linking the label to an abstract conception of cardinality independent of the identities of any objects that are being counted. While previous work has examined b), less is known about the early development of a) in pre-counters. In three experiments, we examined young children’s ability to fast-map representations of quantities of sets of objects to verbal labels. In Experiment 1, we showed 2-3-year-old children (N=16) sets containing two or three identical

blocks, gave the sets unique verbal labels (“blicker” = two objects, “daxer” = three objects), and demonstrated that the sets could be used to activate two different machines. On Test trials, the experimenter told children that one of the sets was hidden in a box, using only the set’s verbal label (e.g. “The blicker is in the box!”). Children were then permitted to reach inside of the box and retrieve either all of the objects in the set (None Remaining trials) or only a subset of the objects in the set (More Remaining trials). To examine whether children successfully mapped the verbal label onto the correct number of objects, we measured children’s continued searching in the box following the removal of the objects in each type of trial. We also asked whether children generalized the labels to other sets of two and three objects, and measured their extant number knowledge using the What’s On This Card task (LeCorre & Carey, 2007). We found that children searched longer in the box on More Remaining compared to None Remaining trials, and that children’s ability to do so did not depend on the extant number word knowledge (even pre-knowers succeeded). However, children did not show evidence of generalizing the labels to sets of two and three new objects. In Experiment 2 (n=16 2-3-year-olds), we found that pre-knowers could map the number words “two” and “three” onto the sets of objects, but again failed to generalize those labels. Finally, in Experiment 3 (n=16 2-3-year-olds), we confirmed that pre-knowers’ success in Experiment 2 was not due to extant number knowledge - children also successfully mapped the word “three” onto sets of two and “two” onto sets of three. Together, these results suggest an initial mechanism by which object tracking may be linked to language learning in pre-counters, which may support the later conceptual link between cardinal number concepts and verbal labels.

S2.1.4 - Studying numerical innovations with artificial languages

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Details

While most number cognition research investigates existing number systems, most of the diversity in number systems is extinct and cannot be studied naturalistically. To understand the emergence of number words and concepts however, it is nonetheless critical to study the diverse ways in which novel cognitive tools for quantification become integrated with familiar symbolic systems, like drawings or language (e.g., Cooperrider & Gentner, 2019). For example, number systems often begin as specialized counting procedures (e.g., “one, two, three...”), the words of which are only gradually integrated into the syntax of natural language (e.g., “[some / two] rabbits”) (Saxe, 1990; Hurford, 1987). In a recent line of work, we have used artificial number systems to ask how humans innovate and interpret novel representations of number. We find that in all cases, participants use strategies that do not make full use of their numerical abilities. Instead, they seem to create representations that resemble those of historically emerging numeracy. In one study, we asked what graphical strategies adult participants would use to create novel written numerals in a communication game. They frequently used 1-to-1 forms typical of early historical numerals (Schmandt-Besserat, 1996) and innovated similar abstract features, such as the fungibility of 1-to-1 tokens (Damerow, 1996). In another study, we asked how learners of verbal number systems would learn different numerical bases, which are known to vary among the world’s languages (Hammarström, 2010) but are now almost completely extinct, survived by base-10 (Comrie, 2013). Because bases differ in the rules of composition that they expose learners to in the range of small numbers, it is also possible that the ubiquity of base-10 also explains children’s slow acquisition of numerical composition relative to compositional rules in the rest of language (Guerrero &

Park, 2023). Participants learned some compositional rules more effectively than others, and succeeded at very different aspects of number word learning when those words were learned via a counting procedure versus in a statistically similar but not meaningfully structured sequence. In a third study, children interpreted compositions of English number words that featured varying amounts of familiar structure from English syntax. The addition of two number words together was expressed either by the word “and” (e.g., “2 and 2”) or nothing (e.g., “2 2”), and multiplication by either a familiar noun (e.g. “two lunches of [two] bananas”) or number word (e.g. “two twos of [two] bananas”). In both cases, additional structure from English grammar helped children to resolve requests meaningfully. Together, these studies showcase several ways in which the lost diversity of human number systems may be studied empirically, in order to explore not only the world of existing number systems, but the broader past and possibilities of human number cognition.

S2.1.5 - How numerals influence numerical thinking

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Details

The acquisition of number concepts has proven to be an interesting test case for investigating the role of language in conceptual development. Many scholars argue that language learning plays a causal role in the development of number concepts (e.g., Barner & Carey, 2019; Guerrero & Park, 2023; Spelke, 2017), but the exact properties of language that drive number concepts are largely unknown. Furthermore, many studies aimed at addressing this relationship fail to address how formal and informal mathematical education (e.g., the base-10 system, the Arabic notation system) influences this relationship. The focus of this talk will be on how the structures of both verbal (e.g., “sixty-two”) and Arabic numerals (e.g., “62”) influence numerical thinking. On the premise that children acquire an abstract and precise understanding of number through the pedagogical transmission of numeration systems (Guerrero & Park, 2023), we aimed to characterize children’s familiarity and mastery of various structural properties of verbal and Arabic numerals. To do so, we asked over three hundred English-speaking 4- to 8-year-olds to generate, open-endedly, a number larger than the probe number given. Children received probes in verbal or Arabic formats. When the probe was verbal, they said a number; when the probe was Arabic, they wrote a number. Overall, children’s responses were strongly influenced by the formal syntactic structure of the numerals. Children also appeared to produce complex responses in the verbal numeral trials earlier than in the Arabic numeral trials. This pattern of responses suggests that the formal structure of numerals, both verbal and Arabic, influences how children represent and acquire number concepts.

S2.2.1 - Investigating children's understanding of counterfactuals and alternative possibilities

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Summary

We examine children's emerging abilities to consider counterfactual and alternative possibilities. Paper 1 provides evidence that 4-8-year-olds are more successful in reasoning about counterfactuals when thinking about deterministic than probabilistic systems. The findings help explain why previous work reached conflicting conclusions about when counterfactual reasoning first emerges. Paper 2 shows that with age, children distinguish between two kinds of counterfactual closeness, one linked with physical proximity, the other with ability. Paper 3 shows that 3-year-olds represent alternative possibilities, contrary to suggestions that this ability does not emerge until age 4. Finally, paper 4 finds that from age 6, children across cultures consider counterfactuals when socially evaluating others and judging whether they should be punished or rewarded.

S2.2.2 - Which counterfactuals are difficult?

Angela Nyhout¹, **Patricia Ganea**²

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Details

Children are often attributed with counterfactual reasoning when they can answer counterfactual questions about causally overdetermined outcomes - outcomes that would remain unchanged even if one of the causes were removed. The developmental timeline of counterfactual reasoning is highly debated: the available data suggest that children can first think counterfactually as early as age 4 (Nyhout & Ganea, 2019) to as late as adolescence (Rafetseder et al., 2013). Children generally succeed earlier on tasks that involve reasoning about physical causal systems versus reasoning about agents in short stories. In the current set of studies, we explore several explanations for this apparent decalage, asking what makes some counterfactuals more difficult than others for children.

First, to make sense of stories, listeners must make inferences, and perhaps this tendency to draw inferences leads children to make unwarranted connections in response to story stimuli, as compared to the non-story stimuli used in physical tasks. In Study 1 (n=102, 5-6 years), we did not find support for this explanation. Specifically, children who answered counterfactual questions about overdetermined events in stories performed better (72% accuracy) than children who answered counterfactual questions about the same events happening live in front of them (47%).

Second, children might have difficulty particularly with *psychological* causation that tends to characterize stories featuring agents. In Study 2 (n=154, 5-8 years), we used tightly controlled narratives involving overdetermined events leading to a change to a character's knowledge state. Comparing these results to previous ones (Nyhout et al., 2019; Rafetseder et al., 2013), we found a slight improvement in performance on our task suggesting that the psychological causation is not the main source of difficulty.

Third, cross-study differences in performance might stem from differences in how children represent the causal relations they think counterfactually about. Humans tend to assume agentic causes are more probabilistic, whereas physical causes are more deterministic (Strickland et al., 2017). In cases where the relation between cause and effect is reliable or *deterministic* (e.g., a button that always works to switch on a machine), one can be more certain about what would happen under different (counterfactual) circumstances compared to where the causal relation is *probabilistic* (e.g., a button that sometimes works). We predicted that, all else being equal, children would be better able to reason counterfactually about deterministic than probabilistic causes.

In Study 3 (n=62; 4-5 years), we found support for this hypothesis. Children in a deterministic condition, who saw that causal blocks *always* made a machine work were more likely to answer counterfactual questions correctly than those in a probabilistic condition, who saw that causal blocks *sometimes* worked (75% of the time). However, children in both conditions performed significantly better than chance. These findings indicate that the reliability of causal relations predicts children's counterfactual inferences. In ongoing studies, we are varying the probabilistic nature of causal relations with both psychological and physical causation.

Taken together, our findings suggest that children's difficulty in previous studies may have been driven by the causal relations being *probabilistic* and therefore less predictable under counterfactual conditions.

S2.2.3 - Children use proximity and ability to infer counterfactual closeness

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Details

Counterfactual outcomes (i.e., events that did not happen) vary in their closeness to reality. Sometimes, when we think of how things could have turned out differently, the alternative outcome was not even close to happening. Other times we think about close counterfactuals - alternative outcomes that were indeed close to happening, like missing your train by one minute.

What makes some counterfactuals seem close? One account holds that counterfactual closeness depends on propensity (i.e., the sense of events building towards an outcome; Kahneman & Varey, 1990). Young children use propensity to infer counterfactual closeness starting at age 5 (Beck & Guthrie, 2011). However, adults also infer closeness based on *proximity* and *ability*, and they differentiate between these as two forms of closeness (Doan et al., 2023a, 2023b). Specifically, adults use proximity to infer what almost happened and use ability to infer what *easily could have* happened.

In two experiments, we investigated how young children (N=310) recognize these two kinds of counterfactual closeness. In Experiment 1, children saw vignettes about races, where one racer initially takes the lead and moves faster than the other two. However, this racer trips on a rock and finishes last. As a result, the second fastest racer wins the race, with the slowest racer close behind. Children judged who almost or easily could have won. In examining the results, we first compared choices of the racer in

second place with choices of the other racers. Children were more likely to choose the racer in second place in Almost judgments than in Easily judgments ($p < .001$), with no effects of age. We then compared choices of the racer who tripped with choices of other racers. This time, children were more likely to choose the racer who tripped compared to other racers ($p = .001$); however, this effect did depend on age ($p = .002$) and examining the 95% confidence intervals suggested that choices of the tripper for Easily judgments exceeded chance rates at age 7;2.

One concern with these findings is that young children might not have understood the phrase “easily could have.” Hence, in Experiment 2 we used the same design but instead asked children which racer should have won the race. Children were more likely to choose the racer in second place in Almost judgments than Should judgments ($p < .001$). Choices of the racer who tripped were compared with choices of other racers, resulting in a significant interaction ($p = .002$). Although children were overall more likely to choose the tripper in Should than Almost judgments, this difference increased with age: Almost judgments did not significantly vary with age, but older children were more likely than younger ones to choose the tripper in Should judgments ($p < .001$). Examining the 95% confidence intervals suggested that choices of the tripper in Should judgments exceeded chance rates at 5;8.

These findings show that with age, children use proximity and ability to recognize distinct kinds of counterfactual closeness and infer counterfactual closeness from factors besides propensity. Additionally, children appeared to understand counterfactual closeness at younger ages than previously demonstrated.

S2.2.4 - Young children's ability to represent alternative possibilities

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Details

One of the central capacities of human cognition is the ability to reason about alternative possibilities. Considering alternative possibilities is essential to decision making (“would it be more convenient to walk or to drive to work?”) as well as counterfactual thinking (“would I have arrived on time had I decided to drive?”). The ability to generate multiple hypotheses, or possibilities, is also thought to underlie the process of early learning, and used to explain how children acquire and revise theories about the world (Gopnik et al. 2001, 2004; Gopnik & Wellman, 2012; Meltzoff, Waismeyer, & Gopnik, 2012; Xu & Kushnir, 2013). Computational work suggests this ability is best captured by holding multiple probabilistic beliefs in mind (Gopnik & Bonawitz, 2015).

Despite this, previous studies have found that, before the age of four, children consistently fail on tasks that require that they explicitly reason about alternative possibilities. In response to this evidence, Leahy and Carey (2019) have argued that this ability is relatively late-emerging and dependent on the acquisition of modal logic. Specifically, they claim that young children are initially unable to distinguish what is necessary from what is merely possible, and when faced with multiple possibilities, will simulate a single outcome and treat that simulation as knowledge.

Here we investigate the possibility that previous empirical work may have masked children's true competence, and that even 3-year-olds can and do represent alternative possibilities. We assessed 24 three-year-olds and 24 four-year-olds' modal reasoning using a novel search design. Children were asked to search for a target item after it was dropped from either a transparent or opaque set of y-shaped tubes into one of two opaque boxes attached to the bottom openings of each tube. The fully transparent tubes allowed children visual access to the final location of the object, while the opaque set allowed for two possible locations. We hypothesized that if children indeed have only a minimal representation of possibility, their search behavior should not differ between the opaque and transparent trials. However, if children are instead sensitive to the presence of multiple possibilities, they should spend relatively less time searching the first search location in the opaque compared to the transparent condition.

In line with our hypothesis, both 3- and 4-year-olds spent significantly less time searching the first location they approached when the object was dropped into the opaque set of tubes compared to the amount of time spent in the first location when it was dropped into the transparent tubes. This provides evidence against the claim that children under 4 have only a minimal representation of possibility. Instead, our findings suggest that even 3-year-old children can distinguish what is merely possible from what is necessary, well before they have acquired a full modal logic.

S2.2.5 - Counterfactual thinking and social judgements in children across three cultures

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¹ Boston College

Details

People make choices every day, such as what to cook for dinner and whether we should go to the gym. By assessing such choices, we can make inferences about the person making them. For example, someone who misses an important meeting at work may be judged less harshly if their bus broke down, as compared to if they had simply snoozed their alarm. In the former case they had no choice over the outcome, whereas in the latter they clearly did. Reflecting on past choices relies on an ability to think counterfactually about what could have happened, and what alternatives could have been chosen. Interestingly, young children show a protracted ability for counterfactual thinking and may not think counterfactually about the past until around the age of 6. Recent work has found that being able to reflect counterfactually on choice has a direct impact on how children evaluate the behavior of others (Gautam et al., 2023). Specifically, it is only from the age of 6 that children will consider what someone could have chosen to do when evaluating how nice or mean they're being.

Evaluations of others are an important part of children's developing social cognition, yet they may not translate to an actual desire to *intervene* on the behavior of others. In the present study we explore whether children's emerging ability to reflect on choices influences who they decide to reward or punish. In addition, we examine whether children's evaluation of behavior relates to how they decide to actually intervene. We address these questions across three diverse cultures, the US (N = 117, 5- to 8- year- olds), China (N = 133, 6- to 10- year- olds) and India (5- to 8- year- olds, data incoming November 2023). We ask children to make evaluations and intervention decisions about characters in a story who 1) cause a good

or bad outcome, and who 2) either had a choice to do so or had no choice but to do so. For evaluations, children rate characters on how nice or mean they're being, and for intervention decisions children can either reward characters by giving them stickers or punish them by taking stickers away.

Across the US and China we find that, in line with past work, children from around age 6 are considering what characters could have chosen to do when evaluating how nice or mean they're being. Importantly, across both countries, choice also matters for whether children are deciding to reward or punish characters. Further, in the US where we also included 5-year-olds, we find a preliminary age effect such that children appear to make character *evaluations* based on choice from the age of 5, yet do not consider choice in their reward and punishment judgements until the age of 7.

Overall, this work shows that the ability to think counterfactually about choice has a direct impact on how children evaluate, and intervene on, the behavior of others.

S2.3.1 - Reasoning about social distance and affiliation across human development

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Summary

Children face the challenge of navigating a highly social world, determining the strength and nature of others' relationships. How does our understanding of social relationships develop?

Paper 1 finds that young children spontaneously infer what others know based on their relationships. Paper 2 demonstrates how children use race to infer who to affiliate with and who they expect others to affiliate with. Paper 3 investigates whether children use the accuracy of others' mental state attributions to infer social distance. Paper 4 provides evidence that infants and children represent relationships in terms of how much people value others' welfare.

Together, these papers shed light on the inferences children draw about social relationships, providing critical insights into how children map out the social world, find their place in it, and form new relationships themselves.

S2.3.2 - Children use social relationships to reason about the flow of information between people

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Details

Humans have an intuitive sense of what others know and how they learned it. For example, you might be surprised that a stranger's parent, but not your own, knows what your favorite food is. These

expectations are often latent, and appear to depend on our representation of the social world: who communicates what with whom. However, when these expectations are violated - such as a stranger mentioning something about you in passing - it can elicit surprise and even curiosity, inviting us to “connect the dots” and infer how a source acquired their unexpected knowledge. Although adults appear to form such expectations “on the fly” (Rubio-Fernandez et al, 2019), it is unclear how these expectations are formed or develop. Therefore, the current studies ask how young children - four and five year-olds - form expectations about what others know and detect them spontaneously in conversation.

To get a sense of whether children form expectations about others’ knowledge and how they might respond to violations of them (Exp 1), we asked a sample of parents (n=127), if they had ever observed their child express surprise that someone knew something about them. Parents reported “Yes” for a majority of their children (72%), beginning at 3.78 years on average. Further, most parents (98%) who reported that their children engaged in these behaviors were able to recall and describe a particular instance. Overall, children tended to be most surprised about unexpected knowledge acquired second-hand (75%) and a plurality expressed their surprise verbally (29%).

In Experiment 2, we utilized a naturalistic dialogue task to elicit children’s (n=49) surprise experimentally. Before the experiment, parents were asked to (secretly) report their child’s favorite food and movie. During the study session, the experimenter engaged in a casual conversation with the child where they mentioned these pieces of information. Crucially, the source was either described as an expected source (their parent, “your mom”) or an unexpected source (the experimenter’s parent, “my mom”). We measured both children’s facial expressions when the source was mentioned, and explicitly asked them if they were surprised that each source possessed knowledge about them. Children were more likely to change their facial expression, $p = .002$, and report being surprised, $p < .001$, when the experimenter’s parent knew personal information compared to their own parent.

Experiment 2 demonstrated that children appear to attribute knowledge about them to their parents, but not to a stranger’s parents. However, it is unclear if children simply privilege their parents’ knowledge over others. Experiment 3 was identical to Experiment 2, except the experimenter provided children (n=48) with information about the experimenter’s sibling, yielding an opposite pattern of results. Children were more likely to change their facial expression, $p = .01$, and report being surprised, $p = .003$, when their parent knew personal information about the experimenter’s sibling compared to the experimenter’s parent. Together, these results suggest preschool-aged children readily use social relationships to form expectations about what others know and can detect violations of their epistemic expectations in casual conversation.

S2.3.3 - Racial majority and minoritized children use race to guide their own social preferences and infer others' social relations

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Details

An early emerging sign of intergroup bias is young children's preference for people from the same racial background as themselves (i.e, racial ingroup) (Waxman, 2021). Around this age of 4 to 6 years, children also use race to infer who would affiliate with whom (Shutts et al., 2013; Roberts et al., 2017). However, past research has been limited to Black-White dichotomy when the U.S. is constituted of many racial and ethnic groups. Thus, the current study examines whether children show racial ingroup preferences and race-based affiliation inferences beyond the Black-White dichotomy and how racial diversity in children's social environment (from social network to neighborhood) influence these preferences and inferences.

Seventy-one 5- to 6-year-old 35 White and 36 racially minoritized children (Black=2, Asian=15, Latine=3, multiracial=16) participated in the study. Children completed the (1) preference and (2) inference tasks (order counterbalanced). For the preference task, children were shown four pictures of children and adults (Black, Asian, Latine, and White; order randomized) and asked, "Who do you want to be friends with?" For the inference task, children were shown four pictures of children/adults identical to the preference task but with one picture of a target child or adult at the top. Children were asked who they thought the target will be friends with amongst the four (e.g., "This is Oliver. He is going to the movies with a friend. Which of these kids is his friend?"). Caregivers provided home zip codes and demographic information about the people in their child's social network.

In the preference task, children were above chance (25%) in preferring racial ingroups as friends ($M=41.6\%$), $t(70)=6.402$, $p<.001$: White children ($M=35.2\%$) were the most likely to be chosen, Asian children ($M=29.1\%$) second, Latine children ($M=20.9\%$) third, and Black children the least ($M=14.9\%$). In the inference task, children chose above chance (25%) people from the same racial group to be friends ($M=35.2\%$), $t(70)=5.658$, $p<.001$. There were no differences in children choosing the same-race person as the target's friend according to the target's race except when the target was Latine: Children were less likely to choose the same-race person for the Latine target compared to other races ($ps>.051$). Further, children were above chance (25%) at selecting the same-race person as the target's friend for Black ($M=40.5\%$), Asian ($M=37.7\%$), and White targets ($M=36.6\%$) ($ps<.001$) but not for Latine targets, ($M=26.1\%$; $p= .694$). This pattern suggests children were not as likely to use race to infer relationships among Latine people or that children may have more difficulty using race as a marker for Latine individuals. Children who chose more White people as their friends also were more likely to infer White people will affiliate with each other ($r=.25$, $p=.039$), this type of correlation was not found for other races ($rs>1.0$, $ps>.263$). There were no differences in responses between White and racially minoritized children. We are currently examining how racial diversity in children's social network and neighborhoods relate to these preferences and inferences.

The current study shows that White and racially minoritized children show preferences for racial ingroup members and predict same-race affiliation when given choices beyond the Black-White dichotomy.

S2.3.4 - Children's understanding of mental state attributions within close relationships

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Details

Imagine a child who is about to go on a roller coaster. This child might feel excited, or they might feel scared. Who might be more likely to correctly infer how this particular child feels: their best friend or a random classmate? As adults, we may guess that the best friend would, for at least two reasons. First, the best friend likely has more knowledge of the child's past behavior, and would therefore be able to make a more educated guess. Second, the best friend may be more motivated to track the child's mental states. By accurately representing the mental states of their social partners, people can better cooperate with their social partners. Here, we investigate whether children's developing theory of social relationships includes the intuition that people in close relationships are better able to represent one another's minds.

Experiment 1 focused on emotional state attributions within social relationships. We first asked 7-year-old children ($n = 56$) to rate the closeness between different individuals. The children were presented with different kinds of relationships (e.g., a mother and her baby), and they were asked to map those relationships onto circles of varying overlap (from fully overlapping to not overlapping). We found that children mapped social space onto physical space: They rated the social distance between a mother and a baby (median = 1) as less than that between friends (median = 3) (posterior median (PM) = -1.06, 95% credible interval (CI) [-1.47, -0.64]), and they rated the distance between friends as less than that between strangers (median = 6) (PM = 2.80, 95% CI [2.20, 3.47]).

After validating the use of this measure of relationship distance, we presented the children with three test vignettes in which characters were either correct or wrong about a protagonist's emotional state. For each vignette, we asked the children to rate how close each character was to the protagonist. We found that the children rated the distance between a character and the protagonist as lower when the character was correct (median = 3) than when the character was wrong (median = 5) about the protagonist's emotional states (95% highest posterior density interval (HPDI) [-1.75, -1.24]).

Could children just be focused on whether a character was correct? To test this possibility, we included a control vignette in which the characters were correct and wrong about a fruit: a topic irrelevant to the protagonist. We found that the children did not differently rate the distance between the characters and the protagonist when the character was correct (median = 4) vs. wrong (median = 4.5) (95% HPDI [-0.59, 0.17]).

The present findings suggest that, by seven years of age, children appear to use the accuracy of others' mental state attributions as an indicator of social distance. In ongoing research (Experiment 2, target $n = 56$, data collection on track for completion before CDS), we are examining whether children also reason that people who are close will accurately represent each other's minds. Together, such abilities to reason flexibly about people's relationships and minds may support children's navigation of the social world.

S2.3.5 - The nature of early social relationship concepts

Lindsey Powell ¹

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Details

Infants are born into a social world structured by relationships: ties between people that determine how they interact. To join this social world, infants and children need to develop an understanding of what social relationships are and how they operate. In this talk, I will discuss the proposal that early developing relationship concepts are centered on representations of how much one social agent values the goals and welfare of a partner agent (interpersonal value adoption). This concept can be embedded in an intuitive psychology that also includes expectations of rational action and appraisal-based emotion. In this framework, representing relationships as interpersonal value adoption would allow infants and young children to associate them with multiple social behaviors, including helping, empathizing, and interpersonal alignment or imitation. I will discuss several recent and ongoing lines of research from my lab that support this proposal by showing that infants and children do associate this set of behaviors with relationships, and that they use observations of one such prosocial behavior to generate expectations about other prosocial interactions between the same pair. For example, we find that infants expect friends but not rivals to empathize with one another (Smith-Flores, Herrera-Guevara & Powell, in press), that children use patterns of empathy to infer relationships (Smith-Flores, Bonamy & Powell, in press), and that infants use observations of social imitation to guide expectations of helping behavior (Pepe & Powell, under review). Ongoing work is asking if infants use observed patterns of helping to guide expectations of empathy or vice versa. Preliminary data also suggest that, when evaluating helpful actions, older children may use the presence or absence of empathy to judge whether helping was motivated by interpersonal concern or other factors (e.g. reputational benefits). Together, this research points to an early, abstract understanding of relationships based on interpersonal value adoption that can be inferred from or predictive of a range of prosocial behaviors. Estimating interpersonal value adoption between different pairs of individuals may be one way infants map the social network around them.

To close the talk I will briefly discuss three important open questions about the role of this concept in social development. First, some moral principles involve impartial concern for the welfare of any social partner; are infants and children able to represent interpersonal value adoption as a trait of an agent that applies to any potential social partner (i.e. can infants infer that someone is nice)? If not, what might the development of such trait concepts require? Second, how does this concept of relationships become integrated with other cues to social ties, such as membership in particular social categories? Third, how might this core concept develop in diverse ways? Individual people represent a range of relationships (e.g. parent, friend, sibling) and people's expectations about relationships differ (e.g. how stable one expects a caregiving or friendship relationship to be). What sorts of experiences inform these distinctions and differences, and how might learning from these experiences be supported by the basic notion of relationships proposed here?

S2.4.1 - Biology, social environment, or psychology? how causal explanations of human behavior influence its perceived malleability.

Lea Combette¹

¹ Boston University

Summary

People's beliefs about the stability of physical and mental traits are hugely consequential for representations that can underpin various prejudicial attitudes. This symposium presents 4 talks that explore factors impacting children's and adults' theories of trait malleability in different domains. Talk 1 shows how children's discriminating ideas about parent-offspring resemblances relate to diverse trait malleability beliefs. Talk 2 explores the downsides of seeing cognitive abilities as biologically fixed for language learning beliefs. Talk 3 adds further nuance by showing that the differentiation between internal and external explanations is crucial for understanding trait stability beliefs. Finally, Talk 4 explores attitudes to weight, showing that even social and psychological explanations can lead to detrimental stability beliefs if they are integrated into essentialist thinking.

S2.4.2 - Children's explanations for physical and mental traits and their influence on perceived malleability.

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Details

Prior research has consistently indicated a relationship between attributing traits or behaviors to biological determinants and perceiving them as non-malleable (Nettle et al., 2023; Lebowitz & Ahn, 2014). However, the extent to which this relationship exists among elementary school-aged children and whether these young students maintain a uniform theory across all types of traits remains unknown.

To address this, we investigated the beliefs of 304 3rd-grade public school students regarding the heritability of physical, personality, and cognitive traits, and explored the influence of these beliefs on children's perceptions of the malleability of these traits.

Participants were presented with questions related to parental-offspring resemblance and judged the malleability for two physical (chin shape and earlobe length), two personality (shyness and friendliness), and two cognitive traits (being smart and being good at math). Our findings revealed that children perceived physical traits as more heritable than personality ($\beta = 0.39$, $p < 2e-16$) and cognitive traits ($\beta = 0.65$, $p < 2e-16$), while personality traits were seen as more heritable than cognitive traits ($\beta = 0.27$, $p < 2e-16$). In alignment with outcomes previously observed in adults, stronger belief in the heritability of a trait was associated with a decreased judgment of the trait's potential for change ($\beta = -0.38$, $p < 2e-16$).

Shortly afterwards, participants in our study participated in a science curriculum focused on natural selection, which included frequent discussions about the biological inheritance of physical traits. We therefore conducted a second data collection to assess the curriculum's impact on children's prior beliefs. Results demonstrated that the intervention heightened the perception that traits are inherited from parents across all trait categories (physical: $\beta = 0.40$, $p < 2e-16$; personality: $\beta = 0.34$, $p < 2e-16$; cognitive: $\beta = 0.40$, $p < 2e-16$).

Moreover, physical traits remained perceived as more inherited than personality ($\beta = 0.45$, $p < 2e-16$) and cognitive traits ($\beta = 0.66$, $p < 2e-16$), with personality traits still regarded as more inherited than cognitive traits ($\beta = 0.21$, $p = 2.91e-13$). Intriguingly, while the perception of traits as inherited from parents continued to negatively predict malleability ($\beta = -0.49$, $p < 2e-16$), participation in the curriculum primarily influenced the perceived malleability of physical traits ($\beta = -0.27$, $p = 7.04e-10$). It did not generalize and significantly alter children's perception of malleability of personality ($\beta = -0.008$, $p = 0.78$) or cognitive traits ($\beta = -0.008$, $p = 0.82$).

In summary, our results indicate that 3rd graders possess the ability to differentiate between the causal factors underlying physical, personality, and cognitive traits. Physical traits emerge as the category US 3rd-graders view as most strongly influenced by parental inheritance. Consistent with findings from adults, our study replicates, among children, the negative association between beliefs in trait inheritance and the perceived malleability of those traits. Notably, we also observed that increasing the perceived inheritance of traits exclusively amplified the perceived stability of physical traits. This outcome suggests that while parental-offspring resemblance in physical traits may be attributed to shared genes, other, less stable factors appear to be integrated into children's explanations of mental traits following an intervention on evolution.

S2.4.3 - Language essentialism and its association with educational neuromyths and policy endorsements

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Details

Decades of research have revealed the factors that shape children's language acquisition, including the complex interplay of both nature and nurture as causally relevant (Kidd et al., 2018). Yet little is known about how lay people may reason about language acquisition, and how variations in these beliefs relate to attitudes, beliefs, and misconceptions concerning language instruction, policy endorsements, and best practices. Most notably, an important question is how people's beliefs about the role of innate and biological factors may shape the way they think of real-world developmental and educational issues. Understanding how adults' intuitive theories of cognitive development may inform their judgments and choices regarding educational contexts is an as-yet-unstudied factor with potential implications for instructional practices and developmental outcomes.

The current two studies employed a psychological essentialism framework to assess adults' lay theories about different aspects of language acquisition and their educational consequences. Using a Switched-at-Birth task (Gelman et al., 2007) and questionnaires (Nancekivell et al., 2020), we tested the extent to which people use essentialist thinking when reasoning about: 1) learning a specific language (e.g., "People are born with the ability to more easily learn the language that their biological family speaks than to learn other languages"), 2) learning a first language more generally (e.g., "A person inherits their ability to learn their first language from their parents"), and 3) learning two or more languages (e.g., "A person's ability to learn multiple languages is determined at birth"). In both Study 1 (N = 726) and Study 2 (N = 289), we found substantial individual differences in the degree to which participants essentialized language acquisition. Furthermore, participants were more likely to essentialize the ability to learn multiple languages than a first language, and more likely to essentialize the learning of multiple languages and a first language than the learning of a particular language. In both studies, higher levels of language essentialism correlated with greater endorsement of language-related educational neuromyths (e.g., "Teaching a young child multiple languages can cause language problems such as stuttering or dyslexia", $r_s = 0.10-0.49$, $p_s < 0.05$). In Study 2, these views were also correlated with a rejection of educational policies that promote multilingual education (e.g., endorsing "Bilingual education is not acceptable because it meets only the needs of a small select group", $r_s = 0.13-0.28$, $p_s < 0.05$). Together, the current studies revealed how essentialist reasoning about language learning, a critical skill acquired as a child, corresponds to educational beliefs and policy attitudes.

S2.4.4 - Children's explanations for ability grouping arrangements

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Details

From the start of formal schooling, children are exposed to ability cues in the classroom. One salient source of ability information in elementary school is within-class ability grouping—the instructional practice of separating children by putative ability for small-group instruction. Despite the ubiquity of within-class ability grouping practices, children are seldom told why they and their peers are assigned to their respective groups or what their group placements mean for their ability to learn and succeed in school. Instead, children are left to make sense of these arrangements on their own. In the present work, we characterize children's thinking about the sources of ability group arrangements and examine whether this explanatory thinking underlies children's expectations of low-ability-grouped students' upward mobility.

Six- to eleven-year-old children ($N = 159$; 79 girls; $M_{\text{age}} = 9.03$; recruited from across the US) were presented with a vignette that described a classroom with a high- and a low-ability reading group. Children then evaluated eight explanations that varied on the dimensions of locus (internal vs external) and stability (stable vs unstable). Thus, explanations cited causes were either: (a) internal and stable (e.g., "Because they weren't born smart"), (b) internal and unstable (e.g., "Because they didn't practice a lot"), (c) external and stable (e.g., "Because their teachers never give them extra help"), or (d) external and unstable (e.g., "Because they didn't have a library card last year"). Children rated their agreement with

explanations on a four-point scale (1 = “really not right” to 4 = “really right”). Children also responded to questions that measured their expectations for low-ability-grouped students’ upward mobility.

Children rated explanations appealing to internal, unstable causes most highly ($M = 2.97$), followed by explanations appealing to external, stable causes ($M = 2.61$), then explanations appealing to external, unstable causes ($M = 2.37$), and finally explanations appealing to internal, stable causes ($M = 1.82$) (all $ps < .001$; see Figure 1). Further, children’s overall agreement with internal, stable explanations—which appealed to biological causes—decreased with age ($b = -0.13, p < .001$). Children’s endorsement of these sorts of explanations also related to their interpersonal judgments: Children who attributed students’ placement in a low-ability group to internal, stable causes were more likely to think that those students could not move to a high-ability group ($b = -0.26, p < .001$). This relation was not moderated by child age ($p = .52$).

These findings suggest that children attribute ability-group placements to internal causes, but only when such explanations do not appeal to biological causes, suggesting that children view group placement as earned through effort and practice. Moreover, children’s causal thinking was related to their judgments of low-achieving students’ capacity to improve. When children endorsed the idea that student placement in ability groups stemmed from biological causes, they were more likely to think that low-achieving students could not achieve placement in a high-ability group. We discuss potential cognitive and ideological influences on children’s thinking about achievement in school, as well as implications for how children view and may form stereotypes about students in low-ability groups.

S2.4.5 - Children's essentialist conceptions of weight

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Details

Striking weight biases emerge early in development. By the preschool years, for example, children rank fat peers as least likable, even compared to peers with other physical differences (e.g., a child in a wheelchair, a child with facial disfigurement). Despite the robust nature of early weight biases, little research has examined young children's conceptions of weight. How do children conceive of weight as a characteristic? In the present study, we examined whether children held essentialist views of weight - in other words, whether children conceive of weight as natural, stable, inductively meaningful, and reflective of a stable internal "essence" - as they do of so many other social characteristics.

Weight represents a unique test case for examining the development of essentialism, in several respects. First, weight reflects biological predispositions (e.g., genetics), personal choices (e.g., diet and exercise), and structural constraints (e.g., availability of fresh food). How do children make sense of these three causal pathways? Next, essentialism of social characteristics (e.g., race, gender) is typically associated with increased prejudice. However, essentialism of weight is associated with *decreased* prejudice; providing children with biological explanations for weight improves their attitudes toward heavy peers. The unique relationship between essentialism and prejudice in the domain of weight raises important questions about how essentialist theories develop when they are in tension with preexisting prejudices.

We assessed children's weight essentialism across two studies. A total of 356 participants (280 4- to 11-year-old children and 76 adults from the United States) participated in three tasks, respectively assessing three dimensions of social essentialism: Beliefs about weight stability (i.e., whether a person's weight would remain stable across their lifespan), heritability (i.e., whether a child's weight will resemble their parent's), and inductive potential (i.e., whether a person whose weight was superficially transformed would retain their original weight-related behaviors, such as their food choices).

Results revealed that children viewed weight as highly stable (similarly so to race) and informative of someone's food choices, but they did not view it as biologically- or genetically determined. Thus, children do not view weight as reflecting people's biological nature (biological essentialism), but they may view weight as reflecting people's stable personal character (moral essentialism). Both biological and moral essentialism support a view of weight as stable and meaningful, but the nature of the "essence" (biology or moral character) differs across the two views, in line with evidence that children may consider an "essence" to be blood, a brain, a heart, a soul, moral character, or yet other forms. Crucially, moral essentialism is highly compatible with weight bias, as it enables weight to be construed as blameworthy, whereas biological essentialism is incompatible with weight bias, as research finds that biological attributions for weight are negatively related to weight bias. So, a moral essentialist view of weight may enable children to reconcile their essentialist tendencies with their preexisting weight prejudice. Overall, results shed new light on how different forms of prejudice - biological and moral - have distinct implications for malleability judgments, blame judgments, and social attitudes.

S3.1.1 - Functions, relations, and abstractions in infants, preschoolers, and AI

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Summary

The ability to infer, transform, and compose functional relationships is critical to human learning. Across four pioneering studies, this symposium explores 15-month-olds' understanding of compositionality, providing evidence that infants can learn multiple functions and productively combine their outcomes; two to four-year-olds' understanding of causal functions and their ability to extrapolate novel relations to design tools and solve problems; preschoolers' ability to infer abstract properties of sets (e.g., means; modes, proportions, etc.) and functions (e.g., monotonic, U-shaped, cyclic); and the strengths and weaknesses of large language models' relational reasoning, including their failure to solve some problems readily solved by human children.

S3.1.2 - Function composition in the crib: human infants productively combine two newly learned functions of a tool

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Details

The unique productivity of the human mind is rooted in our ability to flexibly combine concepts and functions into countless new thoughts and ideas, yet the developmental origins of this ability remain poorly understood. To date, only two studies have explored children's readiness to compute function composition, $(g \circ f)(x) = g(f(x))$. While preschoolers readily compose two novel functions (f1: color change, f2: pattern change, Piantadosi & Aslin, 2016), preverbal infants fail to do so (Piantadosi et al., 2018). Several factors, such as the need for linguistic scaffolding, inability to perform multiple updates to a model held in working memory, or struggle to learn two distinct functions, could explain this failure. Indeed, studies show that infants detect color changes (Wilcox et al., 2014) but seem less sensitive to pattern changes (Xu et al., 2004). We reexamined infants' ability to combine functions by using object transformations (kind change; numerosity change), which they have been shown to be sensitive to during the first year of life.

In Experiment 1, we tested whether infants (N = 16, mean age: 15 months) can learn two functions of a tool, i.e., a machine transforming objects that go inside. The machine had two functions (f1: change kind, $a \rightarrow b$, f2: duplicate, $a \rightarrow aa$). Each function was linked to one of the two manipulanda (different-looking and activated via different actions, pulling v. rotating, to maximize salience and distinctiveness). Infants were familiarized with each function separately and, then, learning was assessed via a violation-of-expectation test. On congruent test trials, they saw expected outcomes; on incongruent test trials, they saw an action-outcome swap (e.g., operating the kind-change manipulandum resulted in a duplication of the input object). Infants looked longer to the incongruent outcomes, suggesting that they learned the trained functions.

In Experiment 2, we tested whether infants (N = 32, mean age: 15 months) could combine two newly learned functions (f1: change kind; f2: duplicate). We conducted a baseline and an experimental condition. In the experimental condition (N=16), we used the same familiarization as in Experiment 1, and a new test, in which both manipulanda were activated simultaneously. There were two test outcomes: congruent with function composition (e.g., duplication + kind change: $a \rightarrow bb$), or incongruent with function composition and involving the outcome of only one operation (e.g., duplication only: $a \rightarrow aa$). Because the congruent outcome was perceptually novel (i.e., infants have never seen this configuration of objects before), the baseline condition evaluated the effect of the perceptual novelty. This was achieved by showing only the manipulations and their outcomes but not the input objects. We observed that in the baseline condition, infants displayed longer looking to the perceptually novel set of objects, but this preference reversed in the experimental condition whereby the novel set was congruent with the function composition outcome.

In conclusion, 15-month-olds readily learn two functions and productively combine their outcomes. Computational foundations of combinatorial thought seem to be in place during the second year of life, operating independently of natural language scaffolding.

S3.1.3 - Causal-functional reasoning in children and AI

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Details

We propose casual-functional reasoning, a form of abstract relational reasoning, as an early-emerging cognitive mechanism that may underlie innovative tool use. Causal-functional reasoning is the ability to learn, generalize, and extrapolate from the abstract form of a causal relation to solve a novel problem.

In two studies, children aged 24 to 48 months old rapidly inferred functions (e.g., $F(x) = ax$) that mapped the relation between the starting and ending states of an object that was transformed by a novel, mechanistically opaque machine. The causal functions of the machine were unusual: it enabled the rapid growing ($a > 1$) and shrinking ($0 < a < 1$) of physical objects (x). In Study 1, 72.2% three-year-olds ($n = 36$, $M_{age} = 41.3$ months, $SD_{age} = 4.37$ months) chose the appropriate machine to solve the problem ($SD = 0.45$) significantly above chance (50%), $t(35) = 2.94$, $p = 0.006$. In Study 2, 100 toddlers ($M_{age} = 27.3$ months, $SD_{age} = 2.69$ months) underwent a causal rule learning task in which only appropriately sized objects could make a music box play, and more than two-thirds of them subsequently chose the appropriate machine to transform novel object sizes for the music box to play ($M = 68\%$, $SD = 0.47$) significantly above chance, $t(99) = 3.84$, $p < 0.001$. In both studies, children had no information about the mechanisms underlying the observed changes, and they did not hear relational language describing them. Yet, after only a few observations, they generalized this causal function and extrapolated from it: they used the tool to change the size of a perceptually distinct, unrelated object to solve a novel problem.

This work adds to a growing body of research demonstrating that learning and reasoning about abstract relational concepts emerges earlier in casual than non-causal contexts (e.g., Cartesian et al., 2019; Muthukrishna & Henrich, 2016; Walker & Gopnik, 2017). Here, toddlers spontaneously attend to abstract relations embedded in a problem-solving task.

Moving forward, we are adopting a similar causal relational reasoning framework to more robustly evaluate object reasoning in children and in foundational models such as GPT-4V. Recent studies have suggested that human adults are substantially superior to GPT-4 and other machine solvers on a new set of few-shot abstraction and relational reasoning problems (e.g., Moskvichev, Odouard & Mitchell, 2023). That said, it is unclear at which step these models are failing (whether it be recognizing a specific type of relation or extrapolating the relationship to a new context), and if they are even capable of solving the simpler, more concrete relational reasoning tasks established in developmental psychology for younger children. Thus, taking advantage of existing developmental tasks (e.g., Coates et al., 2023; Goddu, Lombrozo & Gopnik, 2020), we are developing a benchmark to evaluate children and models on a level playing field: their ability to infer a common underlying object relationship, and generalize it to novel, out-of-distribution instances at test. These object relationships span from spatial transformations to more causal and functional abstractions.

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S3.1.4 - Preschoolers represent abstract relational properties of sets and functions

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Details

We present a unified body of novel work (nine independent experiments) showing that preschoolers can infer abstract relationships, including properties of sets and functions. Previous research on children's ability to make relational matches has been mixed (Christie & Gentner, 2014; Goddu, Lombrozo, & Gopnik, 2020; Kotovsky & Gentner, 1996; Kropin & Carey, 2020; Magid, Sheskin, & Schulz, 2015). Here we conducted two pre-registered, automated online studies (Experiment 1; N=39; mean: 56 months; Experiment 2; N = 39; mean: 42 months) testing children's ability to represent relative size and symmetry. On each of eight trials, children saw the target, the distractor, and either a direct match or an inverted match (the target increased and the match decreased; the symmetry – e.g., large, small, large – was inverted in the match – e.g., to small, large, small). Four and five-year-olds performed near ceiling (mixed effects regression 95% probability of success; $\beta = 3.64$, $z = 5.08$, $p < 0.0001$), and three-year-olds succeeded as well (69% probability of success; $\beta = 0.79$, $z = 3.86$, $p < 0.001$).

Confident that children could represent at least simple, abstract relationships, we moved on to tasks that could more richly probe children's thinking. In Experiment 3, children (N = 34; mean: 66 months) were asked to match abstract properties of sets: relative number; relative proportions among two and three kinds; relative means and modes; and arity (the number of values taken by each variable). Children succeeded across all six concepts (84% probability of success; $\beta = 1.69$, $SE = 0.36$, $p < 0.0001$).

In a final series of studies, we tested children's sensitivity to functional properties of dynamic events. Children were shown lights dimming and brightening, and flowers opening and closing, according to different functions. The lights and flowers were presented separately so children had to remember the functional dynamics of each event to link them. In five pre-registered experiments children (Exp. 4; N = 29 mean: 66 months) distinguished monotonic, quadratic, and cyclic functions ($\beta = 1.41, z = 5.20, p < 0.001$); and both distinguished within function types (e.g., linear vs. sigmoid monotonic functions; Exp 5; N = 32; mean = 66 months; 95% CI [0.43,0.51]), and generalized across them (e.g., grouping sigmoid and linear functions vs. U-shaped and V-shaped functions; Exp. 6, N = 32; mean: 53 months; $\beta = 0.734, z = 3.31, p < 0.001$). We then looked at whether children's representations were perceptual or more abstract by asking children to match observed functional dynamics to verbal descriptions. Children succeeded at this (Exp. 7, N = 32; mean: 52 months; $\beta = 0.87, z = 3.40, p < 0.001$) and, in ongoing work (23 of 32 participants have been coded) spontaneously and accurately described these functions themselves (Exp. 5; N = 32; mean: 56 months). Taken together this work suggests that from early in development, children represent abstract relationships in observed data. This may be critical to humans' ability to infer non-obvious connections in the world, including structural and causal relationships among events.

S3.1.5 - Language models and the development of relational abstractions

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Details

Large language models (LLMs) have recently demonstrated impressive performance in a number of task domains, raising the prospect that they might serve as cognitive models of these capacities. One issue of particular interest concerns whether LLMs can reason in a robust and human-like manner. I will present results from recent work (Webb et al., 2023a) suggesting that LLMs (GPT-3 and GPT-4) possess an emergent capacity for *analogical* reasoning - a major component underlying the flexibility of human thought and problem solving (Gentner, 1983; Holyoak, 2012). Across a series of experiments, ranging from abstract tasks (involving letters and digits) to more real-world problems (involving words and stories), we found that LLMs were able to solve analogy problems at a level comparable to college students. These involved tasks that were created specifically for the purpose of this investigation, indicating that LLMs were able to solve these problems *zero-shot* (without direct training), a key desideratum for cognitive models of analogy (Webb et al. 2023b). LLMs also displayed similar error patterns as human participants, providing some indirect evidence for the presence of human-like reasoning mechanisms.

Despite these notable successes, there are reasons to doubt the status of LLMs as models of human analogical reasoning, particularly when it comes to modeling the *development* of this capacity. While the systems that we investigated were able to solve some analogy problems on par with adults, they were also unable to use analogies in a physical problem-solving task that can be reliably solved by children (Holyoak et al., 1984). This suggests an uneven distribution of cognitive capacities, with strengths in some areas that can be difficult for adults (abstract pattern induction), and weaknesses in other areas that are mastered early in life (physical and commonsense reasoning). Additionally, even for the cases in

which LLMs performed well, this capacity depends on exposure to a much larger training corpus than individual humans receive in an entire lifetime (Frank, 2023), undermining their status as models of the developmental process.

To address these issues, I will discuss two factors that are likely to be necessary for capturing human-like development of analogy and relational reasoning. First, the poor physical reasoning abilities of LLMs are likely due at least in part to their relatively low-bandwidth and indirect exposure to the physical world, whereas human development occurs in the context of rich multimodal inputs and physical embodiment. The development of artificial systems with robust physical reasoning abilities will likely require multimodal and embodied training paradigms. Second, I will suggest that better inductive biases - assumptions made by a learning model that enable it to learn some tasks more quickly - will be necessary to match the human developmental time course. In particular, I will discuss a recent proposal for an inductive bias termed the ‘relational bottleneck’, an architectural constraint that encourages neural networks to focus on relations between objects rather than the attributes of individual objects, resulting in the rapid acquisition, and systematic generalization, of relational abstractions (Webb et al., 2023c).

S3.2.1 - Shining new light on neural mechanisms of word learning

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Summary

This symposium brings together work using modern neuroscience (functional near-infrared spectroscopy) to gain new insights in the context of canonical tasks assessing word learning in childhood. The first talk examines neural mechanisms of novel word learning between mono- and bi-lingual toddlers in a fast-mapping task. The second talk examines neural mechanisms of attentional biases in the novel-noun generalization task with toddlers. The third talk examines neural mechanisms of label learning between visual dimensions and visual displays of emotions with 7-year-olds. Our discussant is a leader in the field of word learning and has done foundational work on the processes of word learning in early childhood. Thus, the discussant will be able to situate these modern approaches within the traditional debates and theoretical approaches in the study of word learning.

S3.2.2 - Neural Correlates of Disambiguation in bilingual and monolingual toddlers

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Details

As young children acquire language, they use several word learning strategies. One strategy is *disambiguation*, in which children map a novel word onto an unfamiliar referent instead of a familiar referent. Some studies have suggested that bilingual children do not rely on disambiguation as often as monolingual peers, because they often encounter more than one label for familiar referents. In the present study, we investigate the neural signature of word recognition and disambiguation in monolingual and bilingual toddlers. Furthermore, we explore whether bilinguals and monolinguals show brain differences during successful and unsuccessful disambiguation. We hypothesize that differences will emerge when bilinguals do not rely on disambiguation.

Bilingual and monolingual toddlers (N = 48) were presented with a Fast-Mapping task, in which participants were presented with a familiar object (e.g., cup, car) and a novel object (Halberda, 2003). Two types of trials were presented: during Familiar trials, children hear a familiar label (e.g., *find the cup*), and are predicted to look at the familiar object (i.e., demonstrating word recognition); during Disambiguation trials, children hear a novel label (e.g., *find the sofa*), and are predicted to look at the novel object (i.e., showing a disambiguation effect). An eye-tracker measured looking time and functional Near-Infrared Spectroscopy collected brain responses from frontal and temporal cortical regions.

Behavioural results. Both monolingual and bilingual toddlers looking increased to the appropriate object following labelling during Familiar, but only monolinguals attention increased during Disambiguation trials ($ps < .05$). Neither group showed evidence of retention as a whole.

Brain imaging results. For the **Familiar vs. Disambiguation** contrast, monolinguals show more left frontal dorsal activation during Disambiguation, while bilinguals show more right frontal dorsal activation during Disambiguation ($ps < .05$). For the **Familiar vs. Retention** contrast and the **Disambiguation vs. Retention**, there were no significant channels showing differences between the conditions and there were also no significant differences in brain activity between the language groups.

Correlations. Correlations suggest that brain activity within the left frontal and the right dorsal areas during Retention trials was positively associated with looking to the appropriate object during Retention.

These results provide insight on how the brain supports encoding of a new word in both monolingual and bilingual toddlers. Future work will explore bilinguals greater activity when they fail to rely on disambiguation, and which other strategies support bilinguals word learning.

S3.2.3 - Mind over material: neural mechanisms of attention in novel-noun generalization

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Details

In the course of word learning, children's attention becomes tuned to the regularities in their vocabulary and language. In English-speaking children, this manifests as a bias to attend to shape over other object features (e.g., material) when learning new words or categorizing objects. One task used to measure these attention biases, the novel-noun generalization (NNG) task, presents children with a novel object and label. Then an array of items is presented and children are asked which other item also has this label. The items that children can pick from typically match different features of the initial reference object. The shape bias appears around age two, corresponding with the advent of language production. However, it is most rigid at age 3 (Landau et al. 1992). Although participants above or below this age can be manipulated out of this bias, 3-year-olds remain consistent (Samuelson et al. 2008). Research on cognitive control development has demonstrated limitations in children's attentional control in 3-year-olds, though the relationship between attentional control and performance on the NNG task has not been examined. In the NNG task, warm-up trials are used with known objects to demonstrate practice with the task structure and typically involve objects with well-defined shape-based categories. Thus, these warmup trials could create a task-based bias to attend to shape that children with poor attentional control skills cannot overcome in the context of manipulations to shift attention away from shape.

In the current project, we take a cognitive neuroscience approach to examine behavioral and neural indices of attention in the NNG task. We measured neural activity using functional near-infrared spectroscopy measured bilaterally in frontal, temporal and parietal regions. We administered the NNG task following the protocol created by Samuelson et al. (2008). To address whether warmup trials create an attention bias, we compared two conditions: a known, shape-based training condition typically used and a material-based training condition with known categories defined by material. Next, we examined whether general attentional control skills are related to performance on the NNG task. To address this, children completed a triad classification (TC) task measuring children's ability to process object features selectivity within dimensions.

Children in the shape-based training ($M=.733$) more shape bias than children in the material training ($M=.522$, $p=.025$). These results show clear evidence that the standard training trials bias attention towards the shape dimension. Neurally, left inferior frontal gyrus ($r^2=.23$) and left angular gyrus ($r^2=.21$) activations were associated with a stronger shape bias, and the left middle occipital gyrus activation was associated with weaker shape bias ($r^2=.244$). Thus, a stronger shape-bias was associated with activation of regions associated with higher level cognitive processing, whereas weaker shape bias was associated with activation of lower-level regions. Additionally, activation of the inferior frontal gyrus was stronger in the material training group, suggesting higher level cognitive processes involved in shifting attention to material. Lastly, the TC task was correlated with shape bias such that tendency to pick the identity match in TC was associated with a stronger shape bias, suggesting that a child's ability to parse apart individual object features contributes to shape bias development.

S3.2.4 - Testing the temperature: comparing the neural dynamics of "hot" and "cold" label learning

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Details

Background: Research suggests that during early childhood individuals gain control over attention to visual information, gaining the ability to selectively process single features of objects and flexibility shift attention between them when the task or context requires. These developments in attention are associated with increased activation along a frontal, temporal, and parietal network of regions when presented with basic dimension of visual information (e.g., shapes and colors; Buss & Spencer, 2018; Lowery, Nikam, & Buss, 2021). There is extensive evidence for a developmental shift in processing of features like shape and color, but much less work has examined the development of attention to emotional stimuli. Childhood is a pivotal stage for socioemotional development, including one's awareness and understanding of emotional states. While studies suggest emotion understanding has arisen by 6 years of age, few studies have explored how the behavioral or neurocognitive processes for emotion information learning may compare to processes used to understand non-emotion content. Mental health disorders (e.g., anxiety) have known connections to emotion identification and processing; thus, understanding how children comprehend and process emotional versus non-emotional content is imperative. Thus, the present study investigates the neurocognitive mechanisms involved in processing emotion and non-emotion content in a sample of 7-year-old children.

Methods: Twenty-three children completed computer-based label comprehension and production tasks with emotion (e.g., emotion-expressing faces) and non-emotion (i.e., shape, color) stimuli. During production tasks, children were shown a single stimulus and asked "What color/shape/emotion is this?". During comprehension tasks, children were shown an array of 6 stimuli and asked, for example, "which one is red/star/happy?". Neural activity was measured via functional near-infrared spectroscopy (fNIRS) placed bilaterally in frontal, temporal, and parietal regions. Behavioral outcomes (e.g., accuracy, reaction time) and relevant parent self-report responses were also collected.

Results: Right superior parietal cortex was activated more strongly during emotion ("hot") tasks relative to visual dimension ("cold") tasks. In contrast, during "cold" stimuli tasks, children exhibited significantly stronger activation within the right middle occipital region compared to "hot" tasks. When comparing label production to label comprehension abilities across emotion and non-emotion dimensions, children exhibited stronger activation within the left inferior frontal gyrus for production relative to comprehension, and significantly stronger activation within the right middle frontal gyrus for comprehension relative to production.

Conclusions: Findings show there are inherent differences in how 7-year-old children engage with "hot" versus "cold" label representations: children engaged frontal cortex more strongly during tasks involving "hot" stimuli whereas children engaged lower-level cortex during tasks involving "cold" stimuli. Further, different task demands (i.e., comprehension vs production) produced different patterns of neural activation: production tasks recruited frontal cortex more strongly whereas comprehension tasks recruited posterior cortex. Future directions will investigate brain-behavior differences, and how study tasks may differ among children at-risk for anxiety compared to typically developing peers.

S3.3.1 - Structural reasoning about inequality across childhood and adolescence

Jamie Amemiya¹

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Summary

This symposium examines how children and adolescents develop a structural understanding of social inequality, in which they recognize the systemic, societal forces that produce such disparities. Talk 1 will provide a theoretical introduction to structural thinking, clarifying the definition of “structural” and identifying key gaps in the literature. Talks 2-4 will begin to address these gaps and offer new empirical insights: Talk 2 demonstrates that structural explanations must implicate the high-status group as the creators of the structure in order to address children’s biases and promote rectification. Talk 3 finds that children’s structural thinking is best supported when they observe that removing structural barriers makes a difference for inequality. Finally, Talk 4 identifies ethnic studies as a real-world context that facilitates adolescents’ structural reasoning.

S3.3.2 - Limitations and future directions in studying structural thinking in young children

Marianna Zhang¹, **Ellen Markman**¹

¹ Stanford University,

Details

Social structures mark and produce presumed group differences and disparities. For example, modern American society distributes economic resources differently by gender and race: the average American woman makes \$0.84 to every \$1 the average American man makes, and the median Black household holds \$38,000 in wealth to the median White household’s \$184,000. How do children reason about the origins of such social disparities? Much work in cognitive development has established children’s natural tendencies to see social disparities as inherent in origin, with pernicious consequences.

Recently, cognitive development research has explored an alternate way of thinking: structural reasoning. Drawing from the causal reasoning literature, cognitive development has characterized structural reasoning as the ability to reason about a relatively stable external context that social groups are situated within, and how that context causes group properties or outcomes. Social structure is often operationalized as a perceptually salient feature of physical environments: classrooms set up in a way that encourages segregated groups to play different games, geographies with different resources available to segregated groups, or games set up in a way that advantages one group’s physical abilities. Such studies have yielded important insights into children’s emerging capacity for structural thinking as a counter to intrinsic thinking and the positive consequences that result. However, insights from such studies have failed to translate to children’s reasoning about real-world structural differences, where children struggle to engage in structural thinking and still default to intrinsic thinking.

I identify several limitations of existing studies that might explain such failures. The physical environments in such studies are perceptually salient and often have accidental or ambiguous origins,

while real-world structural causes are often less obvious and intentional in origin (e.g., discriminatory policies, historical violence). Momentary status disparities (e.g., who wins or loses a game, who a teacher rewards at a competition) may be easier to understand as structural, versus pervasive real-world disparities (e.g., long-term economic disadvantage). And unlike novel inequities, real-world disparities also involve cultural stereotypes that strengthen internal thinking, presenting a stronger challenge for structural thinking to overcome.

Drawing on adolescent development, social psychology, and other fields, I highlight an alternative characterization of structural thinking, focusing on the role of institutions, laws, policies, and norms in distributing power and resources. This characterization raises questions typically not addressed in cognitive development research to date: How do children reason about who is advantaged versus disadvantaged by such structures? How do children reason about the origin of such structures: by whom and why such structures were created and sustained over time? Answering these questions can connect cognitive development with longstanding work in adolescent development and social psychology for a unified understanding of the development of structural thinking.

S3.3.3 - Structural explanations for inequality reduce children's biases and promote rectification only if they implicate the high-status group

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Details

Children become aware of group-based hierarchies from a young age (Olson et al., 2012) and quickly become active participants in them. Indeed, children often favor those from high-status groups (Newheiser et al., 2014) and willingly accept (Rizzo et al., 2020)—and even perpetuate (Paulus & Essler, 2020)—group inequalities. Among adults, highlighting the *structural* causes of inequality predicts a range of egalitarian outcomes, including increased behaviors to rectify group disparities (Piff et al., 2020) and reduced bias toward low-status groups (Cozzarelli et al., 2001). Might teaching young children about the structural roots of inequality yield similar benefits?

Correlational research is consistent with this possibility (Rizzo et al., 2022), but evidence of a causal link is mixed. That is, while young children can understand structural explanations when taught (Vasilyeva et al., 2018), such explanations often do little to shape children's attitudes or behaviors in experimental contexts (e.g., Peretz-Lange et al., 2021). These lack of findings may be due, in part, to children's tendency to believe that what is *true* is *right* (Roberts et al., 2017); as a result, even when children are taught about the structural conditions that lead to inequality, they may assume that they reflect how things *should* be and thus fail to challenge them. This process may be disrupted, however, if children learn about the structures' origins: specifically, the role (and selfish intentions) of the high-status group in creating the structures. We tested the efficacy of such an intervention with a large sample of children ($N=206$, $M=7.56$ years, $SD=1.65$, *range*: 5-10; 50% girls, 50% boys; 54% White, 20% Asian, 17% multiracial, 5% Hispanic, 2% Black, 1% unreported), recruited predominately from the U.S.

We presented children with an inequality intended to mirror dynamics observed in everyday life. Then, we provided children with one of three explanations—a structural explanation that attributed the

inequality to the high-status group (condition: *High-Status Power*), a structural explanation that attributed it to a third-party (condition: *Third-Party Power*), or an explanation that did not appeal to structural causes at all (condition: *Control*)—and assessed children’s attitudes, beliefs, and behaviors. Relative to those in the other two conditions, children in the High-Status Power condition displayed less bias in favor of high-status children ($X^2(2)=11.08, p=.004$), perceived the status hierarchy to be more unfair ($X^2(2)=21.37, p<.001$), and allocated more resources to the low-status group ($X^2(2)=12.32, p=.002$). Children in all conditions, however, understood the inequality: across conditions, children expected the low-status child to have little social mobility throughout their lifespan if they remained in the same context but more if they moved to a new one, where the relevant structures need not apply ($X^2(1)=16.77, p<.001$).

Our findings suggest that structural explanations that identify the high-status group as the structures’ creators lead children to possess more egalitarian attitudes, beliefs, and behaviors, despite children *understanding* the inequality without this added element. These insights pave the way for future interventions, illuminating a critical component of structural explanations—the role and intentions of the high-status group—that may aid in the formation of adaptive beliefs, attitudes, and behaviors across the lifespan.

S3.3.4 - Children and adults reason structurally about STEM gender inequalities after observing that removing structural constraints makes a difference

Jamie Amemiya ¹, Lin Bian ²

¹ Occidental College, ² University of Chicago

Details

The gender gap in STEM participation is one of the most pervasive social inequalities that children observe. For children to explain this inequality accurately, it is critical for them to consider structural causes, including fewer STEM learning opportunities for girls. The traditional view is to increase children’s *awareness* of the different structural constraints that groups experience, such as how girls face greater barriers in STEM than boys do (what we refer to as a “between-group comparison”). However, we propose that this may be an insufficient strategy, as children could reason that girls would still not pursue STEM even if they had the same opportunities as boys. We hypothesize that children *also* need to reason counterfactually that had *girls’* constraints been removed, *girls* would increase their participation in STEM. In other words, children need clear evidence that structures would have made a difference for girls (what we refer to as a “within-group comparison”). The current experiments (total $N = 145$ 5- to 8-year-old children; $N = 555$ adults; 50% female, 46% male, 3% non-binary; 63% White, 12% Asian, 8% Latinx, 8% Black, 7% Mixed) tested whether this novel approach of showing within-group comparisons, relative to the traditional approach of between-group comparisons, more strongly support children’s (and adults’) structural reasoning and rectification of STEM gender inequalities.

In the first set of experiments, children ($N = 97$) and adults ($N = 255$) learned about a target group of girls who chose not to participate in STEM and chose a gender-stereotypical option instead (e.g., cookie-baking). In the within-group comparison condition, they learned about another group of girls who were given greater learning opportunities in STEM relative to the target group of girls, and in turn chose to pursue STEM. The between-group comparison condition was almost identical, except that it

was a group of *boys* who were given greater learning opportunities in STEM, and in turn chose to pursue STEM.

Results indicated that both children and adults more strongly endorsed structural causes for the target group of girls' choice not to pursue STEM (i.e., lack of learning opportunities) than intrinsic causes (i.e., lack of an inherent preference for STEM) in the within-group comparison than between-group comparison condition (condition x rating interaction for children: $B = 1.08, p < .05$; for adults: $13.21, p < .01$). In further support of our hypothesis, these judgments were related to the belief that this target group of girls would have chosen differently if they had been granted greater opportunities (children: $r = .24, p < .05$; adults: $r = .49, p < .001$). Importantly, in a second set of experiments (total $N = 48$ children; $300 =$ adults), children and adults in the within-group comparison, relative to the between-group comparison, were more likely to rectify inequality by including girls more in STEM activities (child study; $B = 0.99, p < .05$) and giving scarce STEM funds to girls (adult study; $B = 0.74, p < .01$).

Overall, our research points to within-group comparisons—which highlight how *removing* structural constraints makes a difference for the disadvantaged group—as a novel strategy to promote structural reasoning and inequality rectification.

S3.4.1 - Science and Me: How scientific thought and engagement is shaped by identity factors and diverse learning contexts.

Khushboo Patel¹, Aarti Bodas²

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Summary

This symposium features how age, gender, race, and culture shape science cognition. Talk 1 shows that children's and adults' feelings of belongingness in science influences their tendencies to provide scientifically normative causal-mechanistic explanations about natural phenomena. Talk 2 shows that pretend play promotes girls' persistence in science activities when they are asked to be a female but not a male scientist. Talk 3 highlights the role of peers and family for racially and ethnically diverse U.S. adolescents' science identity development during situations like COVID-19. Talk 4 shows cross-cultural and gender differences in Indian and U.S. adolescents' perceptions of science ability and interest, the usefulness and importance of science, and effort required in learning it. Thus, science cognition is multifaceted and strongly linked to a person's identity and learning contexts.

S3.4.2 - Indian and American adolescents' beliefs about science learning: A cross-cultural perspective

Khushboo Patel¹, Judith Danovitch¹, Allison Master², Ritu Sharma³

¹ University of Louisville, ² University of Houston, ³ Pandit Deendayal Energy University

Details

Cultural context plays an important role in shaping children's science identity and choices (Eccles & Wigfield, 2020). In the U.S., girls often lose interest in STEM during middle school years (Riegle-Crumb et al., 2010) which affects their decisions about taking STEM-related courses in high school and college (Maltese & Tai, 2011). However, little is known about children's attitudes about STEM-related learning in non-Western countries, like India. India is one of the largest contributors of STEM graduates in the world (UNESCO, 2022). However, Indian women remain underrepresented in the STEM workforce (Swarup & Sabarwal, 2023) and boys often face pressure to enter STEM fields (Bansal, 2020). We explored how culture and gender shape adolescents' attitudes toward science. Participants were 12-to-16-year-old Indian (n = 503; 272 girls, 231 boys) and American adolescents (n = 520; 254 girls, 266 boys) who completed a survey based on Situated Expectancy-Value Theory (Eccles & Wigfield, 2020). Participants rated their science ability, how much hard work is required for science learning, and the intrinsic value, utility value, and attainment value of science. A series of regressions revealed that Indian adolescents gave higher ratings than American adolescents for all 5 variables (ps ≤ .001). Gender significantly predicted attainment value (B = -.292, p = .001) and hard work (B = -.279, p < .001) required in science, and marginally predicted ability (B = -.163, p = .052), with girls reporting higher value, hard work, and ability compared to boys. Age significantly predicted ability (B = -.091, p < .001), intrinsic value (B = -.196, p < .001), utility value (B = -.094, p < .001), and attainment value (B = -.174, p < .001), with older students reporting lower ability and value compared to younger students. The only significant interaction was between gender and country (B = .432, p < .001) for ability ratings. In India, girls rated their ability higher than boys did, but in the U.S., boys rated their ability higher than girls. Correlational analyses revealed that American girls and boys who rated their ability higher viewed science as requiring less hard work than those who gave lower ability ratings (ps < .001). However, there were no significant correlations between ratings of ability and hard work for Indian girls or boys (ps > .284). This may be because working hard is viewed as a core cultural value in India (Vig, 2022). American boys and Indian boys who gave a higher utility value rating also believed that more hard work is required in science learning than boys who gave lower ratings (ps < .001), whereas there were no significant correlations between American girls' or Indian girls' ratings for utility value and hard work (ps > .144). Our findings suggest that cultural context shapes girls' and boys' science attitudes in different ways. Girls from both countries reported a greater need to work hard in science compared to boys. Although American adolescent girls seem to be vulnerable to negative stereotypes regarding their ability in STEM, Indian adolescent girls may not be as vulnerable, leading them to perceive their science ability more highly than Indian boys or girls and boys in the U.S. Meanwhile, Indian boys may feel pressured to enter STEM fields regardless of their competence in STEM and hence may not consider science as personally important. These findings have implications for targeted interventions to encourage girls' entry and retention in STEM fields across cultural contexts.

S3.4.3 - Perceptions and experiences of science and science engagement among diverse adolescent youth during COVID-19: A qualitative study

**Matthew Kim¹, Nicholette Derosia², Rachel Guldin³, Maya Lazaro², Jenefer Husman², Ed Madison²,
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Details

In this study, we explored how diverse adolescent youth during the COVID-19 pandemic described their interests, experiences, and future plans in science. Initially, our research was situated within a science identity framework, particularly interactionist approaches that highlight the role of socializing agents and the environment (Kim & Sinatra, 2018). As our research progressed, our focus broadened to include the affordances and constraints that students perceive in science. Therefore, our theoretical framing emphasizes the role of student engagement and how students reflect on their participation in scientific spaces in shaping science identity (Brickhouse et al., 2000; Burke & Navas Iannini, 2021; Strong, 2016). The present study builds on and extends theory and empirical work in 3 ways. First, acknowledging the continued need to redress inequities in science, we examined experiences among students from groups marginalized and underrepresented in science (Avraamidou, 2020; Jackson & Suizzo, 2015; Rocha et al., 2022; Rosa, 2018). Second, collecting data during the COVID-19 pandemic—an event that sparked renewed conversations around inequality and social change—allowed us to examine students’ science reflections in ways that intersected with their social identities and contexts. Third, participants viewed digital storytelling videos featuring racially and gender diverse youth engaged in mentored science learning activities. As such, we adopted a “funds of science identity” (FoSI) framework (Wofford & Gutzwa, 2022), an asset-based approach for studying the lived experiences of students in science; we expected that viewing these videos would prompt deeper reflection and greater authenticity of responses. In July of 2020, we conducted 11 virtual focus groups with 38 high school students across grades 9-12 (34% Hispanic, 23% Multiracial, 16% Black) from 2 university-based summer research programs in the United States serving students underrepresented in higher education and STEM pathways. In each focus group, students viewed 2 videos featuring undergraduate mentors and high school mentees engaged in unscripted, authentic dialogue and activities in science. These videos were used to prompt participants’ own reflections around their experiences in and perceptions of science, as well as their interest and future plans in science. We used inductive coding and reflexive thematic analysis that centered participants’ voices (Braun & Clarke, 2021). We identified 3 themes characterizing how the pandemic shaped key developmental ecological processes, within and beyond the science domain. First, peer, family, and community influences shaped the beliefs and experiences of diverse youth in science, highlighting the importance of interpersonal connections and interactions between microsystems in shaping science identity during times of crisis. Second, the pandemic impeded the transition to social and emotional goals for adolescent youth, consistent with socioemotional selectivity theory (Carstensen et al., 1999). Third, the videos had different impacts on how individuals perceived their personal agency to visualize and shape their futures in science and more broadly. Findings underscore the importance in addressing the unique societal challenges that arise out of emergency situations—such as global pandemics—for refining developmental theory and reimagining approaches for supporting science engagement and science identity development.

S3.4.4 - Becoming a scientist: The influence of a science role model's identity on children's engagement in science

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¹ University of Chicago

Details

Cultural messages associate science with men over women (Smyth & Nosek, 2015). Even young children hold these gender-science stereotypes (Miller et al., 2018). These beliefs are problematic and alienate young girls from identifying themselves as scientists, creating early disparity in science engagement (Bian et al., 2017; Rhodes et al., 2019). The current research aims to increase girls' identification with scientists to boost girls' engagement in science. One recent study shows that asking girls to pretend to be a science role model increased girls' persistence in science activities (Shachnai et al., 2022), yet open questions concern whether the identity of the scientist affects the effectiveness of the intervention. Across 2 studies, we investigated how the characteristics (hardworking v. brilliant) and gender (gender-matched v. gender-mismatched) of a scientist affect girls' persistence in science activities. In Study 1, 6-to-7-yo participants (N = 180) were asked to play a sink-or-float science game, in which they made predictions about whether real-life objects would sink or float when they were dropped in water. Participants in the baseline condition did not receive additional information. Participants in the other 2 conditions were asked to pretend to be either a "really, really hardworking" (dedication condition) or a "really, really smart" (brilliance condition) gender-matched scientist while playing the science game. We measured participants' persistence, defined as the total number of trials they chose to continue playing the science activity. A survival curve analysis revealed a significant main effect of condition on persistence in the science game, $\chi^2(1) = 7.48, p = .024$. Follow-up pairwise comparisons revealed that girl's persistence in the science game was significantly higher in the dedication ($\beta = 0.70, p = .02$) and the brilliance condition ($\beta = 0.67, p = .03$) compared to the baseline condition. Girl's persistence in the science game did not differ between the dedication and the brilliance condition ($\beta = 0.03, p = .99$). Boys' persistence was equivalent across all 3 conditions ($ps > .40$). These results suggest that girls benefitted from pretending to be a scientist, regardless of whether the scientist was described as hardworking or brilliant. In Study 2, 4- to 7-yo girls (planned N = 120) were asked to play a different science game, in which they made predictions about whether putting different objects in a circuit would make a bulb light up. Girls in the baseline condition did not receive additional information. Girls in the gender-matched condition pretended to be a female scientist, whereas girls in the gender-mismatched condition pretended to be a male scientist. Preliminary results suggest that pretending to be a female scientist, but not a male scientist, is effective in boosting girls' persistence in the science game. Our findings highlight the importance of using pretend play to promote girls' persistence in science. Notably, asking girls to be a female scientist, but not a male scientist, may help girls to identify with scientists and boost their engagement in science.

S3.4.5 - Relationships between children's and adults' explanatory tendencies and science identity

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Details

Children tend to be more excited and interested in science earlier in life (Lei et al., 2019), even though their scientific knowledge grows with age. Feelings of belonging in science (i.e., science identity) are impacted over the lifespan by multiple identity factors, including how science is discussed in classrooms during childhood (Rhodes et al., 2020) and the development of stereotypes about the kinds of people who belong in science workspaces (Cheryan et al., 2009). Across 2 studies, we ask how science cognition is influenced by science identity. Specifically, we explore children's and adults' tendencies to spontaneously respond to questions about non-living natural phenomena with scientifically normative forms of explanation (i.e. causal explanations) and whether they are influenced by their feelings of belonging in science (self-science identity) and their beliefs about how much others perceive them to belong in science (other-science identity). Study 1 ($N = 296$, $M = 39.58$, age range = 18-95 years, 141 women) was conducted on Prolific to recruit a general adult sample. Then, to better understand the development of the tendency to provide causal explanations, Study 2 ($N = 145$, $M = 20.37$ years, age range = 5-68 years, 76 women/girls) was run at a science museum to recruit a broad age range within a potentially more science-focused sample. We assessed participants' causal explanatory tendencies using their responses to 3 open-ended questions about non-living natural phenomena and their self- and other-science identity based on Likert scale ratings. Preliminary findings indicate that in Study 1, despite a quite broad adult age range, there was no relationship between age and causal explanatory tendencies, with participants at all ages being highly likely to provide causal explanations to questions about non-living natural phenomena. However, in Study 2, in the science museum sample that included children, we found lower tendencies to generate causal explanations ($t(157.73) = -8.71$, $p < 0.05$) where age positively predicted causal explanatory tendencies $R^2 = 0.04$, $F(1, 134) = 5.49$, $p < 0.05$. Importantly, in both studies, both science identity measures predicted tendencies to spontaneously produce causal explanations, and these relationships were bi-directional. In Study 1, self-identity: $R^2 = 0.02$, $F(1, 287) = 4.72$, $p < 0.05$; other-science-identity: $R^2 = 0.03$, $F(1, 286) = 9.165$, $p < 0.05$, and in Study 2, self-science identity: $R^2 = 0.05$, $F(1, 134) = 6.95$, $p < 0.05$; other-science identity, $R^2 = 0.06$, $F(1, 130) = 7.72$, $p < 0.05$. Thus, participants in both a general and science-museum sample tended to provide more scientifically normative explanations about physical natural phenomena when they felt greater personal and perceived belonging in science. Given the probability of interrelationships between these variables, we plan to probe these preliminary results further using modeling techniques. However, these results demonstrate that science cognition is multifaceted and complex. These results demonstrate that science cognition - in this case, causal explanatory tendencies - is influenced by factors above and beyond development. If science is more inclusive, individuals may engage with it in more scientifically normative ways.

S4.1.1 - Cross-cultural and cross-linguistic trends in relational ability using the Relational Match-to-Sample task

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Summary

Human's ability to engage in relational learning and reasoning far exceeds that of other species and is a major contributor to our cognitive expertise. It is therefore critical to examine the factors that influence the development of this ability. The papers in this symposium detail three projects that investigate the effects of culture and language on preschoolers' relational task performance. All three papers use the same task: the Relational Match-to-Sample (RMTS) task, a classic test of relational ability. Paper 1 examines the role of language in the performance of children in the US. Paper 2 examines factors that influence RMTS performance among Turkish children. Paper 3 compares performance of children in the US and China. Our discussant is an expert in the development of relational reasoning. Together, these papers highlight effects of culture and language on relational ability.

S4.1.2 - Relational insight in preschoolers: does language matter?

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Details

Relational ability—the ability to notice and transfer relations across different situations—is a key component of higher-order cognition (Gentner, 2003, 2010; Goldwater & Schalk, 2016; Penn et al., 2008). Relational ability is critical for success in mathematics and science (Goldwater & Schalk, 2016; Richland & Simms, 2015). Therefore, it is important to understand its development in humans and the factors that facilitate or hinder this ability. One factor that has been found to facilitate relational insight is relational language (e.g., Christie & Gentner, 2014).

In two studies, we examine the performance of preschool children on a classic task of relational ability: the Relational Match-to-Sample task (RMTS; Premack, 1983). Unlike the Match-to-Sample task (Given X, choose X over Y), the RMTS task (Given AA, choose XX over YZ; given BC, choose YZ over XX) requires a mental representation of the relations *same* and *different*. In both studies, we sought to clarify (1) the age at which children pass the unaided RMTS task and (2) whether knowledge of relational language predicts success.

Developmental trajectory. Previous studies examining U.S. children's performance on the RMTS task have found mixed results. There is general agreement that children below the age of 4 fail the RMTS task unless given additional support. However, the age at which children succeed is unclear. Christie & Gentner (2014) found success at 4.5 years with stimuli that only tested the *same* relation; however, two studies using the full (*same* and *different*) RMTS task found that children did not succeed until 5.5 years (Hochmann et al., 2017; Kroupin & Carey, 2022). Therefore, one goal of the current studies was to establish a baseline age at which children spontaneously succeed on the RMTS task. To do so, Experiment 1 tested 79 4.5-year-old children in the US on all three conditions: *same*-only ($n = 26$),

different-only ($n = 26$), and *full* (half *same* and half *different*) ($n = 27$). Children chose the relational match at above-chance levels in each of the three conditions (all p 's $< .03$)—suggesting that the age of success is 4.5 years.

Experiment 2 was motivated by the findings of Kroupin and Carey (2022). Using horizontal stimulus pairs (instead of vertical pairs as in Christie & Gentner (2014) and our Experiment 1), they found that 4.5-year-olds failed the RMTS task. Therefore, in Experiment 2, we tested 31 4.5-year-old US children on the full RMTS task using horizontal pairs. As in Experiment 1, children chose the relational match at above-chance levels ($p < .001$).

Relational language. Prior findings have suggested that having symbols for *same* and *different* contributes to performance on the RMTS task (Christie & Gentner, 2014; Hochmann et al., 2017). To test this possibility, after the 8 RMTS trials were complete, we asked children to explain their choices for the last two trials (following Hochmann et al., 2017). In both studies, children who justified their responses with relational language were more likely to succeed on the task (Experiment 1, $b = 21.76$, $CI = [8.79, 34.72]$, $p = .001$; Experiment 2, $b = 36.98$, $CI = [22.24, 51.72]$, $p < .001$).

Overall, we find that children can pass the RMTS task by 4.5 years of age and that the spontaneous use of relational terms is predictive of success on the task. We discuss factors that could have led to the different findings in different labs and consider the implications of these findings across cultures and languages.

S4.1.3 - Sources of variation in preschoolers' relational reasoning: the interaction between language use and working memory

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Details

Western preschoolers fail to match two cards based on the sameness relation in the relational match-to-sample task (RMTS; Christie & Gentner, 2014). This failure was not observed in East Asian children (Carstensen et al., 2019). This difference can originate from the cultural differences in attention allocation towards inter-object relations vs. individual objects (Christie et al., 2020). These attention allocation styles might also differ across individuals within a single culture. Our previous study found that basic objects (e.g., triangles, squares) enhanced children's performance in the RMTS; however, children who uttered object property words during the RMTS continued to fail (Esmer et al., 2023). Thus, some children, even in an easy RMTS version, persist in prioritizing object properties and continue failing. However, these results do not imply that children who succeeded in the RMTS disregarded object properties at all. The present study followed up on the previous one by asking whether object-focused children succeeded in the RMTS and what roles other cognitive resources (e.g., working memory) play in object-focused children's RMTS performance. We expected that object-focused children would need working memory) to succeed in the RMTS.

We collected data from 41 Turkish-learning preschoolers ($Mage=59.01$ months, $SD=6.41$). We used an RMTS version testing only the sameness relation with simple objects. To measure children's object vs.

relational focus, we used a scene description task where children described eight short videos. These videos involved two dynamic objects: one was located centrally in the scene and the other in the periphery. Each scene had different dynamic objects moving in front of different backgrounds. We coded children's use of object-focused (object names) vs. relational (verbs, prepositions) words. We also coded focal vs. background descriptions based on Imada et al. (2013). Last, we measured children's working memory with a backward word span task to investigate whether it is utilized similarly across children with differential object focus.

First, our sample performed above chance in the RMTS ($M=.695$, $SD=.235$). Next, we conducted four glmer models to test the relations between RMTS performance, working memory, and children's scene descriptions. The performance in RMTS was negatively related to relational word use ($b = -.480$, $SE=.210$, $p=.022$) and children's background descriptions ($b = -.636$, $SE=.256$, $p=.013$). Moreover, working memory and RMTS were associated more strongly for children who used relational language less frequently ($b = -.475$, $SE=.201$, $p=.018$). Finally, working memory and RMTS were more strongly associated for children who used less object-focused descriptions ($b = -.527$, $SE=.227$, $p=.020$).

Our results revealed that children with an object focus (as indexed by less frequent relational language use) could rely on their working memory to succeed in the RMTS. The background vs. focal description use might not indicate object vs. relational focus; rather, it might signal whether a child focuses on the central information presented in a task. Thus, object-focused and relation-focused children could differ in their cognitive resources used to solve RMTS beyond their performance levels in the RMTS.

S4.1.4 - Cognitive diversity in context: US-China developmental trajectories on four tasks over early and middle childhood

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Details

This project investigates cross-cultural variation in the phenomenon of the “relational shift,” in which early learners shift from an initial focus on concrete object features to abstract relations. Previous work suggests that the “relational shift” view of cognition reflects a sampling bias in existing research, and shows that the development of abstract reasoning follows qualitatively different trajectories in the US and China, depending upon the learning context (Carstensen et al., 2019). The causal mechanisms for these differences are unknown, but a range of accounts have been proposed. These accounts implicate several potential factors that differ between the US and China, including language (Hoyos et al., 2016), executive function (Richland et al., 2010), visual attention (Christie et al., 2020), and social reasoning (Jurkat et al., 2022). While there is extensive work documenting differences in both language and executive function in US and Chinese children, much less is known about the development of cross-cultural variation in visual attention and social reasoning. The current research begins to address this empirical gap by measuring performance on tasks of visual attention and social reasoning over a broad developmental window, in children aged 3 to 12 years, from the US and China.

We document abstract reasoning about relations (Ambiguous cRMTS, Carstensen et al., 2019) alongside the potential moderating factors of visual attention (Free Description) and social reasoning (Causal Attribution, Uniqueness Preference) in a cross-sectional sample of 3-12-year-olds, with 120 children in the United States and 120 in China. Previous work has documented cross-cultural differences in adult performance in each of these paradigms. Specifically, adults from Western cultures show a tendency to remember and emphasize focal information compared to their counterparts in East Asia, who (1) more often describe relational and background information in naturalistic scenes in Free Description (Masuda & Nisbett, 2001), (2) place importance on contextual factors like resource availability in addition to personal factors like temperament in Causal Attribution (Morris & Peng, 1994), and (3) demonstrate a stronger preference for harmony when choosing between unique and non-unique objects in Uniqueness Preference (Kim & Markus, 1999). Our study uses the child-friendly Free Description paradigm from Imada et al. (2013), a developmental version of the Causal Attribution task created by Seiver et al. (2013), and a novel adaptation of Kim and Markus' (1999) Uniqueness Preference paradigm. All tasks were re-developed for experimenter-led online administration (e.g., via Zoom, with stimuli presented through a shared webpage).

Preliminary results ($n=222$, 18 remaining), show similarities and differences in performance between children in these countries. Performance in our study is consistent with previously reported differences in relational reasoning in the youngest children (in Ambiguous cRMTS), with older children converging toward adult performance, which does not differ across cultures. The clearest cultural differences were observed in the social paradigms (Causal Attribution and Uniqueness Preference), suggesting that cross-cultural variation between children in the US and China in middle childhood may be most robust in the social domain.

S4.1.5 - Development of attention in two cultures: the role of caregiver-child interaction

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Details

Visual attention plays an important role in social and cognitive development. Traditionally, developmental research has predominantly focused on documenting age-related changes from participants living in Western, Educated, Industrialized, Rich, and Democratic (WEIRD) cultures (Henrich et al., 2010; Nielsen & Haun, 2016). Furthermore, the biological or maturation explanations of child development, instead of social contexts shaping child development, are still dominant in the current literature. Despite the widespread interest in understanding the mechanisms of development, the current literature focusing on change remains limited (Gauvain, 2002; Miller, 1993; Siegler, 1996). Cultural analyses can elucidate a nuanced and comprehensive understanding of cognitive development by examining the diverse social contexts in which development occurs (Keller, 2017; Miller, 1997; Rogoff, 2003; Wang, 2017). In the present research, we focus on changes in children's attention in two cultures, with an emphasis on the constitutive role of collective meanings in culturally variable psychological processes. We attempt to connect the narratives constructed during caregiver-child interaction (i.e., learning episodes) to the precise changes in children's attention.

Study 1 examined the role of caregiver-child narrative construction on the development of visual attention among 3- to 4-year-old children in the United States (predominantly non-Hispanic Whites) and Japan (predominantly Asian) (N = 60 mother-child dyads, 29 girls, 31 boys). The findings revealed that caregivers directed children's attention to culturally sensitive information, with U.S. caregivers focused mostly on objects and their properties such as color and shape (e.g., "There is a rabbit. He has large ears that are pink."), while Japanese caregivers focused on interactions among objects (e.g., "The rabbit is saying hello to the mouse."). Patterns of gaze fixations were measured via an eye-tracker, and cross-cultural differences in attention emerged only after interacting with caregivers. Specifically, the Japanese children shifted their attention to both objects and backgrounds after they interacted with their caregivers. Furthermore, caregivers' narratives related to social interactions among objects, and not the object-oriented narratives, mediated cross-cultural differences in visual attention measured via an eye-tracker.

In Study 2, we examined the socialization practice of moral development in 3- to 4-year-old children and their parents in the U.S. and Japan. Children and parents watched emotion-laden scenarios, in which two cartoon characters engaged in prosocial or antisocial actions. We also analyzed socialization practices in the child-caregiver dyads (N = 57). The results indicated that US caregivers cued children to attend to the agent (e.g., actor of prosocial or antisocial actions), while Japanese caregivers cued children to attend to emotion of the victim.

We will discuss the role of narratives and the construction of collective meanings in understanding cultural differences in the development of attention in young children.

S4.2.1 - Money talks, and children listen: investigations into how developing minds think and talk about wealth, social status, and money

Richard Ahl¹

¹ Boston College

Summary

Our symposium illuminates how American children think and talk about wealth, social status, and money in middle childhood, a pressing topic in a society with high economic inequality. Paper 1 finds that children deem wealth obtained via inheritance and luck as less deserved than wealth via merit. Paper 2 shows that children readily infer wealth and status from adults' occupational attire and endorse intrinsic explanations for wealth. Paper 3 finds that children's spending orientations relate to actual spending behavior and parental conversations about money. Paper 4 shows that children increasingly endorse the dishonest concealment of wealth with age, indicating a reluctance to openly discussing wealth with peers. Our papers indicate that even young children are perceptive regarding wealth and money and progress towards adult-like beliefs and behaviors across childhood.

S4.2.2 - Who deserves to be rich?: Children's and adults' judgments of the wealthy

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Details

Economic inequality across and within various societies is an undeniable reality (World Inequality Lab, 2022). This disparity not only impacts people's lives but also shapes their perceptions of other individuals. From a young age, people are sensitive to signs of wealth (Shutts et al., 2016), and assume that wealthy individuals possess distinct characteristics compared to those who are not financially well-off (Sigelman, 2013). Here we examined the development of these biases and tested whether they are influenced by the origins of wealth.

We investigated how 5-12 year-olds ($N = 120$) and adults ($N = 154$, also replicated with a representative sample of 297 adults) evaluate the deservingness of wealth acquired through various means, and whether their perceptions of rich people change based on the sources of wealth. We introduced participants to novel characters who acquired wealth via different means: merit, inheritance, luck, or theft, or unexplained. The results indicated that while both children and adults believed that the character who acquired wealth through merit deserved it the most (on a 5-point scale, children: $M = 4.88$, $SD = .57$, adults: $M = 4.54$, $SD = .90$, $ps > .001$), and the one who stole the money deserved it the least (children: $M = .42$, $SD = 1.23$, adults: $M = .29$, $SD = .94$, $ps > .001$), their opinions on inheritance and luck differed. Adults perceived wealth obtained through lottery (i.e., luck) ($M = 3.77$, $SD = 1.22$) as more deserved than inherited wealth ($M = 2.76$, $SD = 1.57$) ($p > .001$), but children did not differentiate the luck ($M = 3.57$, $SD = 1.64$) and inheritance ($M = 3.21$, $SD = 1.61$) ($p = .140$) conditions. Politically conservative adult participants ($t(743) = 6.59$, $p < .001$) and children with politically conservative parents ($t(442) = 3.03$, $p = 0.003$) gave overall higher deservingness judgments (although this effect was stronger in the unexplained wealth condition).

The origin of wealth also affected the way how children and adults perceived these rich characters. Both children and adults believed the character in the merit condition was the most competent (children: $M = 4.60$, $SD = .75$, adults: $M = 4.04$, $SD = .88$, $ps > .001$) and the warmest (children: $M = 4.43$, $SD = .68$, adults: $M = 3.52$, $SD = .88$, $ps > .001$). Children did not distinguish between the luck and inheritance conditions for competence or warmth judgments ($ps > .573$). Adults believed that the character who won the money in lottery was warmer ($M = 3.19$, $SD = .65$) than the one who inherited their wealth ($M = 2.85$, $SD = .88$, $p = .002$), but they did not differentiate their competence ($p = .916$).

These findings shed light on how judgments of wealth deservingness change across development, particularly providing insights into less-studied aspects of wealth, such as inheritance. We believe these findings will be helpful in understanding how children and adults navigate conversations around wealth and economic inequalities.

S4.2.2 - American children's inferences of wealth and occupational status: an early- emerging endorsement of the myth of meritocracy

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Details

In the United States, adults readily use occupational attire to draw inferences about wealth and social status. Here, across a geographically and racially diverse sample of 5 to 9-year-old American children (n = 159; Mage = 7.44 years; 51.6% female, 47.2% male, 1.2% nonconforming or not provided; 59.1% White, 23.3% racial-ethnic minority, 17.6% not provided) we find that children also do so. In an exploratory, synchronous study administered via Zoom, we asked children to infer whether men or women in business or janitorial attire would also exhibit stereotypically higher (live in a larger house, have a newer phone, are the boss) or lower (live in a small house, have an older phone, work for others) status characteristics, and whether these characteristics were due to intrinsic or extrinsic factors (e.g., do you think this person has a lot of money because their parents had a lot of money too?). By age 5, children reliably believe that people in business suits are resource-rich and powerful ($F(1,401) = 362.33, p < .001$). Further, older children not only share this belief ($t(362) = 3.29, p = .001$) but also believe that people in janitorial clothes are poorer and less powerful ($t(362) = -6.76, p < .001$). Additionally, when explaining why some people have more or less wealth than others, children endorsed intrinsic (e.g., s/he works hard/not hard, s/he's really smart/not that smart) (M highwealth = 0.75, SE highwealth = 0.29; M lowwealth = 0.32, SE lowwealth = 0.32) over extrinsic factors (e.g., their family is wealthy/not wealthy, s/he's lucky, unlucky) (M highwealth = 0.29, SE highwealth = 0.36; M lowwealth = 0.29, SE lowwealth = 0.32). This suggests that children endorse a meritocratic view when explaining someone's high (Wilcoxon $V = 1545, p < .001$) or low wealth (Wilcoxon $V = 24, p = .007$). This pattern of causal explanations for wealth remained consistent across early childhood. Additionally, we investigated whether children would consider intersectional identities when making their inferences. In preliminary results, we find that children are more likely to explain high-status or wealth in extrinsic terms when reasoning about women than when reasoning about men. Our findings suggest that although younger American children (~5 years) believe that individuals in high-status occupational attire will also exhibit other trappings of wealth, they seem temporarily buffered against assuming those in stereotypically lower-status occupational attire will not be wealthy; however, older children readily make this latter inference as well. This age-related difference in inferences may allow educators a brief window of opportunity to teach young children to be aware of potentially negative stereotypes towards poorer individuals before they are ingrained, especially since children appear to endorse the myth of meritocracy over structural inequalities when explaining a person's wealth, particularly for lower status social groups. We hope this knowledge allows educators to be confident to speak to children at a young age about the systemic barriers that often cause inequality. Future work should continue to investigate these patterns to inform targeted interventions that can help eradicate these early emerging, wealth-based stereotypes for a fairer and more equitable world.

S4.2.4 - Exploring relations among child spending orientations, parent-child talk about money, and child spending

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Details

Adults differ in the degree to which they experience the “pain of paying” when spending money. More precisely, work in this area identifies three affective spending orientations: spendthrifts, tightwads, and unconflicted spenders, as assessed via the Spendthrift-Tightwad Scale (ST-TW) (Rick et al., 2008). Spendthrifts experience too little pain and spend more than they would ideally like; tightwads experience too much pain and spend less than they would ideally like. Unconflicted consumers spend about as much as they would like. Spendthrifts and tightwads are both unhappy about their spending, but spendthrifts tend to carry more credit card debt and have less saved than tightwads (Rick et al., 2008). Given the financial implications and unhappiness associated with these orientations, we sought to explore their developmental origins, by examining whether children’s own “pain of paying” relates to their spending behaviors and parent-child talk about money.

We recruited 208 children aged 5-10 years ($M=7.99$; 102 boys, 106 girls) and their parents. Children completed a child-adapted ST-TW Scale (Smith et al., 2018). The scale presents pairs of statements (e.g., *I like saving money vs. I like buying new things*) and asks children to indicate which statement best reflects their feelings. Children and parents then read and discussed a book we designed covering money-related topics (e.g., saving, spending, borrowing). Lastly, children received \$2.00 in quarters, any of which they could save or spend independently (without adult supervision) in a small lab “store” that included toys of various prices available for purchase.

First, we tested whether children’s ST-TW scores predicted the amount they spent in the store, adjusting for age, gender, and liking of the store items, and they did, $B=.18$ $t=2.50$, $p=.013$; the other measures offered no predictive utility ($ps>.37$). Second, we tested relations between parent-child talk about money and children’s spending behavior. Children who reported that book characters should spend more, spent more in the store themselves, $r(194)=-.20$, $p=.004$. Thus, not only have children developed feelings about spending and saving by age 5, how they talk about money-related behaviors relates to what they do with it. Moreover, children whose parents engaged in discussions about spending spent less in the store ($M(\text{discuss})=.84$ vs. $M(\text{no discuss})=1.03$), $t(198)=2.08$, $p=.039$, suggesting that avoiding talking about spending can backfire and lead to higher rates of spending among children.

Eighty-five children returned 1-3 years after their initial visit to complete the child ST-TW scale again. Results revealed that children’s scores at Time 1 and Time 2 were moderately correlated, $r(83)=-.41$, $p<.001$. Interestingly, then, children’s orientations seem to be relatively stable during a period of great cognitive change.

Taken together, these findings reveal that children have early and stable orientations toward spending and saving that relate to parental talk about money with them. This suggests that the roots of ST-TW orientations begin at an early age, well before children have much financial literacy, and demonstrates the importance of parent-child conversations about money. Indeed, it is precisely these parent-child

conversations that may prove beneficial toward promoting financial inclusion among economically vulnerable families.

S4.2.5 - Children increasingly endorse the dishonest concealment of wealth across development

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Details

The United States has high levels of wealth inequality. Wealthy adults in this context often choose to minimize wealth differences by dishonestly concealing their wealth in social settings (Sherman, 2017). How might children view such actions? Prior work shows that children in middle childhood are often averse to interpersonal inequality (Blake & McAuliffe, 2011), can detect wealth cues (Shutts et al., 2016), and develop awareness of their family's wealth (Peretz-Lange et al., 2022); thus, children are likely sensitive to situations involving wealth differences. With age, children are increasingly likely to assign positive ratings to "prosocial" lies, which shield recipients from negative emotions (Popliger et al., 2011). We investigated how children view dishonestly "underreporting" wealth. We predicted that, with age, children would be more likely to evaluate it favorably.

Participants ($N = 80$; 37 "younger," ages 6 through 8; 43 "older," ages 9 through 11) heard four illustrated stories, presented in counter-balanced order. The stories depicted children who honestly report getting an expensive present (honest: expensive), got an expensive present but dishonestly report an inexpensive present (underreport), honestly report an inexpensive present (honest: inexpensive), or dishonestly report an expensive present (overreport). For instance, in "underreport," the focal child's friend asks them about their birthday present. The child got an iPad (expensive) but reports an etch-a-sketch (inexpensive). Participants used 6-point scales to rate the "niceness" and then "rightness" of the child's action along with how it would make their friend feel ("feelings"). Our predictions focused on the contrast of the underreport and honest: expensive stories. We predicted that, relative to younger children, older children would be likelier to rate underreporting as more nice, more right, and producing more positive feelings than honest reporting.

Our linear mixed models tested the effects of age group and story on ratings for the "expensive" story types. As predicted, for "niceness," the age by story interaction was significant, $B = -1.67$, $SE = .42$, $p < .001$. Younger children assigned "meaner" ratings to underreporting than honesty, $B = 2.11$, $SE = .31$, $p < .001$. In contrast, the effect of story type in older children was not significant, $B = .44$, $SE = .29$, $p = .13$. Also, older children rated underreporting as "nicer" than younger children ($p = .001$). Similar effects were seen for "rightness" (e.g., older children rated underreporting as more "right" than younger children, $B = .85$, $SE = .27$, $p = .002$). For "feelings," however, there were no significant age effects, $B = -.5$, $SE = .34$, $p = .12$, and both age groups assigned positive ratings to underreporting. Thus, both age groups view underreporting as making others feel better, but older children evaluated underreporting as nicer and more right than younger children.

Older children viewed hiding one's wealth as "nicer" than younger children and may deem such wealth concealment to be "prosocial" dishonesty. Dishonesty in this domain may lead to fewer "hurt feelings"

but obscures the true existence of wealth inequality. Our findings suggest that, with age, children may be less likely to honestly discuss material wealth with peers.

S4.3.1 - Unlocking potential: new insights into motivational factors shaping children's achievement behaviors

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Summary

What motivates children to embrace challenges and persist? This set of talks presents new evidence on cognitive and psychosocial factors that influence young children's achievement motivation. Talks 1 and 2 explore belief correlates of children's mastery-oriented behavior—focusing in particular on children's beliefs about the nature of intellectual ability and beliefs about what is possible, respectively. Talk 3 addresses social determinants of children's mastery-oriented behavior by examining the impact of congruence between adults' expressed and behavioral valuation of effort. Finally, Talk 4 considers how even minimal significance of their work affects children's motivation. Together, these talks illustrate the importance of beliefs about ability and possibility, as well alignment between words and actions from adults, and task significance for even very young children's motivation.

S4.3.2 - The development and consequences of beliefs about intellectual ability in early childhood

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Details

Beliefs about the nature of intellectual ability play a key role in students' motivation and achievement. Relevant beliefs include those concerning the stability of intellectual ability, its responsiveness to effort, its universality, origins, and its importance for success in school. The goal of the present research was (a) to examine developmental change in these beliefs across the elementary-school years and (b) to evaluate the relation between children's beliefs and their motivation.

Five- to 11-year-old children ($n = 107$; 51 girls; $M_{\text{age}} = 8.84$) recruited from the US and Canada rated their agreement with statements that concerned five properties of intellectual ability. Statements concerning the stability dimension queried children's beliefs about the degree to which intellectual ability can change; the responsiveness-to-effort dimension queried children's beliefs about whether intellectual ability increases in response to concentrated practice and effort; the universality dimension queried

children's beliefs about the exclusivity of high intellectual ability; the origins dimension queried children's beliefs about the innateness of intellectual ability; and the importance-for-success dimension queried children's beliefs about whether high intellectual ability is a precondition for success in school. Responses to each of the measures were coded such that higher values reflected more adaptive beliefs: i.e., that ability is unstable, responsive to effort, universal, acquired, and not a precondition for school success. We measured challenge-seeking behavior (a key component of motivation and learning) by asking children to indicate their preferred difficulty level for a puzzle (1 = "really easy" to 6 = "really hard").

Overall, children thought that intellectual ability was unstable ($M = 3.04$ [possible range = 1-4], $p < .001$ vs. the midpoint), responsive to effort ($M = 5.04$ [possible range = 1-6], $p < .001$), universal ($M = 3.01$ [possible range = 1-4], $p < .001$), acquired ($M = 3.21$ [possible range = 1-4], $p < .001$) and not a precondition for school success ($M = 2.97$ [possible range = 1-4], $p < .001$). Compared to younger children, older children viewed intellectual ability to be more unstable ($r = .41$, $p < .001$), more responsive to effort ($r = .21$, $p = .039$), less innate ($r = .33$, $p < .001$), and less central for success in school ($r = .52$, $p < .001$). Beliefs about intellectual ability's universality did not change with age ($p = .30$). The five dimensions were modestly correlated with one another (average $r = .20$).

S4.3.3 - Action possibilities and mastery motivation in early childhood

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Details

Our intuitive theories of competence, intelligence, and self-efficacy have a direct influence on motivation. To date, there has been no systematic investigation of the development of similar self-beliefs in early childhood. This gap is likely due to a dominant view that young children are unrealistically overconfident in their abilities (Wigfeld & Eccels, 2000, Plumert, 1995) and is not until late in middle childhood or early in adolescence that self-beliefs impact motivation (Dweck, 2017).

A challenge to this view stems from a growing literature on possibility beliefs, which start low and increase across childhood (Shtulman & Carey, 2007; Lane et al, Kushnir et al, 2015). If questions are possibility-focused (e.g. "*Even if X is hard, can you choose to do X?*") rather than trait-focused (e.g. "*How good are you at X?*", e.g. Wigfeld & Eccels, 2000) young children may more easily articulate realistic views about themselves. We explore this hypothesis, and links to motivation, in two cultural contexts that vary in their emphasis on internal vs external motives for action (e.g. Zhao et al, 2021) - a mostly white middle-class sample of children in the US, and sample of middle-class ethnically Chinese children in Singapore.

Four- to 9-year-old children in the US ($N = 121$, $M = 6.9$, $SD = 1.75$, 59 girls) and in Singapore ($N = 100$, $M = 7.0$, $SD = 1.85$, 51 girls) participated. Children first completed a standard one-item puzzle choice task to assess Mastery Orientation ("MO" e.g. Murgadoglu et al, 2022) then completed an 8-item possibility

scale (items counterbalanced). In four *Achievement Possibility Items* children were asked how hard it would be to complete one of four academic tasks (math, reading, puzzles, mazes), then were asked the possibility question (e.g. “*Even though it’s hard, can you choose to do X anyway*”). In four *Desire Possibility Items* children were asked to name something that they liked/disliked then asked the possibility question (e.g. “*Even though it’s scary, can you choose to do X anyway*”). Affirmative responses were summed for a total Achievement Possibility score and Desire Possibility score (each out of 4).

A linear regression showed that children’s beliefs about Achievement Possibility started low and increased with age ($B = 0.31$, 95% CI = [0.20, 0.41], $p < .001$), with no cultural differences or interactions. Replicating past work (Zhao et al, 2021), children’s Desire Possibility beliefs also started low and increased with age ($B = 0.22$, 95% CI = [0.14, 0.30], $p < .001$) and US kids reported more possibility of acting against desires than Singaporean kids ($B = 0.85$, 95% CI = [0.58, 1.13], $p < .001$).

A logistic regression with Mastery Orientation as the dependent variable and Total Possibility Score (out of 8), age, culture, and the interactions as predictors showed that MO increased with age ($OR = 1.90$, 95% CI = [1.53, 2.38], $p < .001$) and was similar in both cultures. Importantly, accounting for age and culture, children with greater possibility beliefs were more likely to have high MO ($OR = 1.23$, 95% CI = [1.01, 1.51], $p = .039$, see Figure 1).

In sum, we found that young US and Singaporean children are realistic about their abilities, that possibility beliefs increase in childhood, and that individual children who have higher possibility beliefs are more likely to be mastery motivated. A focus on action possibilities may be important early on for encouraging children to try and persist. Questions remain about whether beliefs about action possibility form the basis of later self-efficacy.

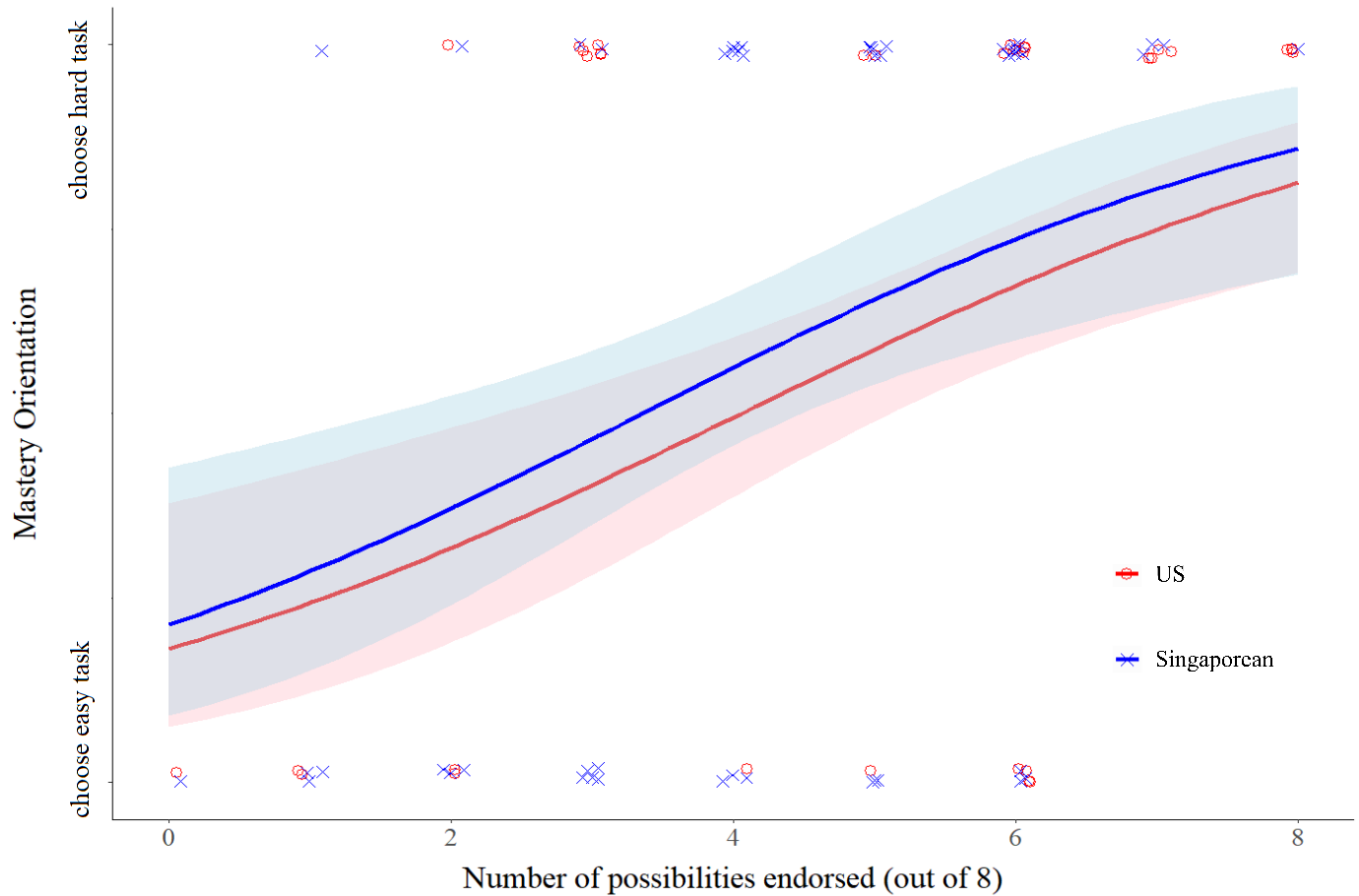


Figure 1: Children’s choice in a 1-item Mastery Orientation measure as a function of the number of possibilities they endorsed for doing things that they stated were either hard for them or undesirable (out of 8). *Note: follow-up analyses confirmed that this effect held when each domain (Desire and Achievement) was considered separately, all p ’s < .05.*

S4.3.4 - Practice what you preach: consistent messages about the value of effort boost children's persistence

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Details

Children are sensitive to messages emphasizing the value of their effort and show enhanced academic outcomes as well as higher intrinsic motivation for learning when they value effort over achievement (Yeager & Dweck, 2012). Despite the focus on rewarding effort in both informal and formal educational settings, the reality is that most evaluation frameworks continue to reward achievement (Harlen & Crick, 2002; Schinske & Tanner, 2014). Past work indicates that mixed messages about the value of effort from verbal input and grading schemes may underlie the failure of growth mindset interventions in academic contexts (Hecht et al., 2022; Walton & Yeager, 2020). However, it is unclear how contradictory messages

about the value of effort (e.g., praising effort but rewarding achievement) influence children's motivation.

Here, we explore how mixed messages about the value of effort impact 4-to-5-year-olds' persistence across tasks ($n = 54$; $M_{AGE} = 4.96$ years, range: 4.06 – 5.93 years; 26 girls). We focus on preschool-age children to examine how reasoning about effort develops through a naïve lens rather than studying those who have already conformed to the systematic reward structures present in the formal education system. Participants were randomly assigned to receive consistent or inconsistent messages about the value of effort. In both conditions, the experimenter first talked to participants about the importance of effort in everyday life. Then, children were told that they would either receive rewards (stickers) based on trying time (effort-consistent) or task performance (effort-inconsistent) across four trials of visual search tasks (iSpy). Persistence (trying time) was measured both during the iSpy trials as well as on a second, novel task (impossible puzzle box) to assess whether effects would transfer when no rewards were offered. Specifically, this second task allowed us to test whether these mixed messages play a role in shaping children's broader beliefs about the efficacy of their persistence in solving challenging problems.

We found that children persisted more when they received effort-consistent messages. Although trying time decreased across iSpy trials in all conditions ($\chi^2(1, N = 54) = 19.07, p < .001$), children on average, spent more time on the iSpy games in the effort-consistent condition than in the effort-inconsistent condition (Figure 2A; $\chi^2(1, N = 54) = 6.33, p = .01$). Similarly, children in the effort-consistent condition persisted more in the transfer task when compared to those in the effort-inconsistent condition (Figure 2B; $W = 237.5, p = .02$). Importantly, children's trust ratings of the experimenter did not differ by condition ($W = 283, p = .48$), suggesting that children's decreased persistence in the effort-inconsistent condition was not simply due to increased skepticism about the solvability of the tasks.

This work provides initial evidence that verbal messages about the value of effort lose efficacy once children are in environments that reward performance. In this sense, tangible rewards may speak louder than words not just on the rewarded task, but more importantly, in novel learning experiences. Ultimately, these results should inspire future caregiving and pedagogical practices to more effectively cultivate contexts that support motivation towards lifelong learning.

S4.3.5 - Minimal but meaningful: Even minimal significance matters for children's motivation

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Details

Humans have a need for meaning. We are repelled by meaningless existence, like the enduring image of Sisyphus, who repetitively expends effort yielding nothing of lasting significance. To have feelings of meaning in life, we need to pursue work and activities with significance--the sense that something matters beyond the trivial or momentary (Martela & Steger, 2016). Is there an early emerging sensitivity toward (the absence of) significance in our activities? Motivated by this question, across five preregistered studies (total $N = 725$ 4-9-year-old children and 586

adults), we examined how activities without significance vs. with minimal significance affected children's motivation to engage in productive activities.

In Study 1, children were presented with two games putting together puzzles. One game lacked significance (their work would be taken apart, coded as 0), while the other had minimal significance (their work would be kept, coded as 1). Children were randomly assigned to play these games in two contexts: repetitively or for one round. Binomial tests indicated that, compared to the game without significance, children across ages were more likely to evaluate the game with minimal significance as better and mattering more ($M = 0.70$, $p < 0.001$). They were also more motivated to play the game with minimal significance ($M = 0.79$, $p < 0.001$) (Study 2).

Building upon the initial findings, Study 3 revealed that children were more willing to exchange a sticker to create a work but not to watch one being saved, suggesting the boundary effect that minimal significance matters for children's active engagement in productive activities but not for passive observation.

Study 4 further examined how minimal significance would affect children's motivation to initiate productive efforts. When knowing their work would be preserved, most children were motivated to put together a puzzle rather than doing a simpler task of moving the pieces into a bin. However, when children knew their work would be taken apart later, they were much more likely to opt for the effortless simple task.

Finally, Study 5 found that this effect, especially pronounced in adults and to a lesser extent in children, could be mitigated by emphasizing that the primary goal of the activity was to have fun. This suggests that as we mature, we become more motivated to focus on the process when the end result lacks lasting significance.

Taken together, the results suggest that even minimal significance could function as a source of motivation from the earliest stages of life. Recognizing the value in seemingly minor aspects of our existence has implications, not only for fostering productivity during childhood but also for cultivating a life rich in the sense of meaning.

O1.1.1 - Sources of error in numerical estimation: insights from the wisdom of crowds effect

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Details

The average of many estimates is typically more accurate than the most accurate estimate (Galton, 1907; Kahneman et al., 2021; Surowiecki, 2005). This “wisdom of crowds” (WoC) effect can be explained by the law of large numbers: averaging cancels out noise just if estimates are independent and unbiased. Here, we focused on the WoC effect to provide a novel test of whether compression in children’s number-line estimates reflects logarithmic encoding (bias) or uncertainty (noise). Specifically, we compared the accuracy of children’s group estimate with the accuracy of individual adults’ estimates for small (0-30) and large (0-100) numbers. Simulations showed that if children’s errors were solely caused by noise, a large crowd of children would outperform most individual adults. In contrast, if children’s errors were solely caused by bias, a crowd of children - even a very large one - would underperform most individual adults.

In Experiment 1, 80 adults and 80 4- to 7-year-olds were asked to estimate the number of dots on a number line. When estimating 0-30 dots, children’s mean estimates were more accurate than those of 95% of adults’, suggesting that the greatest source of children’s errors was noise. In contrast, when estimating 0-100 dots, a crowd of children outperformed only 55% of adults, suggesting that the greatest source of children’s errors was bias. Crowd size also had a smaller effect on 0-100 ($b = .07$) than 0-30 problems ($b = .39$), again indicating as numbers gain in value bias becomes a larger source of errors.

In Experiment 2, 78 4- to 12-year-olds and 70 adults completed a symbolic number line task, where Arabic numerals were presented instead of dots. When estimating 0-30, a crowd of children was more accurate than 14.29% of adults. On 0-100 number line, a crowd of children outperformed only 5.71% of individual adults. These results suggest that children are more erroneous than adults mostly due to bias in symbolic number representation. To examine age-related changes, we compared a crowd of young children (pre-K and K, $N = 44$) with individual school-aged children ($N = 34$). On 0-30 number lines, a group of young children was more accurate than 70.59% of school-aged children. On 0-100 number line, a group of young children outperformed only 35.35% of school-aged children. Similarly, increasing crowd size of young children had a smaller effect on the 0-100 ($b = .05$) than on the 0-30 problems ($b = .29$), again indicating that bias is a greater source of error than noise as numbers gain in value.

Overall, experimental results provide novel evidence for a logarithmic-to-linear shift occurring for small numbers prior to large numbers. As predicted by simulations, the bias-free WoC effect was strongly evident in children’s estimates of small numbers, whereas no WoC effect was evident in a large numeric range. These results also comport with findings using a more traditional approach for testing a logarithmic-to-linear shift: children’s estimates were more logarithmically compressed than adults’ estimates on 0-30 and 0-100 problems ($b = .90$). Results also underscore that bias and noise co-exist during development, which strongly limits the WoC effect. Thus, rather than the WoC effect reflecting some spooky insight that crowds possess (“vox populi, vox dei”), the WoC effect is better seen as reflecting a development of numerical ability that increasingly conforms to the assumptions of the law of large numbers.

01.1.2 - Quantitative coding of logical relations does not depend on counting

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Details

Cognitive development is often depicted as overcoming concrete thinking and developing logical reasoning. A classical task to assess logical reasoning is the class inclusion task (Piaget, 1952), which asks children about the quantitative implications of class membership. Performance on such problems is often facilitated by use of collection terms that highlight part-whole relations (Markman & Seibert, 1976). An open question is whether this highlighting of part-whole relations facilitates a non-logical, counting solution to the class inclusion problem, and whether part-whole and class reasoning even involve the same cognitive abilities (Campbell, 1991). Unfortunately, significant variations in task features and use of between-participant designs make it impossible to address these issues definitively. Thus, we conducted a systematic comparison to further explore the impact of presentation format on logical reasoning and counting skills over development.

Forty-six 3- to 5-year-olds, 46 6- to 8-year-olds, and 46 adults participated in the study. Each participant completed both a logical reasoning and counting task, where dots were presented either as classes or collections (Figure 1). Note that logical reasoning problems may be solved using subset-set or part-whole relations, without counting, or may be solved merely by counting. In contrast, solutions to counting problems always required exact enumeration.

Consistent with findings on use of collection terms, use of a continuous line to highlight the part-whole relations increased accuracy (OR = 1.70, 95% CI [1.38, 2.08], $p < .001$). Interestingly, we also observed an age by type interaction ($\chi^2(2) = 32.77$, $p < .001$). Specifically, 3- to 5-year-olds performed better with collections than classes, whereas 6- to 8-year-olds performed better with classes than collections. Adults' accuracy was equally high for both. Tellingly, the collection format *reduced* counting accuracy (OR = .79, 95% CI [.70, .90], $p < .001$) despite improving logical reasoning. These results would not be expected if solving logical problems depended on counting accuracy or if the part-whole relations made counting easier.

Consistent with the idea that part-whole and class inclusion reasoning involve overlapping (if not identical) skills, performance with the class and collection formats on the same task (reasoning vs. counting) were highly correlated (r 's = .71-.86, p 's < .001). In contrast, the correlation between reasoning and counting performance within the same format was small to non-existent (r 's = .12 - .32, p 's = .001 - .225). Overall, accuracy in counting did not predict accuracy in logical reasoning (OR = 1.16, 95% CI [.91, 1.48], $p = .230$), indicating a dissociation between logical and numerical reasoning.

Overall, results suggest that ability to solve two variants of class inclusion problems are highly correlated, and neither depends on counting ability. Indeed, the easier variant of the problem elicited *worse* counting performance. More importantly, our results also uncovered a novel developmental pattern: rather than collection reasoning simply being easier than class reasoning, younger children are better at the former than the latter, whereas older children show the reverse pattern. An intriguing implication is that learning to ignore the concrete features of a logical reasoning task blinds older children not just to misleading information, but also to supportive information.

O1.1.3 - Children's notation preferences for fraction and decimal arithmetic

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Details

Rational numbers are represented using multiple notations, including fractions, decimals, and percentages. A possible reason is that each notation serves distinct functions. Consistent with this possibility, a growing body of research has found that each rational number notation is preferred for some tasks (DeWolf et al., 2015; Tian et al., 2020). For example, adults convert fraction addition problems into decimal form more than vice versa, but convert decimal multiplication problems into fraction form more than vice versa, thus revealing preferences to use decimals for addition and fractions for multiplication (Authors).

The present study tested whether children display explicit preferences analogous to adults' revealed preferences described above. Fifth to eighth grade children in the USA (Experiment 1) and China (Experiment 2) were presented pairs of equivalent fraction and decimal problems involving addition (e.g., $1/4+9/10$, $0.25+0.9$) or multiplication (e.g., $3/4*1/2$, $0.75*0.5$) and were asked which problem they would prefer to solve. Decimals were preferred for most problem pairs involving addition (USA: 73%, China: 74%), and fractions were preferred for most pairs involving multiplication (USA: 55%, China: 53%).

The above preferences are consistent with two theoretical accounts. First, Semantic Alignment Theory (Bassok et al., 1998) suggests that notation preferences may reflect differences in semantic alignment between each notation and each arithmetic operation. Decimals may align with addition due to the connections of both with measurement, whereas fractions may align with multiplication due to the connections of both with division. Second, the Strategy Choice Model (Siegler, 1996) suggests that notation preferences may reflect the speed or effort required to execute procedures for each operation in each notation. A rational analysis of these procedures suggested that addition is faster and less effortful with decimals than fractions, whereas the opposite is true for multiplication.

To disambiguate between the above accounts, the studies tested two further predictions that were suggested by the Strategy Choice account and not by the Semantic Alignment account. First, we predicted that notation preferences should be strongest on problem pairs whose operands involve unequal denominator fractions and decimals with unequal numbers of decimal digits. Second, we predicted that when children were asked to solve the problems, accuracies would parallel preferences. That is, accuracy on addition problems should be higher with decimals than fractions, whereas accuracy on multiplication problems should be higher with fractions than decimals. Findings were consistent with both predictions.

The findings demonstrate that children, like adults in prior research, prefer decimals for addition and fractions for multiplication. These preferences are consistent between the USA and China, and are therefore unlikely to reflect idiosyncracies of a particular educational system. Patterns of both preferences and accuracies were more consistent with an explanation based on the Strategy Choice Model rather than Semantic Alignment Theory. Besides these theoretical implications, the findings have

implications for math instruction. Specifically, it may be preferable to introduce addition of rational numbers with decimals before fractions, but to follow the reverse sequence for multiplication.

O1.1.4 - Spatial memory across axes, ages, and cultures

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Details

Spatial cognition is central to human behavior, but the way we conceptualize space varies across cultures and over development. When remembering the locations or movements of objects, people use different spatial *frames of reference* (FoRs). For example, educated adults predominantly rely on an *egocentric* FoR – one based on the sides of the body – which underlies statements like “to my right” and conceptual constructs like the left-right mental number line. By contrast, adults in other groups often prefer coordinate systems based on the features of the surrounding environment – *allocentric* FoRs that underlie statements like “to the East” and support orientation and navigation. Likewise, previous studies have suggested that FoR use undergoes substantial development change, at least in some cultures, but the causes of this cognitive change remain unresolved. We propose that both cultural and developmental variation reflect differences in people’s ability to reliably discriminate left-right space, which is common only among educated adults.

Here we tested this hypothesis in samples of US children (ages 4-8), US adults, and indigenous Tsimane’ adults living in the Bolivian Amazon. Whereas US adults can distinguish mirror images from each other with some confidence, children and unschooled adults are known to have high *mirror invariance*, often confusing letters, shapes, and objects with their left-right reflections (e.g. b vs. d) more than with other spatial transformations (e.g. b vs. p), a difference we confirmed using a visual discrimination task. Then, in non-verbal tests of FoR use, participants memorized arrays of objects or bodily movements, turned around 180 degrees, and then were asked to reconstruct or rehearse the memorized array or movement. Critically, participants performed these tasks both when the relevant spatial relation fell along the lateral (i.e. left-right) axis and when it fell along the sagittal (i.e. front-back) axis, allowing us to compare FoR use on each axis, within participants.

Results show the pattern predicted by differences in spatial discrimination. On the sagittal axis, where egocentric discrimination is easy, participants in all three groups preferentially used egocentric solutions, but the groups diverged on the lateral axis: US adults, who have relatively good left-right discrimination abilities, continued to prefer egocentric solutions, whereas both US children and Tsimane’ adults, for whom left-right discrimination is difficult, preferred allocentric solutions – different FoRs on different axes. These results challenge claims that a single FoR predominates in a given culture or developmental stage. Rather, FoR use varies flexibly within the same individual, among both children and adults. The pattern of variation we observe across axes, ages, and cultures suggest a common principle governing this cognitive diversity: When representing a spatial relation, people may use whichever spatial continuum they can best discriminate, whether it is defined egocentrically or allocentrically. Compared to front-back, left-right discrimination is difficult for many children and unschooled adults, leading them to abandon this egocentric continua in favor of more reliable

allocentric cues. In this way, the spatial reference frames we use may depend in part on cultural practices – like reading and driving – that sharpen the distinction between left and right.

O1.1.5 - Hearing water temperature: characterizing the development of nuanced perception of sound sources

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Details

Objective: Without conscious thought, listeners link events in the world to sounds they hear. We study one surprising example: Adults can judge the temperature of water simply from hearing it being poured. How do such nuanced perceptual skills develop? Previous work has shown that some aspects of cross-modal perception develop in infancy (Spelke, 1979; Meltzoff, 1993). Others have hypothesized that auditory event perception requires extensive experience (Gaver, 1993). Here we ask if auditory perception of water temperature emerges early in life or later in childhood. In doing so, we aim to constrain developmental theories regarding whether early-developing aspects of perception and cognition are sufficient to support auditory sound source judgements, or if extensive experience and/or maturation are needed.

Exp. 1: We first replicated findings of adults' abilities in a pre-registered web experiment. N=280 undergraduates completed 32 trials where they identified pouring sounds as hot or cold water. Stimuli were professional five-second recordings of hot (180-183°F) or cold (43-46°F) water being poured into a paper, plastic, porcelain, or glass cup (from Velasco et al., 2013). Adults succeeded on 72% of trials (significantly above chance, $p < .001$), even though many were unaware of this ability. Individual differences in accuracy were predicted by participants' amount of prior relevant auditory experience (measured by a post-test survey).

Exp. 2: We next tested children across a wide age range (N=113, 3-11 years, in lab/preschools using headphones). Each child completed one two-alternative forced choice trial where they identified which of two matched sounds was hot vs cold water. The order of presentation of hot/cold sounds (and the right/left location of the corresponding icons on the screen) was counterbalanced. Participants' age significantly predicted their accuracy (nested logistic model comparisons, $p < .001$). Notably, young children (<6 yrs) performed at chance. Their failure was not due to a lack of understanding of the task: Pre-tests confirmed that they understood the concepts of 'hot' and 'cold' and could accurately identify other sounds using a similar method. In contrast, 85% of older children (6+ yrs) succeeded ($p < .001$). The oldest children had adult-level accuracy (N=104 undergraduates were tested using the same method to obtain an adult baseline).

Exp. 3: We replicated and extended our developmental findings in a pre-registered study, where N=65 children (4-11 yrs) completed four trials each. Methods were identical to Exp. 2, with the addition of tokens to indicate answers (added to reduce memory load, by allowing children to mark answers while listening). Again, accuracy increased with age (nested logistic model comparisons, $p = .032$). Younger

children (<6 yrs) failed at the task, while older children performed significantly above chance ($p < .001$).

Conclusions: Children showed protracted development of the ability to hear water temperature, succeeding only at 6+ years. Early-developing aspects of perception and cognition are therefore not sufficient to support some nuanced auditory sound source judgements. Extensive relevant experience may be needed; maturation of the auditory system/multi-modal integration may also play a role. Overall, we find that nuanced auditory information that is easily and quickly accessible to adults is not available to guide young children's behavior.

O1.2.1 - Individual differences in executive functions for preschoolers from low-income backgrounds: associations of profiles with pre-academic skills

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Details

Preschoolers' individual differences in executive functions (EFs) are robustly associated with many important outcomes, including pre-academic skills that provide a foundation for learning in formal schooling (Blair & Raver, 2015). Children from families with low incomes perform lower, on average, on direct EF measures than peers from more affluent backgrounds (Raver et al., 2013). However, group comparisons by socio-economic status fail to represent the variability in EFs in children from low-income backgrounds and can promote a deficit narrative that they are lacking in skills, further contributing to marginalization (Miller-Cotto et al., 2021). Mapping within-group variability in EF and relations with pre-academic skills is necessary for guiding differentiated, targeted support of preschool EFs. In this study, we consider individual differences in a population often treated as a monolith by employing a person-centered analysis. We specifically use latent profile analysis (LPA) to identify patterns of heterogeneity and relative strengths in a sample of preschoolers from low-income backgrounds and their associations with foundational pre-academic skills of numeracy, vocabulary, and geometry. Preschoolers in the Midwestern United States ($N = 232$; 120 females, 112 males; $M_{\text{age}} = 52.15$ months, $SD = 6.70$ months) from families with low incomes (defined by being Head Start or free/reduced lunch eligible) were assessed on five direct EF measures: Working memory (Hide and Seek), inhibitory control (Day Night Stroop), cognitive flexibility (Card Sort), complex planning (Tower of Hanoi), and behavioral self-regulation (Head-Toes-Knees-Shoulders). Numeracy (Preschool Early Numeracy Screener-Brief), vocabulary (NIH Picture Vocabulary Test), and geometry (Child Math Assessment- Geometric Subtests) were also assessed. Using LPA with the five EF indicators, we determined that a 4-profile solution best fit the data according to multiple model comparison criteria. The four profiles of children were named according to relative differences and included a *below average profile* (66% of sample), *high profile* (10%), *above average profile* (12%) and a discordant *high EF with below average behavioral self-regulation profile* (12%), see Fig. 1. We next evaluated whether the pre-academic skills differed by profile, utilizing a three-step approach. This revealed that patterns of differences between profiles varied by pre-academic skill. Children in the discordant profile had similar numeracy scores to those in the *above average profile* and were lower than the *high profile* and higher than the *below average profile*, $ps < .01$. For vocabulary, the discordant profile scored similarly to the *high profile*, and

both were higher than the *above average* and *below average* profiles, $ps < .001$. Finally, the *high, above average*, and discordant profile had similar geometry scores, which were all higher than the *below average* profile, $ps < .001$. Overall, despite below average behavioral self-regulation, children in the discordant profile were similar in their pre-academic skills to those with above average to high EFs. Our findings provide meaningful information for guiding differentiated instruction to support preschool EFs and pre-academic skills. Furthermore, identifying within-group variability disrupts deficit perspectives pervasive in research with under-resourced communities.

01.2.2 - Hearing the same story dos veces: examining the structure of bilingual storybooks and their impact on novel word learning

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Details

Bilingual storybooks, which are designed to be read in two languages, are considered a promising tool to support language and literacy in children with diverse language experiences. However, there is little empirical work examining how these books are structured and whether they can support children's vocabulary learning. The present study took a first step towards understanding the efficacy of text in bilingual books by quantifying the prevalence of different formats (Study 1) and testing their impact on novel vocabulary learning in monolingual preschoolers (Study 2).

In Study 1, Spanish-English storybooks ($N = 130$) were systematically sampled from local U.S public libraries. Two bilingual raters evaluated several textual features of the storybooks, such as their format (Figure 1). This content analysis revealed that most bilingual storybooks were structured to teach Spanish to English-speaking children and used full sentence translations (77.5%), e.g., "Maria had a little llama. Maria tenia una llama pequeña." In contrast, few storybooks included code-switching (22.5%), e.g., "Maria had a little llama, una llama pequeña."

The content analysis from Study 1 was used to develop two experimental storybooks and to test their impact on novel vocabulary learning. In Study 2, English-speaking preschoolers ($N = 45$, $M_{age} = 57.23$ months) with no prior Spanish exposure were taught eight Spanish animal names (e.g., frog – rana) from two storybooks: a full translation book (e.g., The boy and his dog had a frog. El niño y su perro tenian una rana") and a code-switched book (e.g., The boy and his dog had a frog, una rana"). Children's memory for the Spanish animal names was tested immediately after reading. Although full translation books are more prevalent, children learned significantly more words from the code-switched book (Figure 2a). A follow-up experiment with a new sample of monolingual preschoolers ($N = 32$, $M_{age} = 57.23$ months) was conducted to rule out a reason for why the code-switched book benefited learning. Here, children were read the same full translation book, but the code-switched book now had the same number of words as the full translation book (e.g., The boy and his dog had una rana. El niño y su perro tenian a frog"). Children's memory for the words was similar across the two books, suggesting that code-switched books benefit learning when Spanish language input is reduced and the English and Spanish animal names are presented contiguously ("... a frog, una rana") (Figure 2b).

Taken together, this study tested the assumption that bilingual storybooks are an effective learning tool. We found that the most common storybook format (full translation) found in U.S. public libraries was less effective than the least common storybook format (code-switched). Indeed, the most important factor for supporting novel vocabulary learning in English-speaking preschoolers was whether the mapping between Spanish and English words was more explicit and whether the Spanish language input was reduced. The talk will conclude with ongoing work on the efficacy of these storybooks for Spanish-English bilingual preschoolers and a discussion of how these findings can be used to develop educational materials that optimally support second language learning.

O1.2.3 - Parenting under pressure: unraveling the effects of economic hardship during the COVID-19 pandemic on children's cognitive development

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Details

The COVID-19 pandemic has caused increased economic and social stress for parents, particularly those with young children (Gadermann et al., 2021). Parents of young children are at particular risk for mental health difficulties and a growing body of research demonstrates that the pandemic led to significant increases in parents' mental health challenges (Brock et al. 2022), with associated effects on children's social-emotional development (Browne et al., 2021; Reich et al., 2023). The Family Stress Model posits that economic challenges exacerbate parents' mental health problems with cascading effects on their parenting behaviors and children's development (Conger et al., 2010). However, robust literature indicates that parents who experience psychological distress also feel increased stress in their role as a parent (e.g., Crnic & Ross, 2017) which is associated with less responsive and more controlling parenting practices (Anthony et al., 2005).

Given research demonstrating large socioeconomic disparities in children's cognitive development (e.g., Merz et al., 2019), this pre-registered, longitudinal study aims to expand the traditional Family Stress Model to include parenting stress as an additional mediator and the effects of economic hardship on children's cognitive outcomes in a socio-economically diverse sample of 170 parent-child dyads during the COVID-19 pandemic.

Parents completed a survey in spring 2020 indicating their household income, financial stress, depressive and anxiety symptoms, and parental distress. Over a third (37%) of families were considered low-income, 56% of parents had clinical levels of anxiety and 51% of the parents were clinically depressed. Parent-child dyads attended a lab assessment when children were in second grade, where children's cognitive skills were directly assessed, and the dyads completed a homework help task. Executive functions (EFs) were measured by 4 tasks (Digit Span Backwards, Listening Recall, Flanker, Dimensional Change Card Sort), math skills were measured on the Woodcock-Johnson Applied Problems subtest, and receptive vocabulary skills were measured on the Peabody Picture Vocabulary Test. Observers coded videos of the parent-child interactions in second grade for parents' autonomy-supportive and controlling behaviors in 30-second epochs. Children's cognitive skills were assessed again in third grade during a follow-up assessment. Child age, cohort, family structure, and child gender were included as covariates.

Path analyses indicated good global fit (CFI = 0.976, RMSEA = 0.042, SRMR = 0.063). We found that

economic hardship and stress worked through parents' mental health to impact parents' distress and parenting behaviors. There was also a direct link between household income and both measures of parenting behaviors, such that higher income was linked to more autonomy-supportive behaviors and fewer controlling behaviors. Parents' controlling behaviors were negatively associated with all 3 measures of children's cognitive development in third grade. We saw longitudinal continuity in children's cognitive skills and unique links between math skills in second grade and both EFs and vocabulary in third grade.

These results suggest that interventions to support families facing economic hardship and parents experiencing mental health challenges would have cascading benefits for parental distress, parenting behaviors, and children's cognitive skills.

O1.2.4 - The development of picture comprehension across early environments: evidence from urban and rural toddlers in western Kenya

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Details

In high-income Western contexts, the most widely used learning materials (e.g., books, posters) typically involve picture stimuli. As these learning materials spread across the world, educators and researchers make an implicit assumption: that children across cultures and contexts understand pictures in the same way, at the same developmental timepoint. What if this assumption does not hold? While children growing up in high-income contexts often have more experience with picture books and other kinds of visual symbols, children growing up in low-income contexts in low- and middle-income countries often have less experience with pictures and other kinds of visual symbols. Differences in picture comprehension can drastically change the efficacy of learning materials. Thus, in order to determine how to appropriately translate learning materials globally, exploring *when* and *how* children understand and learn from pictures across cultures and contexts is of paramount importance.

The current research asks whether previous picture experience is related to toddlers' ability to learn words from pictures, and understanding that pictures refer to actual objects in the world, controlling for maternal education, number of toys, caregiver talk, and caregiver play. 128 2-year-olds ($M = 2.57$ years, $SD = .28$ years, range = 2.00 – 2.99 years) in and around the Kisumu area, in Nyanza Province – who had varying amounts of picture experience – participated in a picture-based word learning task. 64 toddlers were recruited from urban Kisumu ($M = 2.58$ years, $SD = .26$ years, range = 2.00 – 2.98 years) and 64 toddlers were recruited from East Rachuonyo, a rural area approximately 1-2 hours outside of Kisumu ($M = 2.57$ years, $SD = .30$ years, range = 2.00 – 2.99 years).

We found a positive association between toddlers' performance on the picture-based word learning task and their picture experience in the urban sample ($\beta = .63$, $SE = .31$, $p = .04$), but not the rural sample ($\beta = -.24$, $SE = .28$, $p = .40$) or entire sample ($\beta = .11$, $SE = .18$, $p = .56$). Surprisingly, we found a negative association between toddlers' performance on the picture-based word learning task and caregiver talk in the entire sample ($\beta = -.42$, $SE = .19$, $p = .03$), but not the urban sample ($\beta = -.47$, $SE = .30$, $p = .11$) or

rural samples ($\beta = -.33, SE = .27, p = .23$). We found no association between toddlers' referential understanding and picture experience, in the urban sample ($\beta = -.04, SE = .29, p = .88$), rural sample ($\beta = .43, SE = .31, p = .17$), or entire sample ($\beta = .23, SE = .20, p = .25$). We caution that this is a new area of research, and that more work should be done to replicate and extend these current findings.

Overall, these results tentatively suggest a positive association between children's early experience with pictures and their capacity to learn from pictures. Since early childhood learning materials often involve pictures, this research will help teachers, researchers, and policy-makers determine the most effective learning materials for children from diverse global backgrounds.

O1.2.5 - Children's language ecologies: understanding day-to-day variability in caregivers' child-directed speech during the COVID-19 pandemic

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Details

Research suggests that variability in the child-directed speech (CDS) children receive contributes to individual differences in their language development.¹ But what explains variability in CDS? Prior work has focused on differences in caregivers' characteristics (e.g., their income and education), yet recent work suggests that external pressures—like financial strain—may affect CDS regardless of these more stable characteristics.² Here, we move beyond cross-caregiver comparisons to explore the sources of variability in CDS *within* individual families over a series of 20-60 days. Initiated at the beginning of the COVID-19 pandemic, our study captures a period when families experienced rapidly-changing external circumstances. Following a pre-registered analysis plan, we ask whether individual caregivers' CDS varies systematically as a function of external conditions and day-to-day experiences. We further investigate whether effects are consistent across families, or specific to individual families.

We took an experience sampling approach, asking socioeconomically-diverse English-speaking American caregivers to audio-record an interaction with their child—their bath time—each day, for 20-60 days ($N=50$). Children ranged in age from 18-26 months at study start. Here, we analyze an initial 17 families for whom 662 bath time recordings have been transcribed and coded ($M_{\text{age}}=21.87\text{mo.}$; $M_{\text{recording duration}}=19.52\text{min.}$). Caregivers also filled out a daily survey that captured their mood, worries, sleep, and how they spent their time that day, and any financial assistance received (e.g., government stimulus check). Finally, family-level variables were linked with national daily data related to the pandemic (e.g., COVID cases). We performed separate cross-validated ridge regressions for each family, to explore which variables explain CDS variability while dealing with potential multi-collinearity.

We highlight three main findings (Fig. 1-2): (1) Even in a consistent context within a single family, caregivers' rate of CDS varies widely each day (Fig. 1). (2) This variation is not random, but predictable. For most families, models trained on a subsample of the family's data could meaningfully predict

variability in held-out testing data; R^2_{cv} for each family's best fitting model ranged from .11-.73 ($M=.41$). (3) The factors that account for CDS variability differ for individual families, and span internal (e.g., mood) and external (e.g., time of month, COVID case numbers) variables. For some factors, effects were more consistent across families, e.g., caregivers use less CDS at the end of the month (when money is likely to be scarce³), and more after receiving financial assistance. However, other factors (e.g., percent of time caregiver spent working) were more variable, with significant positive relations for some families and negative relations for others (Fig. 2).

Taken together, our results provide new insights into sources of day-to-day variability in CDS in a consistent context for young children, highlighting the role of both internal and external factors. While our results highlight that each family's language ecology is uniquely sensitive to these pressures, it is notable that some of the factors most consistently related to CDS across families are external (e.g., financial changes). This suggests that efforts to support families and increase their CDS may be best directed toward alleviating these external pressures.

O2.1.1 - How does the form and content of parent language influence children's developing gender beliefs?

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Details

Children express and endorse gender stereotypes by preschool age (Etaugh & Liss, 1992; Bian et al., 2017). Despite efforts to communicate gender egalitarian values to their children, parents might still be contributing to the development of gender stereotypes in young children through more covert features of language that reinforce the essentialist belief that boys and girls are fundamentally different kinds of people. This longitudinal study examined how non-obvious features of the linguistic form (gender generics, non-generic labels) and content (stereotype expression) of parent language relate to children's developing gender beliefs across time. In Session 1, we transcribed and coded conversations from parent-child dyads ($n = 192$; $M_{age} = 4.52$; 55.2% female) during an unmoderated picture-book reading task administered on families' home computers and designed to elicit gendered talk. In Session 2, children completed measures of gender essentialism and stereotyping at two different timepoints (~6 months apart).

Children whose parents generated more gendered generics (e.g., "Only mommies wear makeup"; "Boys can paint their nails, too") endorsed more gender essentialist beliefs ($p = .01$; Figure 1a), expressed decreased interest in stereotypically other-gender activities ($p = .009$; with no relation to own-gender activities, $p > .24$), and endorsed more binary gender stereotypes ($p = .047$). As a further test of how subtle linguistic cues in parent language can influence children's gender beliefs, we also examined how parents' use of ostensive non-generic gender labels (e.g., "Look, that's a boy painting his nails"; "What's this girl doing with the football?") related to children's gender beliefs. Indeed, parents' increased use of non-generic gender labels (in contrast to generic references to gender categories) showed decreased endorsement of gender essentialist beliefs ($p = .03$).

Importantly, the effects of generic language form on children's gender essentialist persisted regardless of whether parents were communicating gender stereotype-congruent or -incongruent messages. We conducted additional analyses examining how parents' use of stereotype-congruent (e.g., "Boys don't cry") and -incongruent (e.g., "Girls are good at soccer") generics distinctly related to children's essentialist beliefs. We found no main or interactive effects of either stereotype-congruent ($ps > .13$) or -incongruent generics ($ps > .13$; see Figure 1b) on children's essentialist beliefs. Taken together, these findings identify non-obvious features of parent language that contribute to the development of gender essentialism and gender stereotyping in young children, and will allow for the formation of practical intervention strategies that diminish the transmission of biased gender beliefs from parents to their children.

O2.1.2 - A conceptual framework for religious identity: a category's central form and its predictive power in Hindu and Muslim children in India

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Details

People differ in the strength of their religious convictions. For example, some Hindus may believe that it is crucial for another Hindu *to not eat beef*, that if they do eat beef they should be *punished*, and that this rule should be adhered to by Hindus *forever*. Alternatively, other Hindus may believe that eating beef does not deserve punishment, and that religious norms like this may change over time. In the present research, we present data demonstrating that Hindu and Muslim children in India vary markedly in the degree to which they hold these religious convictions. Crucially, we formulate and test a hypothesis which predicts *when* a child will endorse one of these strong beliefs. Our theory proposes that the exact same structure used to represent the conceptual identity of everyday categories (e.g., what makes a watch *a watch*) is also used to represent religious identity (e.g., what makes a Hindu *a Hindu*).

Prior research suggests that each category humans acquire has a *central form*, which captures its conceptual identity. For example, *telling time*, part of the central form of the category *watch*, is understood as "part of what makes a watch *a watch*." Consequently, children and adults endorse some surprisingly strong beliefs about 'telling time' which they do not endorse about the other properties of watches. They believe watches will tell time *forever*, they display a sense of *certainty* that a new watch they encounter will tell time, and if it does not, they will say it's a *bad* watch (among other strong beliefs/judgements; Haward, 2022).

In the present research, 12- to 15-year-old children from a school in Gujarat, India completed surveys probing their understanding of the categories *Hindu* and *Muslim* (n=170, M=13.71 years, 51% Hindu, 49% Muslims, 50% Female). On each trial, they were asked whether they thought a property was part of the category's central form (e.g., "do you think that [not eating beef] is part of what makes a Hindu *a Hindu*"). We also probed the child's endorsement of each of the strong central form beliefs (e.g., exhibit *certainty* that a Hindu they encounter will not eat beef; believe that Hindus will not eat beef forever). Children were asked about a variety of properties for each religious category (e.g., belief in God, norms

of eating and dressing, praying each day, being a good person). Children agreed that all properties were common in both Hindus and Muslims. And yet, strikingly, *only* when a child had encoded a property as a form property did they endorse strong religious beliefs about that property ($p < .001$; Fig. 1). This was true for all properties tested and it was true of children of both religions (all $ps < .001$).

We conclude that the central form is not only an important component of everyday categories (e.g., *watch, tree, university*). It is also used by young children to represent the identity of religious categories, and it can be used to predict when children will endorse strong religious beliefs. Finally, we discuss the potential application of this approach to other domains within which humans sometimes have strong convictions, like national identity.

O2.1.3 - Stability and change in gender identity across childhood and adolescence

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Details

As transgender youth experience unprecedented levels of societal visibility and debates about their legal rights rapidly gain steam, scientific research on how youth conceptualize their gender identities over time has remained scarce. Developmental science has historically assumed that children's gender identities remain stable across the lifespan, likely because of the field's focus on cisgender youth and the assumption that cisgender people will always be cisgender.

The current work aims to address this gap by describing stability and change in gender in a large longitudinal study of North American transgender and cisgender youth. Data on gender identity have been collected from three groups of youth (and their parents): (1) an *initially transgender* group, who underwent social transitions (i.e., changing names, pronouns, hairstyle, and clothing to align with one's gender, rather than one's assigned sex) by age 12 ($N = 277$); (2) *siblings* of the *initially transgender* group (who were initially cisgender at the beginning of the study, $N = 158$); and (3) an unrelated *initially cisgender* group, a sample of community-recruited youth matched in age and gender to those in the initially transgender group ($N = 267$). These samples include only children who have provided gender identity data in at least one follow-up visit.

How much stability and change do the youth in our sample show in their gender identity across time, and how do the three groups compare? We examined participants' self-reported gender identity at their latest visit in the longitudinal study, which occurred on average approximately 5.5 years after their initial visit, 7 years after transgender youth's initial social transition, and when the youth were approximately 13.5 years old on average. In the *initially transgender* group, 1% were cisgender at their latest visit, paralleling the ~1.5% in the *initially cisgender* and *siblings* groups who were binary transgender at the latest visit. Using a maximally broad definition of "gender diverse or nonbinary", a similarly substantial proportion of participants in all three groups (21% of the *initially transgender* group, 16% of the *initially cisgender* group, 21% of the *siblings* group) now report such an identity. The three groups did not differ in their breakdown of gender trajectories (Fisher's exact 3x3 test, $p = 0.51$), nor did participants assigned female at birth differ from those assigned male at birth in their gender trajectories (Fisher's exact 2x3 test, $p = 0.09$).

Contrary to some past work and popular rhetoric, early-identifying transgender children in our sample have re-transitioned “back” to the gender associated with their birth-assigned sex in relatively low numbers, and show similar levels of stability and change as youth who were initially cisgender. In addition, a relatively high number of youth in all three groups reported a nonbinary identity in their latest visit, which we speculate reflects a recent cultural shift in how (North American, largely upper-SES, mostly white) young people are conceptualizing gender categories today. In contrast to some recent media discussion, this was no more true of people assigned female at birth than those assigned male at birth.

O2.1.4 - Bilingualism and simultaneous identities

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Details

Bilingualism and multilingualism are a norm in the majority of the world, yet language-based preferences have largely been studied in Western monolingual contexts. In this set of cross-cultural studies, we investigate the development of and cultural differences surrounding *beliefs in cultural and linguistic simultaneous identity*. In a set of four studies, we investigated how culture, linguistic background, and way of acquiring a bilingual status could affect tolerance for simultaneous identity (the belief that people can be simultaneously part of two social groups – e.g., one can be both a sports fan and a parent, but people generally deny that one can be both a boy and girl). US and Indian adults and children were introduced to two different groups of people who lived in separate regions and spoke separate languages. They were then told stories about three bilingual children who each acquired their second language by different means - a) through books/media out of their interest (learning condition), b) from each parent (parent A spoke one language and parent B spoke the other; parent condition), and c) from their friends and neighbors (the parents of the child had moved from one region to another and therefore the child had a different home language; immigration condition). We measured the extent to which people believed the target could be simultaneously a member of the two linguistic groups. In study 1, we found that US bilinguals had a significantly higher tolerance for simultaneous identities. We found that this difference was the greatest in the immigration condition (where the target bilingual learned their original language at home and their second from their external environment). In study 2, we found that Indian bilingual adults had a high tolerance for simultaneous identities across all conditions, significantly differing from US adults in the learning condition. In study 3, we found that cultural differences are at least partly explained by, language signaling nationality for US adults only. In study 4 (data collection ongoing) we surveyed 5-7-year-old children (monolinguals and bilinguals from the US and bilinguals from India) from both countries to investigate the developmental onset of tolerance for simultaneous identities. Previous literature studying children’s associations with language and nationality has exclusively looked at monolingual contexts. However India is a multilingual country, and language may not signal nationality to its residents. Results from this study could help understand the mechanisms driving the differences between a) monolinguals and bilinguals from a similar context, and b) bilinguals from different contexts. Additionally, it could help us differentiate the effects of culture/context (India vs US) from the effects of language (monolinguals vs bilinguals). A developmental sample would particularly help us identify when cultural differences begin to play a role in the tolerance for simultaneous identities.

O2.1.5 - Why do children think follow we should follow norms? The case of religious and moral norms in India

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Details

Unlike basic moral norms to help others or refrain from cheating, religious norms can differ dramatically by group (Corrigan & Hudson, 2018). A Muslim child in India sees Hindu women without hijabs, and a Hindu child sees Muslims eating beef. Pluralistic encounters raise a fundamental question: Why should one group follow norms that other groups flout? We focused on two potential bases for children's evaluations of religious violations (Cohen et al., 2005): extrinsic goals (e.g., to participate in a group or avoid punishment from others) and intrinsic goals (e.g., to connect with and obey god). We expected these goals to have less influence on evaluations of moral violations.

100 12- to 15-year-old Hindu and Muslim children in India (52 female, 50 Hindu, M = 14.1 years) heard vignettes involving violations of six norms: Two Hindu, two Muslim, and two moral norms. For religious norms, the violator was always from the same religion as the norm. For moral norms, the violator was of the same religion as the participant. The interviewer asked whether the protagonist should follow the norm, whether violating the norm would be okay, and how severe the violation would be if relatives would learn about it, if other Hindus/Muslims did it, or if gods gave permission. The interviewer also asked whether the violator would still be a member of the religion.

Children said that the protagonist should follow the norm in 90% of trials but judged it okay to violate the norm in 38% of trials. Participants judged religious violations as okay more often than moral violations, $p < .001$, and were more likely to accept the violation when they said that the violator could still be a Hindu/Muslim, $p < .001$. Hindus were more accepting of violations than Muslims, $p = .007$ (Tab.1).

Both intrinsic and extrinsic factors influenced ratings of religious violations. Supporting the role of extrinsic factors, children rated religious violations as far worse if the protagonist's relatives learned of the violation, whereas relatives' knowledge had a smaller effect on moral evaluations (interaction: $p < .001$, Fig.1). An exception was that relatives' knowledge had little effect on Muslim participants' evaluations of Muslim violations (interaction: $p = .001$). Learning that everyone else engaged in the behavior made children's evaluations less negative ($p = .033$), though this effect was comparable for religious and moral violations ($p = .90$). Supporting the role of intrinsic factors, children rated the religious violations as less bad if the religion's god had given permission, but the effect was significantly smaller for moral norms (interaction: $p = .006$). Muslim children were especially likely to say that the protagonist's god would be angry if the protagonist violated the norm ($p < .001$). Ongoing analyses of justifications will yield further insights into the intrinsic and extrinsic bases for religious evaluations.

The findings demonstrate children's diverse reasons for following religious norms. Both intrinsic and extrinsic factors affected children's evaluations of religious violations, though Hindu children appeared more concerned with extrinsic factors than Muslims. We also found that children distinguished moral from religious norms (Srinivasan et al., 2019). Given the Hindu-Muslim differences, it will be key to study other religious communities. Our findings also invite research on how children develop intrinsic and extrinsic motivations for following religious norms.

O3.1.1 - Young children's developing sensitivity to epistemic injustice – evidence from Hindu and Muslim children in India

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Details

People are often given less credibility than they deserve in virtue of their social identity—a phenomenon known as epistemic injustice (Fricker, 2007). Are young children sensitive to epistemic injustice as a form of unfairness? While much work has explored children's sense of fairness in the context of distributions of concrete resources (McAuliffe et al., 2017), they have not assessed children's sensitivity to fairness in more abstract contexts, as in distributions of credibility. Moreover, while studies on selective trust have shown that children privilege testimony of ingroup members (Kinzler et al., 2011), it is unknown whether children evaluate differences in the allocation of belief as unfair. Critically, recognition of epistemic injustice toward an outgroup ostensibly requires overriding one's own intergroup biases, which could be difficult for young children.

Across two pre-registered studies, we probed children's developing sense of epistemic injustice and its relation to intergroup bias. We recruited 6- to 10-year-old Hindu and Muslim children (N=320; 50% female; 50% Hindu) in Gujarat, India—a site where children have been found to exhibit significant bias in favor their religious group (Dunham et al. 2014). In each study, participants were shown two vignettes: one in which a Hindu teacher selectively believed several Hindu but no Muslim students, and one in which a Muslim teacher selectively believed several Muslim but no Hindu students. In Study 1, the students' claims conflicted with one another (e.g., "He hit me." "No, I didn't."); in Study 2, students' claims were independent, such that the teacher could believe all students, potentially making the epistemic injustice more salient. After each vignette, participants were asked several questions to probe their evaluation of the teacher and their behavior.

On average, children in Study 1 judged epistemic injustice as 'unfair' (67.61% of trials); yet, they were more likely to do so when students of their own, rather than the opposite, religious group experienced the injustice ($p=.009$, Fig. 1). Though children in Study 2 were overall more likely to judge the teachers' actions as 'unfair' (82.5% of trials), they were again less sensitive to epistemic injustice toward outgroup students. Children in both studies most often justified 'unfair' judgments by referencing the teacher's bias and justified 'fair' judgments by referencing perceived credibility differences between groups (e.g., "he shouldn't listen to Muslims because they lie"). Interestingly, in both studies, the gap between children's judgments of 'unfair' treatment toward ingroup vs. outgroup members diminished with age (Fig. 2). We found convergent results in responses to whether the teacher was a 'good' teacher and whether children would want the teacher to distribute resources to their class.

Together, our results provide some of the first evidence that children are sensitive to epistemic injustice as a form of unfairness, extending prior work on allocations of concrete resources. We also found evidence that intergroup biases impede children's recognition of epistemic injustice, with only older children demonstrating a "true" sense of epistemic injustice (i.e., in judging the teacher's actions as 'unfair' equally often when it advantaged vs. disadvantaged their own religious group). We discuss the potential mechanisms of this developmental change and the broader implications of our findings.

O3.1.2 - A comprehensive investigation of U.S. children's and adults' understanding of social hierarchies

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Details

How do children reason about the factors that contribute to one's position in the social hierarchy? Examining children's causal understanding of hierarchies is important because these concepts likely drive their motivations (e.g., effort in school, career aspirations; Cimpian et al., 2007; Nicholls, 1990) and behavior toward others (e.g., biased behavior toward low-status groups; Enright et al., 2020; Mandalaywala, 2020). In Study 1, we compared how important U.S. children ($N = 120$, ages 9-12) and adults ($N = 110$) thought 20 hierarchy-related attributes were for an individual's ultimate position in the societal hierarchy. We found that adults rated wealth, fame, occupation, race, and education to be the most important attributes, while children rated more meritocratic and internal attributes (e.g., work ethic, morality) as the most important. In Study 2, we clarified the results of Study 1 by comparing children's ($N = 182$) and adults' ($N = 240$) perceptions of attributes that are *in actuality* important ("descriptive" attributes) vs. that *should be* important ("prescriptive" attributes) to one's position in the social hierarchy. We found that the results for descriptive attributes replicated findings from Study 1, including the substantial differences between children's and adults' top-rated attributes, but that adults' and children's answers to the prescriptive ("should") questions were almost identical. Across both studies, participants' own membership in certain social categories played a role in their causal attributions: children from a low-SES background attributed less importance to work ethic compared to their high-SES peers; As for adults, both women and adults of color were more likely to recognize the importance of social categories (e.g., gender, race) in determining one's position in the social hierarchy. Together, these trends suggest an increased understanding of structural barriers for those belonging in disadvantaged social groups. More generally, understanding children's and adults' intuitive theories of social hierarchies provides us with an important first step toward addressing status-based bias from an early age.

O3.1.3 - Should leaders conform? Developmental evidence from the United States and China

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Details

Every now and then, leaders ranging from chief executive officers to presidents, violate their respective group norms, resulting in serious transgressive acts and group malfunction. Does leadership provide freedom to deviate, or should leaders follow group norms? The present work takes a developmental and cross-cultural approach to investigate this question. Specifically, we examine whether 4- to 11-year-old children across two cultural contexts (the US and China) expect group leaders to conform to group norms.

In Experiment 1 ($N = 114$; 56 girls, 58 boys; 58.9% White, 27.1% Asian or Pacific Islander, 5.6% Latino/Hispanic, 1.9% Black, 1.9% American Indian or Alaskan, and 4.7% Multiracial), children from the US saw two novel groups (Hibbles and Glerks) engage in three pairs of contrasting behaviors (e.g., listening to different kinds of music). Next, children were presented with either a group leader or an ordinary group member who acted against its group norms (e.g., a Hibble listening to music more typical of Glerks). Next, children provided evaluations of the nonconformity on a 6-point likert scale (1 = really, really bad, 6 = really, really good). Children's explanations for their evaluations were then collected. US children evaluated the nonleader's non-conformity more positively with age, $X^2(1) = 5.26, p = .022$, consistent with past studies on children's evaluations of an ordinary group member's deviance (Roberts et al., 2017). In contrast, children's evaluations of the leader's non-conformity became more negative with age, $X^2(1) = 7.93, p = .005$ (Figure 1 Left). In fact, younger children (4- to 7-year-olds) evaluated the leader's non-conformity more positively relative to the nonleader's, yet older children (10- to 11-year-olds) evaluated the leader's non-conformity more negatively (Figure 1 Right). Children's justifications for their responses provided evidence that the growing negativity about a leader's non-conformity was due to children's increased tendency to perceive leaders as central group members.

Experiment 2 ($N = 66$; 35 girls and 31 boys; 81.8% White American, 9.1% Asian or Pacific Islander, 4.5% Hispanic/Latino, and 4.5% multiracial American) asked 4- to 7-year-old children to evaluate a leader's and a nonleader's *conforming* behaviors; children provided similar positive evaluations. These results ruled out the possibility that younger children's favorable evaluations of the leader's non-conformity stemmed from their general positivity towards leaders. Experiment 3 ($N = 116$; 60 girls, 56 boys; 100% Asian) recruited children from China and presented them with nonconforming behaviors performed by a leader or a nonleader. Children's evaluations were similar to their US counterparts (Figure 2), except that Chinese children ($M = 3.24$) developed stronger negative attitudes towards a leader's non-conformity than US children ($M = 3.73$), $X^2(1) = 4.65, p = .031$.

In both the US and China, younger children granted more tolerance toward a leader's deviance than a nonleader's, whereas children at age 10 began to disapprove the leader's nonconformity. Thus, following group norms is a critical aspect of leadership that takes root in childhood and may hold across societies. These findings contribute to theories on early leadership cognition and highlight the importance of taking a cross-cultural approach to understand its development.

O3.1.4 - The role of status-related beliefs in the development of competence and warmth stereotypes

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Details

The Stereotype Content Model posits that competence and warmth are the two dimensions by which adults evaluate social groups (Fiske, 2018). More specifically, the model posits that adults stereotype high-status social groups (e.g., men, White people) as high in competence and non-threatening social groups (e.g., the elderly) as high in warmth (Caprariello et al., 2009). Recent evidence suggests that even young children endorse competence and warmth stereotypes about prominent social groups, such as gender and race (Baharloo et al., 2022; Bian et al., 2017). However, little is known about the origins of these early emerging stereotypes or the role of children's status beliefs in facilitating their development.

This research explored the role of children's beliefs about social status in the development of their competence and warmth stereotypes through three sets of pre-registered studies of 992 British and American children. In Study 1, we examined whether children indeed associate social status with competence and warmth in a sample of 152 British 5- to 11-year-olds, finding that children ascribed substantially greater social status to competent individuals than warm individuals ($B=0.22$, $p<.001$). We replicated these findings in two diverse samples of American children ($N_2=198$, $N_3=198$), again finding that they ascribed greater status to competent individuals than warm ones ($ps<.025$; $ds>0.23$).

In Study 2, we examined whether children causally associate social status with group competence and warmth. Specifically, we introduced 148 British 5- to 11-year-olds to two novel social groups—one characterized as high status and one as low status. Children reported that members of the high-status group were significantly more competent than members of the low-status group and that members of the low-status group were significantly warmer than members of the high-status group ($ps<.003$; $ds>0.50$). We later replicated these results in two samples of American children ($N_2=106$; $N_3=106$) indicating that, across Western contexts, children rely on status to stereotype group's on competence and warmth.

In Study 3, we replicated Study 2's findings with real-world social groups using a new paradigm. We introduced 84 British children to two countries: One country was portrayed as patriarchal (e.g., 4/5 of the country's previous prime ministers were shown to be men), and one country was portrayed as matriarchal. On a standard stereotype task, children exhibited significantly stronger gender-competence and gender-warmth stereotypes when evaluating individuals from the patriarchal country than the matriarchal country ($Bs>.11$; $ps<.023$). These results suggest that children's gender stereotypes about competence and warmth are directly influenced by their beliefs about gender differences in social status, and importantly, these stereotypes display malleability during childhood.

The three studies above shed light on the central role of children's status beliefs in the development of their competence and warmth stereotypes, providing robust evidence that young children ascribe competence to high-status groups and warmth to low-status groups across Western contexts. Moreover, by revealing that children's stereotypes are influenced by their awareness of social hierarchies, this research underscores the need for targeted interventions that challenge children's status-related beliefs.

O3.1.5 - The best start trial: supporting children's oral language and self-regulation skills through professional development with early childhood teachers

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Details

Self-regulation skills in childhood are one of the strongest predictors of later success in many aspects of adult life: academic, occupational, interpersonal, health, and wellbeing (Moffitt et al., 2011; Robson et al., 2020). One way to support children's early self-regulation is through adult-directed games and

activities that foster children’s working memory, inhibitory control, and emotional regulation (Healey & Halperin, 2015). We propose that a complementary way to support early self-regulation is by enhancing children’s early oral language development (Salmon et al., 2016). We designed a randomized controlled trial to test the singular and additive benefits of a play-based self-regulation intervention called ENGAGE (Healey & Healey, 2019) alongside a book- and conversation-based oral language intervention called ENRICH (Reese et al., 2023), both administered via teachers in early childhood centres. We theorize that supporting children’s oral language plus self-regulation (ENRICH + ENGAGE) will produce larger benefits for self-regulation and later academic success than either the ENGAGE or ENRICH intervention on its own. The resulting design of Kia Timata Pai (Best Start in te reo Māori, the indigenous language of Aotearoa New Zealand) is a cluster randomized controlled trial in which 138 English-medium early childhood centres have been randomly assigned to participate in 1) ENRICH only (with children aged 1.5 to 5 years); 2) ENGAGE only (with children aged 3 to 5 years); 3) ENRICH + ENGAGE (with children aged 1.5 to 5 years); or 4) an Active Control condition. A total of 1481 children were enrolled at approximately age 1.5 years; their parents and over 1600 early childhood teachers also enrolled in the study. The present paper will focus on the results of the toddler phase of the study from age 1.5 to 3 years, in which centres were either in the ENRICH condition or in the Active Control condition. After a baseline phase, teachers in the ENRICH condition participated in professional development workshops every 9 months, and received resources (books, informational cards, instructional videos) every 4-5 months. Teachers in the ENRICH condition were encouraged to support children’s oral language in English, te reo Māori (an official language of New Zealand), and in their home languages if possible. Teachers in the Active Control condition received child development webinars on unrelated topics (e.g., nutrition). Parents were invited to attend informational sessions every 9 months as well to reinforce the techniques at home. Assessment waves of teachers’ and parents’ practices and children’s oral language (in multiple languages) and self-regulation then occurred every 9 months to age 3 years. Preliminary analyses of the baseline phase indicate that the cohort is ethnically and linguistically diverse, and that teacher and parent reports of children’s oral language and temperament are reliable and valid indicators. We will next analyze the outcomes at Waves 2 (age 2.25) and 3 (age 3) to assess the effects of the ENRICH professional development for teachers’ practices and for children’s oral language and self-regulation development, relative to the Active Control condition. The findings will have implications for reducing inequities in children’s oral language and self-regulation development, and for evidence-based design of early childhood education curricula.

O4.1.1 - Children track their success over multiple trials, but are underconfident

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Details

How do children learn what they are good at? One signal of competence is past performance (Bandura, 1997). Children can track their past performance on individual trials (e.g., Baer & Odic, 2019; Lyons & Ghetti, 2011). However, beliefs about competence are about global-level confidence that combines multiple trials (“How good are you at this task in general?”). Recent work with adults shows that trial-level and global-level confidence overlap: adults aggregate trial-level confidence over time into global confidence (Rouault et al., 2019). This work shows several interesting patterns: adults underestimate

global confidence, receiving feedback increases global confidence, and recent trials contribute more to global estimates than do earlier trials.

We present two studies showing that children can also aggregate their confidence over multiple trials, including some initial exploration into the mechanisms underlying the formation of global-level confidence.

In Study 1 (N = 160 5-12-year-olds, 40 adults), we tested two methods of obtaining global confidence judgments from children. Participants saw blocks of 20 area comparison questions (“which shape is bigger”), then estimated on a scale from none to all how many questions they answered correctly. We used a 2x2 within-subjects design: half the blocks were easy and half hard, and participants heard feedback about their accuracy (e.g., “That’s right!”) on half the blocks; the other half contained no feedback. As a second measure of global confidence, participants indicated which of two blocks they felt “better” at (and conversely, which was harder). To facilitate this, we paired blocks and intermixed the trials, with each block differentiated through colour and spatial location on the screen.

At all ages, participants selected the easier block as their ‘better’ task, and the harder block as ‘harder’, $p < .001$. Thus, children as young as 5 notice differences in their performance across multiple trials.

Children estimated higher accuracy on easy blocks than on harder blocks, $p < .001$, and estimates generally decreased with age, $p = .001$, even though we matched accuracy across age groups. Estimates were also influenced by feedback: participants gave lower estimates when they received feedback about their performance on hard trials, and higher estimates when they received feedback about their performance on easy trials, $p < .001$. Estimates were also generally lower than actual accuracy—participants at all ages were underconfident at the global level, $p < .001$. This replicates work in adults (e.g., Cavalan et al., 2023, Rouault et al., 2019), but starkly differs from most work in childhood that shows overconfidence (van Loon et al., 2013).

In Study 2 (ongoing, target N = 200 5-12-year-olds and adults), participants report their confidence on each trial (using a scale from definitely wrong to definitely right) and then estimate the total number of correct answers at the end of each block (with no intermixing of blocks as in Study 1). This design allows us to replicate the findings of Study 1 and look more closely at how children and adults aggregate trial-level confidence. We will also analyze recency effects by examining the influence of accuracy, feedback, and trial confidence for the trials immediately preceding the multi-trial estimate (e.g., Marti et al., 2018).

This work prompts exciting discussion about why children miscalibrate their performance.

O4.1.2 - Making it meaningful: story-making practice to improve working memory in first-graders

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Details

Working memory, the ability to maintain information in a highly activated state to perform tasks, improves markedly during childhood. It is typically tested with random lists of unrelated items to simulate the process of retaining new, often unfamiliar combinations of elements. Previous research has shown that with age, children learn to encode more information into working memory without increasing the use of attention directly to hold the information (Cowan et al., 2018). The question then becomes, what accounts for developmental improvements in working memory? We hypothesized that

children become more proficient in strategically combining unrelated objects into meaningful or coherent, multi-item patterns, which require attention but then can be maintained with less attention than individual items. **Objective:** We aimed to verify whether 6- and 7-year-olds can be trained to improve memory for sequences with an explicit strategy to combine arbitrary objects into coherent combinations, via semantic elaboration. **Method:** The strategy was designed to mimic in children what we believe adults may do spontaneously. We trained participants to create, in a timed manner, short stories about pictures of objects presented in random sequences. In each trial of the experiment, participants (21 trained children, 20 control children, and 29 control adults) reconstructed the sequential order of objects in each list; trained children were asked to report their stories, and control children and adults were asked to report their strategy in 20% of the trials. At the end of the experimental session, all participants responded to a questionnaire on the adopted mnemonic strategies during the task. **Results:** The story-telling training procedure was effective and reduced the age gap between children and adults, with a significant and large effect size of the group upon the percentage of correct responses ($F(2,95) = 54.8, p < .001, \eta p2 = 0.62$). On average, control children correctly reconstructed the sequences in 71.1% ($SD = 0.08$) of the trials, while trained children did it in 78.8% ($SD = 0.10$), and adults in 94.8% ($SD = 0.053$) of the trials. The spontaneous use of elaboration to memorize the sequences was reported by 50% of adults and only 15% of children in the control group. In children, the preferred strategy was verbal rehearsal (95%, both trained and control children), followed by temporal clustering (reported by 75% of controls and 67% of trained children); in adults, the preferred strategy was verbal rehearsal (97%), followed by visualization (79%) and temporal clustering (72%). **Conclusion:** Our results shed light on the development of mnemonic strategies during elementary school years. Although not yet fully developed at the beginning of elementary school, semantic elaboration is a mnemonic strategy accessible to first graders, and it can be successfully trained to improve memory for serial information in working memory.

04.1.3 - The relationship between disfluency and confidence in young children

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Details

Young children were historically thought to have little internal awareness of their cognition, and uncertainty representations were argued to be slow-developing (e.g., see Flavell, 1979 for a review). A prominent set of theories in adult metacognition propose that confidence is a consequence of “fluency” – the ease with which we recall, process, and express our answers (Alter & Oppenheimer, 2009; Koriat, 1993). Children may, as a result, need to learn this association, and thus may be slow to demonstrate metacognitive awareness. In two Experiments, we experimentally test this theory in children. We selected three behavioral cues to fluency: speech onset, fillers (e.g., “um”, “uh”), and hedges (e.g., “I think”, “maybe”), generated while retrieving answers from long term memory or making perceptual decisions, and assess the relationship between these *verbal disfluencies* (Smith & Clark, 1993), answer accuracy, and explicit ratings of confidence.

Children between the ages of 5-8-years identified photos of animals, answered questions about animal facts, and performed numerical comparisons. Then, in Experiment 1, they provided explicit ratings of their confidence in their answers on a 7-point scale resembling a thermometer. Children ($N = 60$, $M_{age} = 7.06$) reliably used the scale to report their confidence, indicating lower confidence when they provided incorrect ($M=3.64$) compared to correct answers ($M=5.11$). Furthermore, all three measures of disfluency also predicted children's confidence ratings: children had longer speech onsets and produced more fillers and hedges on trials where they provided lower confidence judgments. Therefore, from at least age 5 onward, disfluency is a reliable index of confidence judgments in children.

But the mere correlation between confidence and disfluency doesn't mean that children are using their disfluencies to generate confidence decisions. In Experiment 2, we replicate the basic association between disfluency and confidence, but additionally examine if disfluency predicts confidence even on "disconcordant" trials where children erroneously indicate high confidence for incorrect answers, or low confidence for correct answers. In Experiment 2, children ($N = 60$, $M_{age} = 6.94$) reported their explicit confidence in a relative forced choice where they answered two paired questions and indicated which was their *better* answer. Children reliably reported their confidence in the forced-choice task: accuracy was higher on chosen trials ($M=72.54\%$) compared to rejected trials ($M=33.29\%$), and again had longer speech onsets, and produced more fillers and hedges on trials they rejected. But – importantly – we failed to observe this association on disconcordant trials, where we found no relationship between fillers and hedges and confidence, and a *negative* relationship between speech onset and confidence (i.e., children were more confident on trials they took *longer* to answer).

Together, our results show that disfluencies are: (a) a prominent feature of children's speech; and (b) reliably correlate with accuracy and confidence from at least age 5 onward; but that (c) confidence decisions are not a simple read-out of this disfluency, and instead are primarily correlated with the *accuracy* of children's decisions, rather than their indicated confidence.

O4.1.4 - Spontaneous relational attention serves as a mechanism between executive functions and math learning outcomes

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Details

Background

Evidence supporting the relation between Executive Functions (EFs) and math achievement is well established (for review see Bull & Lee, 2014). However, the mechanism underlying such a relation is not well understood. Since mathematics is a system of relations, the literature on relational reasoning provides some insight (Zhao et al., 2021), and relational reasoning is well known to require a high investment of cognitive resources to align and map relations (see Morrison et al., 2006). Thus the work of noticing the relevance of high-order relations, especially attending to such relations when no explicit guidance is available (described as *spontaneous relational attention*), might serve as a mechanism underlying EFs and math learning outcomes. Indirect evidence supporting such a hypothesis was found by Begolli and Richland (2016) in which individual differences in EFs predicted children's math learning

outcomes after participating in a mathematics lesson that required relational reasoning. However, to our knowledge, no studies have directly tested whether *individual differences* in relational attention would mediate the relation between EFs and math learning outcomes.

Objectives

This study aimed to examine whether spontaneous relational attention would be a potential mechanism through which EF, conceptualized as the ability to inhibit task-irrelevant information, would impact learning outcomes from a math lesson.

Methods

Participants included 167 fifth and sixth graders from five public elementary schools in Orange County. The current study consisted of two days with one day in between. Participants completed a pretest on proportions on Day 1 and then were randomly assigned to one of two versions of an interactive video-based math lesson. Following this, students completed a measure of spontaneous relational attention and then took an immediate posttest. Two days later, students completed a delayed posttest and an EF task (i.e., Flanker).

Results

A latent class analysis (LCA) was performed on responses to the measure of spontaneous relational attention, and four distinct attentional patterns were identified: Relational Attenders ($n = 90, 53.9\%$), who tended to consistently attend to similarities based on relations, Emerging Relational Attenders ($n = 40, 24.0\%$), whose attention to relational similarities emerged but was not as consistent as the Relational Attenders, Object Matchers ($n = 18, 10.8\%$), who consistently attended to similarities based on the appearance of objects, and Inconsistent Responders ($n=19, 11.4\%$), who had an inconsistent pattern in attending to similarities. An LCA mediation analysis in which EF predicted membership of relational attention, which further predicted math posttest scores, controlling for math pretest score and intervention condition, revealed that individuals with a lower EF were more likely to be identified as an Object Matcher compared to as a Relational Attenders (immediate posttest: $p=.035$; delayed posttest: $p=.037$). Object Matchers were found to have a significantly lower score on the delayed posttest than Relational Attenders ($p=.030$) controlling for pretest and intervention condition. No significant difference was found for the immediate posttest or among other pairs for the delayed posttest.

Conclusions

The findings from this study provided empirical evidence supporting that spontaneous relational attention could serve as a mechanism underlying EFs and math learning outcomes.

O4.1.5 - Intellectually humble tendencies are considered desirable by children and adults, even in intergroup contexts

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Details

People often feel strong allegiances to their ingroups' belief systems, leading them to dismiss divergent viewpoints and endorse biased beliefs (e.g., Cusimano & Lombrozo, 2023; Roberts et al., 2021). Although intellectual humility (and more specifically, receptivity to alternative beliefs) is typically considered an epistemic virtue—a tendency observed in children as young as seven (HagÅi & Olson, 2017)—it is unclear how this disposition and related tendencies are evaluated in intergroup contexts. Given that children and adults are motivated by goals of both accuracy and social cohesion, which of these motivations tends to be stronger when they conflict? In a preregistered study, we investigated whether 6- to 9-year-old children (n = 98) and adults (n = 62) from the United States evaluate information-seeking and belief change—two key components of intellectual humility—as condemnable or commendable in novel intergroup situations, when adopting a new belief would reflect a departure from the factual or moral beliefs held by ingroup members. Specifically, we presented participants with scenarios in which a protagonist discovered that a belief they had long held was opposed by a separate belief in another country, after which this protagonist then attended a lecture in a neutral country and heard expert evidence favoring the outgroup's belief. We manipulated whether the groups were in conflict and whether the beliefs were factual or moral, though neither of these factors exerted a reliable effect. Across conditions, 84% of children and 89% of adults said that it was praiseworthy to seek out information about outgroups' divergent factual and moral beliefs. Additionally, 63% of children and 84% of adults judged that it was praiseworthy for others to change their beliefs to match an outgroup's beliefs when faced with compelling evidence. However, while 80% of adults thought it would be bad to retain existing beliefs in the face of conflicting evidence, only 39% of children judged belief stasis to be bad, suggesting a major developmental shift in evaluations of belief fixedness. Finally, 83% of adults and 62% of children judged that, upon discovering evidence supportive of an outgroup's belief, people should tell their fellow ingroup members that the outgroup's belief is correct. We did not detect any age-related changes between 6 and 9 years of age. Thus, this study indicated that children and adults generally consider information-seeking and belief revision to be praiseworthy tendencies, even when these dispositions mean that people will adopt beliefs that conflict with the dominant beliefs held by their ingroup. In a follow-up study with U.S. adults (n = 440), we have additionally examined these tendencies in the context of contested political beliefs (e.g., defunding the police; restricting immigration) and have found largely convergent results. Overall, our data indicate that children and adults praise intellectually humble tendencies in third-party intergroup contexts. By uncovering evidence that second-order beliefs (e.g., that people should revise their beliefs appropriately) may have the power to combat undesirable first-order epistemic tendencies (e.g., resistance to belief change), our findings carry promising implications for modern tendencies toward belief polarization.

O4.2.1 - Neural sensitivity to mental states in infancy predicts later explicit theory of mind reasoning in childhood

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Details

Pre-verbal infants appear sensitive to others' mental states, including their beliefs and even false beliefs. However, it is not until several years later that they are able to accurately articulate that knowledge to answer explicit questions about others mental states. A central debate in the theory of mind literature is if, and how, these early-present implicit social cognitive sensitivities are related to later explicit theory of mind reasoning. Here we address this debate by asking whether individual differences in functional sensitivity of the right temporal parietal junction (TPJ) in infancy, a region that subserves theory of mind in adults and older children, is longitudinally related to later explicit theory of mind reasoning in childhood. To do so, we opportunistically followed up with a group of 4 to 6-year-old children (N=33) who had previously participated in an fNIRS study of theory of mind when they were infants (6-9 months old). As infants, we recorded the TPJ response to video scenarios depicting an actor with a true belief (TB) or a false belief (FB) about the location of an object hidden in an opaque box by a puppet, as well a control condition where the object was similarly placed but the box was clear allowing direct perceptual access (DP). Then, when they were 4-6 years of age, we assessed their explicit theory of mind reasoning using the Theory of Mind Booklet Task (Booklet 2, Richardson, Gweon, & Saxe, 2022; <https://osf.io/g5zpv/>). We pre-registered our analysis plans (<https://osf.io/6bu7d>) before data collection ended. We do find some evidence of a longitudinal brain-behavioral link from infancy to childhood. Specifically, while we did not find that individual differences in TPJ sensitivity to the FB condition (relative to TB) was predictive of explicit theory of mind reasoning as we had predicted, we did find that individual differences in TPJ sensitivity to the DP condition (relative to TB) predicted later explicit theory of mind reasoning in childhood (all belief score: $\beta = .378$, $p = .012$; false belief score: $\beta = .402$, $p = .008$, see Figure 2 in the attachment). In hindsight, the ambiguity of belief tracking in the control DP condition, relative to the more straightforward need to track beliefs regarding the hidden object in the TB and FB conditions, may have best distinguished between infants who had different propensities to engage in belief tracking, suggesting a potential role for differences in active developmental experience in later theory of mind development. More broadly, these results directly link the brain system for theory of mind in infancy with explicit theory of mind in childhood, suggesting brain and cognitive continuity for theory of mind over development.

O4.2.2 - The development of socially mindful behaviors in early childhood

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Details

The development of prosocial behaviors is a crucial aspect of moral development and moral education. Children's prosocial behaviors, such as sharing, helping, and comforting, have been shown to emerge early in childhood (Dunfield & Kuhlmeier, 2013; Tomasello et al., 2012). However, in addition to these direct prosocial actions that usually involve personal sacrifice in order to benefit others, prosociality can manifest in more indirect and subtle ways, where one's own self-oriented actions imply consideration for others. One such form of low-cost, indirect prosociality is social mindfulness, where individuals considerately leave diverse choices for others when taking something for themselves (Van Doesum et al., 2013, 2021; Van Lange & Van Doesum, 2015). Previous research has shown that adults and 6-year-olds evaluate someone who leaves a choice (i.e., two different items) for others as nicer than someone who leaves no choice (i.e., two identical items) (Zhao et al., 2021). However, to the best of our knowledge, there has been no investigation into the development of socially mindful behaviors in children themselves. Questions arise: Do children spontaneously leave choices for others? Are children's socially mindful behaviors influenced by contextual factors, such as prompts emphasizing "considering others"? Are children's socially mindful behaviors correlated with their theory-of-mind capacities? This study aims to address these questions.

The study included 120 children aged 4 to 7 (4.07-7.89 years old, Mage = 6.01, SDage = 1.10; 50% male, 50% female) and 95 adults (45% male, 55% female). During the study, child participants were asked to choose items (e.g., fruits, pens, stickers etc) in a line with another child (presented via video) waiting behind. They had to choose between two items of the same type and one unique item (e.g., two apples and one banana). First, we asked children which item they would choose in a spontaneous context. Next, we asked them which item they would choose if they wanted to make the person behind them happy (i.e., an "other-oriented" context). We also assessed children's personal preferences for the two types of items. Please refer to Figure 1 for an example of the procedure. Additionally, we measured children's theory-of-mind abilities using two false belief tasks.

See Figure 2 for children's responses in the social mindfulness task. The results indicated that children's spontaneous choices were close to chance and did not vary by age. Furthermore, their spontaneous choices aligned with their preferences. In contrast, in the other-oriented context, children's choices were significantly positively correlated with their age ($r = .29, p = .001$), with older children more inclined to leave a choice for others. Children aged 6 and above consistently left a choice for others significantly above chance ($p < .001$). Additionally, children's choices in the other-oriented context were significantly positively correlated with their theory-of-mind performance (partial correlation controlling for age $r = .19, p = .039$).

In conclusion, children's social mindful behaviors develop between ages 4 and 7 and are influenced by social contexts. These behaviors are also correlated with the development of theory-of-mind abilities. This study holds significant implications for understanding children's prosocial behaviors and the social-cognitive factors influencing them.

O4.2.3 - Epistemic and deontic constraints on U.S. and Chinese children's possibility judgments

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Details

In 2007, Shtulman and Carey found that though Boston 4-year-olds distinguished ordinary events (e.g., eating apples) from impossible events (e.g., eating lightning), they struggled with events that were possible but improbable (e.g., drinking onion juice), frequently judging these events impossible. From 4-8, children became increasingly likely to say improbable events were possible. This age-related increase in children's judgments of improbable events as possible has been replicated numerous times in U.S./Canadian settings (e.g., Cook & Sobel). In 2023, Nissel et al. found that though 4-8-year-olds in Wuhan, China judged ordinary events as possible and impossible events as impossible, Chinese children's judgments of improbable events remained consistent with age: 4-8-year-olds judged these events as impossible. The current research seeks to explore potential underlying mechanisms driving how children in both samples think about possibility and replicate these findings with a Chinese sample with greater geographic diversity.

When judging possibility, one can consider epistemic (i.e., physical possibility) and deontic constraints (i.e., permissibility; Johnson-Laird & Ragni, 2019). Individuals in relatively interdependent cultures (e.g., China) have been shown to value deontic concerns (e.g., norms) more highly than do individuals in relatively independent cultures (e.g., U.S.; Marcus & Kitayama, 1991). Therefore, Chinese children may base possibility judgments on deontic concerns while U.S. children may base possibility judgments on epistemic concerns.

To test whether use of epistemic and deontic constraints explained U.S. and Chinese children's possibility judgments, we asked 125 4-, 6-, and 8-year-olds from Austin, TX, and 5 Chinese cities to judge whether ordinary, improbable, and impossible events were possible. Children then judged whether each event was an epistemic violation (required magic) and a deontic violation (whether someone would get in trouble (U.S.)/get criticized (China)).

As in Nissel (2023), U.S. and Chinese children judged ordinary events as possible and impossible events as impossible. While U.S. children became increasingly likely to judge improbable events as possible with age, Chinese children's judgments remained consistent. Magic judgments aligned with possibility judgments of ordinary and impossible events for children from both countries at each age, such that children judged ordinary events to not require magic and impossible events to require magic. Thus all children sampled seemed to use epistemic criteria to differentiate ordinary from impossible events.

For improbable events in particular, magic judgments became increasingly predictive of possibility judgments with age for U.S. children; suggesting that with age, U.S. children increasingly rely on epistemic criteria to judge the possibility of improbable events. For Chinese children, however, magic judgments became decreasingly predictive of possibility judgments of improbable events, suggesting that increasingly with age, Chinese children may base judgments of these events on different, culturally-learned criteria.

However, across event types and participant nationalities, criticism judgments did not align with possibility judgments. We will explore explanations for these findings as well as directions for future research.

O4.2.4 - How do child learners shape language: a silent gesture study with 6-year-olds

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Details

In the last decade, there has been a surge in studies using silent gesture paradigms to investigate cognitive and learning biases that may shape language structure. In these studies, hearing, non-signing adult participants describe a scene or item using only gesture. Interestingly, participants in these studies do not appear to rely on the world order of their spoken language(s). Rather, there is remarkable consistency in the ordering of gestures cross-culturally with preference for subject-object-verb (SOV) gesture order regardless of native language order. This preference for SOV ordering is often argued to reflect deeply rooted cognitive or communicative biases that may have played an important role in shaping language structure (e.g., Gibson et al., 2013; Motamedi et al., 2019). However, this literature makes a critical assumption: that adult ordering biases reflect the types of biases that have given natural languages their shape.

To better understand how human biases shape language structure, we propose that data from children is crucial, as children are the world's primary language learners. In this pre-registered study, we examined the word order preferences of 27 6-year-old English-speaking children and also 33 English-speaking adults. Participants watched a series of short video clips in which a person acted on an inanimate object and described what they had seen "using only their hands and not their voices." Based on findings from adults, our two hypotheses were that when asked to communicate through gesture without speech, English speaking children would: 1) show a preference for verb-final orders and 2) show a preference for gesturing subjects before objects.

Consistent with previous research (e.g., Goldin-Meadow et al. 2008), when adults were asked to communicate through gesture they did not follow the pattern of their spoken language. Instead, adults showed preference for verb-final gesture utterances ($\chi^2(1, N=33)=63.84, p<0.001$) as well as subjects before objects in those utterances ($\chi^2(1, N=33)=24.95, p<0.001$). Like adults, children's preferences did not fully follow that of their spoken language, however the child results also did not entirely align with adults'. While children rarely produced utterances containing gestures for all three elements (subject, object, and verb), children did show a preference for verb final gesture utterances (from the trials that included verbs, nearly 60% of trials were verb final ($\chi^2(1, N=28)=29.05, p<0.001$). However, the children showed no consistent ordering preference for subjects and objects ($\chi^2(1, N=28)=1.56, p=0.21$). While we remain cautious in our interpretation of this null result, we find it intriguing that in the few utterances where children did produce all three gestural elements, the adult preferred order of SOV was relatively uncommon (found in just 20 of nearly 100 three gesture utterances), and in fact was less preferred than the children's spoken language order of SVO (as well as OSV and OVS, interestingly).

These results suggest that while children were not simply using English word order, they were also not using adult-like SOV order, possibly being more influenced by their spoken language's order than adult participants. If we wish to learn about the human biases that shape language, we must focus additional attention on the biases of child learners.

P1-16 - Why help at home? Young children's and caregivers' reasoning and evaluations

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Details

Helping is usually said to benefit a recipient. But young helpers may also benefit (Rheingold, 1982). Children's participation sometimes slows down caregivers' housework but provide children with opportunities for having fun and learning valuable skills. We expect that these impacts of early helping on the helper and recipient will inform children's and caregivers' evaluations of helping at home. At the preschool age, children consider the needs of others or the cost of helping in judgments that someone should help (Dahl et al., 2020). In conversations about helping, caregivers have opportunities to guide children's prosocial tendencies (Drummond et al., 2014). But past research has not addressed how caregivers and children focus on the impacts of helping in evaluations of when to help (Turiel, 2015).

The present study examined whether preschoolers' and caregivers' evaluations incorporated how helping at home impacts helpers and recipients. The study also examined relations between evaluations of such helping and caregiver-child conversations about helping at home. We assessed young children's and their caregivers' evaluations in response to hypothetical scenarios and storybook conversations.

U.S. 4- to 6-year-olds (47 girls, 40 boys) and their caregivers participated via Zoom and online surveys. We presented 8 hypothetical scenarios in which a child could help at home. In a 2x2 within-subjects design, scenarios varied by whether the protagonist child wanted to help or continue an alternative (alt.) activity, and whether the protagonist parent liked when the child helps or does the alt. activity. Participants judged which action the child should take and provided reasons for their judgments. Children and caregivers also discussed a storybook, with several conversation prompts, in which a child helped around the house.

As expected, when the protagonist wanted to help, children more often judged that they should help, $p < .001$. Children's justifications for these judgments typically referenced child interest. When the protagonist parent liked the child's help, children more often judged that they should help, $p < .001$, and reasoned about others' interests.

By contrast, caregivers heavily weighed child interest, and only considered parent interest when the child wanted to do the alt. activity, interaction: $p = .012$. Caregivers were also more likely than children to say the child should help when they wanted to, $p < .001$.

Coding and analysis of storybook conversations is ongoing. One coding scheme assesses how caregivers and children discuss emotions and internal states (e.g., which and whose emotions they reference, who prompts or produces the reference). Another coding scheme assesses references to the interests of the

protagonist child or the parent. Preliminary results suggest that caregivers and children often reference internal states. We expect that caregivers who focus more on the emotions and interests of one protagonist (child/parent) will have children who weigh that protagonist's interests more heavily in the hypothetical vignettes.

This study reveals how young children and their caregivers in the U.S. weigh 2 key factors in early helping at home: the helper and the recipient's interests. Given the unhelpful nature of much early helping (Hammond & Brownell, 2018; Rheingold, 1982), the weighing of these factors can shape child and caregiver decisions about early prosocial participation—or lack thereof.

P1-17 - Children's gender stereotypes about the individual and collective

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Details

There is evidence that children endorse the gender stereotypes that men are smarter than women and that women are nicer than men. Here we ask whether these stereotypes are specific to individual people (males or females) or apply generally to occupations with different gender demographics (male- or female-dominated jobs). Across three studies, we tested the extent to which 6- to 10-year-olds know the gender demographics of real-world jobs and whether they used this information when judging intelligence and niceness. As a first step, we assessed children's knowledge of gender demographics within different occupations. When asked who is employed in an occupation (Study 1, N = 50 ; 27 boys, 23 girls) via a 3-alternative forced-choice (AFC) method of mostly men, mostly women, or equal (men and women), children were generally accurate at identifying male- and female-dominated jobs (see Figure 1). In Study 2 (N = 54; 24 boys, 30 girls), we presented children with a 2-AFC task where we paired a male- and female-dominated occupation (e.g., nurse and police officer) matched on level of education. When asked which occupation is smart or nice, children judged female-dominated jobs as nicer than male-dominated jobs, but they had no expectations about which jobs employed smarter individuals (see Figure 2). In Study 3 (N = 44; 25 boys, 19 girls), children were further asked about their perceptions of individuals within these jobs. We again employed a 2-AFC task with pairings where males were occupied in female-dominated occupations, and females were occupied in male-dominated occupations (e.g., John is a nurse, and Emma is a police officer). When asked who is smart or nice, children judged males in female-dominated occupations as nicer than females in male-dominated occupations, but they did not differentiate between individuals when judging intelligence (see Figure 3a). Other trials within this study described individuals as either nice or smart and required that children select which job they performed. We found that children were consistent in their expectations about nice individuals; that is, they expected both nice men and women to be employed in female-dominated jobs (see Figure 3b). Children's perceptions of smart individuals, however, were less consistent, though gender specific. That is, whereas there was an association between smart men and female-dominated jobs, smart women were equally likely to be employed in either male- or female-dominated jobs (see Figure 3b). Altogether, these findings suggest that gender stereotypes about intelligence may be less robust than those about niceness. Moreover, they suggest an intriguing difference in children's expectations of occupational status for smart men versus smart women, which will need to be explored in future research.

P1-18 - Two- and three-year-olds prefer learning-oriented instead of outcome-oriented help

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Details

Help-seeking is a crucial social-cognitive skill that learners deploy when encountering the limits of their knowledge or skills. Nelson-Le Gall (1981) distinguishes between mastery-oriented and outcome-oriented help-seeking. Help-seeking is mastery-oriented when the goal is to be shown how to execute a task or receive hints to a solution rather than the solution itself. While studies show that school-aged children use mastery-oriented help-seeking (Arbreton, 1998; Butler & Neuman, 1995; Nelson-Le Gall & Jones, 1990), no studies have directly assessed the origins of mastery-oriented help-seeking.

In two online experiments (N =144, 72 female), we investigated whether 2- and 3-year-old children from ethnoracially diverse backgrounds (68% White; 16% Latinx) prefer mastery-oriented over outcome-oriented help. We used a third-person approach, in which children watched videos showing a puppet trying but failing to complete a task (e.g., pouring water into a cup). Children were then introduced to two potential helpers: one who showed the puppet how to accomplish the task (e.g., demonstrating how to pour the water) and one who only presented the puppet with the desired outcome (water in a cup) without also showing how to perform the task. Finally, children were asked to select one of the helpers to assist the puppet. In Experiment 2, another experimental condition was added (No Learning Condition), in which, instead of failing to complete the task, the puppet, after struggling for a moment, managed to accomplish the task by herself so that no mastery-oriented help was needed. This condition was added to the Learning Condition to show that children do not always prefer procedural demonstrations over presentations of outcomes but do so specifically when an agent seeks to acquire procedural knowledge or learn a new skill.

We hypothesized that children would select the mastery-oriented over the outcome-oriented helper when asked to select help for the agent who was unable to complete the task (Experiment 1 and Learning Condition of Experiment 2). We furthermore predicted that children should show less of a preference or no preference for mastery-oriented help when the agent, by contrast, was able to complete the task on their own (No Learning Condition).

In accordance with these hypotheses, we found that when learning was at stake, 2- and 3-year-olds preferred helpers who demonstrated how to execute a task (mastery-oriented helpers) over those who only showcased a completed task without demonstrating the steps toward that outcome (outcome-oriented helpers). In a non-learning context, however, children showed no preference for a specific helper and selected mastery-oriented help significantly less often than in a learning context.

Our results suggest that even very young children understand a learner's need to be shown how to perform tasks and build skills. By the tender age of 2, children seem to understand that help-seeking is often motivated not by a desire to simply have other persons do the work and complete one's tasks but, rather, by a desire to learn the procedures which eventually will allow one to complete these tasks by oneself. The results will be discussed in the context of social learning theories and the mechanisms of cultural evolution.

P1-19 - Exploring mind wandering and situational interest as mechanisms for how math anxiety negative math learning and understanding across genders

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Details

Previous research has suggested math anxiety, a genuine worry or fear about mathematical situations, might reduce math learning through increased mind wandering with a decrease in interest (Mesghina et al., 2023). Furthermore, gender gaps in math achievement continue to be a persistent issue as past studies have shown higher math anxiety among girls (Devine et al., 2012). Nevertheless, providing worked examples in the classroom may effectively solve this issue by disrupting the complex mechanism of math anxiety. Cognitive Load Theory (Sweller, 1988) suggests that worked examples, mathematical problems with written out solutions, can increase students' available working memory resources during problem-solving and math learning - which are a limited set of cognitive attention resources that allow students to learn mathematics concepts and solve word problems. At the same time, many students feel math anxiety when faced with math learning and problem-solving, which can generate worries that engage the same limited set of working memory resources, reducing available resources for problem-solving. An experimental pre-post design experiment was conducted on 280 fifth-graders from ten schools in Orange County and Chicago to test whether worked examples could reduce math anxiety in students learning about ratios compared to students who received no worked examples. A path analysis was implemented to examine the relationships between situational interest, mind wandering, trait math anxiety, and math achievement (both test scores and perceived understanding) when worked examples were given (WE Condition) or were not given (no WE). Gender was added as a moderator to test gender differences in these relationships. Findings indicate trait math anxiety positively predicted mind wandering while situational interest also predicted mind wandering but negatively. Both trait math anxiety and mind wandering had significant negative impacts on learning achievements. Moreover, no gender differences were found in the effect of trait math anxiety on learning achievements when worked examples were given, signifying that worked examples are effective tools in reducing math anxiety for students of all genders, and may be particularly helpful given that in the general population, trait anxiety tends to be higher in girls. However, our results suggest further precaution for potential gender differences in the impacts of mind wandering on learning outcomes.

P1-20 - Individual differences in categorization development: the mediation of executive functions and world knowledge, the case of food

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Details

Cross-categorization, the ability to represent a single entity in various ways, is a pivotal cognitive function. It enables children to view an object, such as an apple, from different angles like "fruit", "dessert", or even "a food to eat on a diet", depending on the context, allowing them to extract more

relevant information and interact efficiently with the object (Ross & Murphy, 1999). Past research primarily focused on documenting the developmental trajectory of cross-categorization, examining when children attain this ability and how it improves with age (Nguyen, 2007; Nguyen & Murphy, 2003). However, the cognitive underpinnings of the cross-categorization abilities development remain insufficiently understood (Blaye & Jacques, 2009), either resulting from knowledge accretion or an increase in cognitive control. This study aims to investigate the mediating roles of world knowledge and executive functions in children's development of cross-categorization and categorization abilities in the food domain. Further, it considers that, independently of age, children with higher neophobia levels (reluctance to try new food) face categorization difficulties (e.g., Pickard et al., 2023; Rioux et al., 2016). We hypothesize that neophobic children's categorization difficulties may stem from less developed world knowledge and executive functions, specifically cognitive flexibility (Foinant et al., 2022).

In the first experiment, we assessed the ability of 4-to-6-year-old children ($n = 122$) to categorize food items at superordinate levels. In the second experiment, we tested the ability of 3-to-6-year-old children ($n = 100$) to cross-categorize the same food items based on two different relationships (e.g., taxonomic and thematic). In both experiments, we collected independent measures of children's food neophobia via a caregivers' questionnaire, world knowledge through a vocabulary test, and assessments of working memory, inhibition, and cognitive flexibility. Results indicate that both world knowledge and executive functions mediated the effect of age on categorization performance and on cross-categorization performance. However, only cognitive flexibility partly mediated the negative effect of food neophobia on categorization performance.

In conclusion, this research highlights the complex interplay between world knowledge, executive functions, and child characteristics in shaping the development of categorization abilities. It also has potential implications for food education interventions. Indeed, current interventions have shown limited success in achieving even modest improvements in the short term among children with higher levels of food neophobia (e.g., Rioux et al., 2018). In light of the present findings, this outcome is not unexpected, as these children exhibit inflexibility in their perspective and approach to food.

P1-21 - Reach tracking reveals dissociable roles of inhibitory control in children's "trust in testimony"

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Details

Preschoolers selectively reason about others' information based on their past accuracy (e.g., Tong et al., 2020). Children's developing inhibitory control might be a necessary component to this developing capacity. Jaswal et al. (2014), for example, showed that 3-4-year-olds' ability to ignore inaccurate information provided by human informants correlated with performance on inhibitory control measures. What are the mechanisms of inhibition that underlie selective learning?

We presented 4-6-year-olds ($N=48$, $M_{age}=68.27$ months, 26 girls; 37% BIPoC) with an individual (Laura) who played a hiding game with children. On each trial, Laura hid a sticker in one of two boxes presented

on a screen in front of the child. Laura indicated where she hid the sticker by pointing at one of the boxes with her finger or with an arrow. She was always accurate or inaccurate (a 2x2 design). As children made their response, we tracked their reaching movements in 3D space over time. This allowed us to consider distinct inhibitory mechanisms (following Shenhav et al., 2013, validated by Erb et al., 2017, which provided the power estimates for our sample size): (1) A monitoring component that detects conflict between the stimulus and response, operationalized by the latency between the appearance of the stimulus and the finger taking flight, and (2) A conflict resolution component that allows children to respond, operationalized by the maximum deviance in the curvature of their reach compared to an idealized line.

Figure 1 shows data for initiation latency and curvature deviance across the conditions. Regardless of the cue's accuracy, children needed more resources (i.e., had longer initiation latencies) to monitor human pointing for conflict than arrows, $B = 3.37$, Wald chi-squared(1) = 10.36, $p = .001$. The inhibitory resources necessary to resolve the conflict between the location indicated by a human cue and the past accuracy of that cue remained consistent throughout the procedure (i.e., curvature deviance was constant). Early trials with arrow stimuli, in contrast, were more deviant (i.e., required more resources), particularly for the younger children, $B = -0.001$, Wald chi-squared(1) = 3.84, $p = .05$.

These findings suggests that children monitor information from human and non-human informants differently, and more inhibitory resources are required to process information from human than non-human informants. A speculative explanation is children are sensitive to human informants' variability in accuracy and are calibrating the reliability of human informants (e.g., McLoughlin et al., 2021; Tenney et al., 2010). In contrast, learning that a human is inaccurate required fewer inhibitory resources than learning about an arrow particularly for 4-year-olds. A speculative explanation is that children are developing the understanding that once an arrow is drawn, it indicates a fixed location, making it more pedagogically invalid to use as an inaccurate cue. In general, these data show that there are distinct inhibitory mechanisms involved in selective learning and reach tracking can be a novel method to study mechanisms of cognitive development.

P1-22 - International adoption separates cognitive development from language knowledge in the acquisition of negation

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Details

Negation is a cornerstone of human reasoning, and how children learn to express it in language can provide clues to its origins in thought. Although "no" is one of many English-speaking children's first words, it is initially used in a limited way, mainly to refuse (Bloom, 1970). This implies that young children may not grasp the full *negation* meaning of the word "no," and initially map it to a less abstract meaning, like *rejection*. They do not pass comprehension tests of the *negation* meanings of "no" and

“not” until 24-27 months, well after they first say “no” (Feiman et al., 2017). This early struggle with negative language may reflect a conceptual limitation: a child who cannot represent the concept *negation* would be unable to learn the meanings of negation words. Alternatively, children may merely face a linguistic information limitation: even if they can represent *negation*, they might struggle to figure out which words express it until they understand more of their language. Imagine the difficulty of figuring out what “not” means in “the ball is not red” if you do not yet know what “ball” or “red” mean.

To test between these possibilities, we compared internationally adopted toddlers to L1-learning infants. Toddlers adopted internationally into English-speaking families get the same immersive language input as L1-learners, but are older and thus more conceptually mature. If L1-learners struggle with negative language because they struggle with the concept *negation*, then older adoptees should produce negation words relatively earlier in language learning. However, if limited linguistic information is the limiting factor, then adoptees and L1-learners should master the mapping from *negation* to “no” at similar points in language acquisition.

Methods. We analyzed 101 bi-monthly transcripts of spontaneous speech from 8 adopted preschoolers, produced over 6 months (from Snedeker et al., 2012). Each adoptee was matched with one control L1 English-learning infant from the CHILDES database, such that each session matched as closely as possible on mean length of utterance (MLU). Two native speakers categorized each negative utterance (N=4924) as either rejection or denial negation.

Results. Confirming previous findings, the proportion of denial negation increased with MLU (mixed effects logistic regression; OR=1.98, $p<0.001$), and the proportion of rejection decreased (OR=.45, $p<0.001$). However, there was no effect of group membership (adoptee vs. control) on either denial (OR=.79, $p=.11$) or rejection (OR=1.14, $p=.51$), and there was no interaction between group and MLU for either denial (OR=.92, $p=.70$) or rejection (OR=1.45, $p=.20$).

Discussion. There was no difference in the acquisition of negation relative to the trajectory of language learning overall between L1-learning infants and more conceptually mature internationally adopted toddlers. This implies that a linguistic information bottleneck is sufficient to account for children’s relatively late acquisition of negation words. Even more conceptually mature, older children struggle to learn the mapping from *negation* to the words “no” and “not”. This bolsters the possibility that infants can already reason with *negation*, and need time only to identify which words express it.

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P1-23 - Seeing gray in a world of black and white: do children appreciate intellectual humility in the face of moral dilemmas?

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Details

The moral domain involves not only determining what actions are right or wrong based on basic moral principles and norms, but also making difficult decisions that require balancing competing values and principles (i.e., moral dilemmas). Classic research suggests that the independent reasoning skills necessary to resolve dilemmas emerge late in development (Piaget 1932; Kohlberg, 1969). Although some recent studies have explored how children resolve moral dilemmas (e.g., Mammen et al., 2019; Pellizzoni et al, 2010; Bucciarelli, 2015), it remains unclear whether (and at what age) children demonstrate an independent awareness of the appropriate reasoning process for moral dilemmas, and in particular an awareness that the decision ought to involve a degree of uncertainty. Here, in a preregistered study, we ask whether children appreciate that reasoning through dilemmas requires acknowledging uncertainty.

Five- to 8-year-old U.S. children ($N = 129$, 63 boys and 66 girls) were randomly assigned to a Moral Dilemma condition, in which story characters face dilemmas between two prosocial actions (helping versus keeping a promise), or a Personal Cost control, in which story characters face decisions between a matched prosocial action (helping) and a self-interested action (playing). Children were then presented with two reasoners who made the same judgment, but one showed confidence in her thinking, and the other expressed uncertainty. We asked children to determine which reasoner had a better way of thinking, and to make comparative judgments about the reasoners' other positive character traits. Children preferred an uncertain reasoner's "way of thinking" to a confident reasoner's thinking even when they reached the same conclusion (OR = 0.34, 95% CI = [0.2, 0.59]; $p < .001$). With age, children also made other moral and epistemic evaluations of the uncertain reasoner: they thought she was nicer (OR = 0.44, 95% CI = [0.25, 0.77]; $p = 0.004$) and more likeable (OR = 0.47, 95% CI = [0.24, 0.89]; $p = 0.02$), and preferred to learn from her (OR = 0.71, 95% CI = [0.52, 0.97], $p = .03$). In contrast, children who heard about a decision with a conflict between a personal preference and a moral action did not think uncertainty over confidence was a better reasoning approach.

Our study shows that children judge the expression of uncertainty as a more desirable way of thinking about moral dilemmas than appearing confident in one's choice. Given that previous research has shown that young children and adults find confidence to be a salient cue of reliability (e.g., Birch et al., 2010; Sabbagh & Baldwin, 2001), it is notable that children did not use one's confidence as a positive indicator of moral competence by default. Instead, they flexibly displayed a preference for the expression of uncertainty. Taken together, our work suggests that before successfully resolving moral dilemmas independently, children demonstrate an early understanding that it is epistemically and morally virtuous to admit one's uncertainty when reasoning about dilemmas.

P1-24 - Investigating the links between parent math anxiety, parenting behaviors, and child math anxiety and achievement in middle childhood

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Details

Existing evidence indicates that parent math anxiety is a predictor of children's math achievement and anxiety (Becker et al., 2022; Soni & Kumari, 2017). Given research examining these direct links, there is a newfound interest in examining the mechanisms by which parent math anxiety relates to children's math achievement and anxiety to understand how math anxiety is transmitted. For example, existing research has found that parent math anxiety is associated with controlling behaviors, which are negatively linked to children's math achievement (Oh et al., 2022; Retanal et al., 2021). However, more research is needed to examine the mediating role of parenting behaviors, such as autonomy-supportive and controlling behaviors, during homework help in elementary school, when parents feel the need to become involved in homework and believe doing so will help their child's academic outcomes (Hoover-Dempsey et al., 2001).

Using a sample of 175 parent-child dyads followed longitudinally from second to third grade, this pre-registered study explored whether observed parent autonomy-supportive and controlling behaviors mediated the link between parent math anxiety and child math achievement and anxiety one year later. When children were in second grade, parent-child dyads visited the lab to complete individual tasks and a homework help task. The parent-child dyads returned to complete similar measures when the child was in third grade. Parent math anxiety was measured using the Abbreviated Math Anxiety Scale (Hopko et al., 2003), which includes nine statements to indicate feelings of anxiety in specific math scenarios. Parenting behaviors were measured using a coding scheme of six autonomy-supportive and four controlling behaviors. Behaviors were coded for present or absent in 30-second intervals across the ten-minute homework help task (Cheung et al., 2016). Child math achievement was measured by the Woodcock Johnson IV – Applied Problems (Schrank et al., 2001), and child math anxiety was measured by the modified Abbreviated Math Anxiety Scale (Carey et al., 2017). Covariates include parent math achievement, years of parent education, household income, and children's race/ethnicity (White/Caucasian).

Results indicate that parent math anxiety was not linked to their autonomy supportive or controlling behaviors, when controlling for parent math achievement. Autonomy support was not significantly linked to children's math achievement or math anxiety in third grade. However, parental control was significantly and negatively linked to children's math achievement, but not anxiety, a year later.

Overall, this study provides evidence for the pathways that influence children's math achievement. While parent math anxiety was not linked to autonomy-supportive or controlling behaviors during a homework help task, parents' controlling behaviors were linked to lower levels of children's math achievement one year later. These results provide information for researchers and educators on where to intervene to disrupt the link that impedes children's math achievement. By facilitating fewer controlling behaviors through parent homework-involvement interventions, parents can begin to support children's math for long-term success. Next steps include examining parent emotion regulation

as a potential moderator, to explore whether associations between parent math anxiety and parenting behaviors differ for parents' varying levels of regulation skills.

P1-25 - Cascading effects of early maternal cultural orientation on Spanish-English child-directed speech and vocabulary knowledge

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Details

Many Latino children in the U.S. (70%) simultaneously encounter two cultures and languages (Migration Policy Institute, 2019). Both caregivers' cultural orientation (alignment of one's identity, values, and customs with a culture) and child-directed speech shape children's developmental outcomes (Hurtado et al., 2008; Umaña-Taylor et al., 2002). However, the ways in which caregivers' cultural orientation and child-directed speech are linked when children's learning is emerging via exposure to two languages and cultures have not been clearly outlined (Perry & Gámez, 2023). This longitudinal study examines how early maternal cultural orientation is linked to maternal child-directed speech and their children's Spanish and English vocabulary knowledge in a sample of 299 Mexican-American mother-child dyads (54.5% female) from low-income households (Curci et al., 2020).

At child age 9 months, mothers completed the Acculturation Rating Scale for Mexican Americans-II (Cuellar et al., 1995) to measure Mexican and Anglo cultural orientation separately. At 24 months, mother's speech during a five-minute free-play was coded for quantity, diversity, and codeswitching. At 36 months, children's expressive vocabulary in Spanish and English were assessed via the Woodcock Muñoz Language-Revised Normative Update. Demographics, collected prenatally, included maternal education level, years in the U.S., age, number of children, and sex of the child.

A path analysis examined how maternal cultural orientation, child-directed speech, and children's vocabulary scores are linked, controlling for demographics (Fig. 1). Spanish child-directed speech positively predicted children's Spanish vocabulary ($B=1.337, p<0.001$). However, maternal Mexican cultural orientation did not predict their Spanish child-directed speech nor their child's Spanish vocabulary. In contrast, Anglo cultural orientation predicted mothers' English child-directed speech ($B=0.416, p<0.01$), English child-directed speech predicted children's English vocabulary knowledge ($B=2.585, p<0.001$), and maternal Anglo cultural orientation predicted children's English vocabulary ($B=1.034, p<0.05$). This effect was no longer significant when accounting for English child-directed speech ($B=0.758, p>0.05$); thus, English child-directed speech fully mediated the link between Anglo cultural orientation and English vocabulary.

Results revealed that maternal Anglo orientation predicted children's English vocabulary through English child-directed speech, suggesting that mothers with high Anglo cultural orientation provide more English exposure, diversity, and codeswitching in their speech, subsequently supporting children's English knowledge. Although Spanish child-directed speech predicted Spanish vocabulary, maternal Mexican orientation did not predict Spanish child-directed speech or Spanish vocabulary. Given that mothers were highly Mexican affiliated and spoke predominantly Spanish child-directed speech, the lack of

heterogeneity in the sample may have obscured any effects. Overall, this study demonstrates the cascading effects of early cultural-linguistic environments on emerging dual language skills. Together, the results demonstrate the importance of understanding caregiver cultural orientation in children's early development as an indicator of caregivers' child-directed speech and children's vocabulary development.

P1-26 - Intentional social perception construction by those with minoritized identities

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Details

The present study's mixed-methods convergent design proposes a theoretical framework on how having a minoritized identity increases everyday utilization of theory of mind. Previous research in cultural psychology illustrates how collectivist values place importance on other group members' mental states, through frequent consideration of such (e.g., Markus & Kitayama, 1991; Wu & Keysar, 2007). Subclinical levels of social anxiety experienced by minority group members, specifically about self-perception through others' eyes, are functionally similar to collectivist cultural values of maintaining group harmony. Literature in social psychology additionally presents the concept of 'sociocultural realities' where membership in one social group membership brings about different values and expectations of others' behaviors than membership in a different social group. This combined with living in a prejudicial environment where discriminatory acts (e.g., microaggressions, hate crimes, systemic biases) are common for social group members with lower social power identities (e.g., ethnic, LGBTQ+, disability) provides a foundation for understanding how someone with a minoritized identity can develop a need for utilizing theory of mind as a form of social survival. Adult participants who self-identify as someone with at least one minoritized identity are included in the study. All participants completed a predominantly quantitative questionnaire. A sub-sample additionally participated in individual follow-up interviews to create a narrative relating Minoritized Identity to Theory of Mind utilization both quantitatively (through Structural Equation Modeling) and qualitatively (through thematic analysis). Identity is measured through three domains (Strength, Prior Experiences, and Awareness) with Cultural Self-Construal as an expected moderator for Theory of Mind. The construct of theory of mind was captured quantitatively through a social anxiety measure after extensive identity and cultural self-construal priming. The SEM model and measures will be discussed in the context of participant-generated cognitions and experiences. Qualitatively, participants with various minoritized identities (including ethnic, LGBTQ+, and disability identities) display an active response to a prejudicial environment where their behaviors are intentionally modified to manipulate how others perceive them. An additional finding is how participants are able to state a singular primary minoritized identity that is most salient among multiple they have and/or a combined identity that cannot be separated within their sociocultural reality (e.g., Samoan woman). This provides evidence that those with minoritized identities frequently express a functional, everyday utilization theory of mind, and that theory of mind utilization may influence the salience of their identity/identities chosen to be presented. Findings will be presented in the context of identity development within a prejudicial cultural environment.

P1-27 - Exposure to interactive media, but at low levels, is associated with better executive functioning in children: a meta-analysis

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Details

This meta-analysis investigates the relationship between media exposure and executive function (EF) skills in children aged between 1 to 6 years of age. A literature search was conducted and studies had to meet the following inclusion criteria: a) the age range of the children should be between 1 and 6 years old; b) the children should not have any developmental disorder (e.g., ADHD, autism) or special conditions (e.g., bilingualism, preterm birth); c) the studies should include at least one measure of executive functions such as inhibition, working memory, cognitive flexibility, problem-solving, planning, reasoning, or composite EF; d) the studies should also include at least one measure of media usage and exposure (e.g., TV, touchscreen devices, computers, smartphones, video games, handheld games, touchscreen apps, or unspecified overall media use); e) executive functions should be assessed using behavioral or neurocognitive tasks, f) media usage should be reported by parents; and g) the correlation coefficient between media usage and EF should be either presented in the paper or calculated using available information (e.g., means, standard deviations, sample size) from the study manuscript. We analyzed data from 26 studies with 94 effect sizes and 6,886 children and explored both the overall association and potential moderators. While the overall relationship between media exposure and EF skills was non-significant, several moderators were found to play important roles in this association. Media interactivity type significantly moderated the association, such that children's interactive media usage was positively, yet receptive media usage was negatively associated with EF skills. The amount of exposure was also an important moderator, indicating that while low levels of interactive media usage may benefit children's EF skills, excessive receptive media exposure can be detrimental. The current meta-analysis findings further emphasize the importance of considering specific factors such as media type and amount of exposure when making a conclusion about whether media usage benefits or harms children's cognitive development.

P1-28 - Variable embodied experience improves children's ability to reason about altered physical laws

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Details

A key component underlying children's successful interactions with the external world is their ability to reason about action outcomes and future events. Studies from psychology and neuroscience have shown that this reasoning skill is critical when humans need to respond quickly to changes in local conditions and adapt to real-world environments that are variable, unpredictable, and full of novel situations. An influential cognitive perspective posits that children reason by forming an internal representational model of the external world and simulating actions forward in time. However, in daily

life, reasoning is a cognitive process that intertwines with the real-time embodied experience in the physical world.

Despite the importance of reasoning and adaptability to human function and survival, existing evidence is limited in explaining how and which embodied experience affects high-level reasoning when adaptability is required. Here, we investigated the effects of different types of embodied experiences on high-level reasoning using virtual reality (VR) environments with altered gravities.

We tested 72 school-aged children (8- to 12-year-olds) and adults in a basketball game where they were asked to throw a ball into a basket under different gravities. They were randomly split into three experimental groups in which the practice differs by the level of variability in gravity and distance inside a VR setting. Before and after the VR practice, all participants were tested in a computerized 'virtual tool use' game, which consisted of a series of reasoning challenges in which participants were asked to place an object (a 'tool') in a simulated environment to achieve a goal. The tool placement triggers physical cascades, which approximate the physics of the real world but with altered gravity, which affects the object-to-object interactions. To solve the challenges, participants had to apply their physical knowledge to reason about how to use the tools but had to adapt to the altered physical law.

We found that more variable practice in the VR setting led to better adaptation of physical reasoning. In addition, different VR practices led to different strategies for how participants solved the reasoning problems. Finally, children were affected more by the VR practice compared to adults. Our results demonstrate how embodied experience in real-time shifts high-level reasoning when adaptability is required. These findings suggest that children's internal representation of the physical world is based on an adaptable underlying cognitive mechanism which can be improved with more variable embodied experience.

P1-29 - Episodic future thinking and children's delayed gratification: an individual differences study

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Details

Cueing adults to imagine their personal future has consistently been proven to increase their preference for delayed rewards in intertemporal choice tasks. However, growing evidence suggests that similar episodic future thinking (EFT) cueing does not improve children's delay of gratification performance. The current study follows on from two studies that failed to find an EFT cueing effect. In the first of these ($N=139$) 8-11-year-olds who were cued to imagine receiving their rewards in the future prior to their decisions showed no difference in performance in comparison to a no cue condition. In an unpublished follow up study ($N=119$), we also failed to find differences in performance between children who were cued to engage in reward-related versus reward-unrelated future thinking. The current study aims to understand why children struggle to benefit from cueing by identifying cognitive characteristics that may influence whether future thinking cues are effective.

The predictor variables chosen for our study reflect three potential explanations for children's difficulties in benefitting from EFT cues:

1. Children have insufficient EFT abilities
2. Engaging in EFT places high demands on children's limited cognitive resources
3. Children differ to adults in the extent to which they experience pleasure/displeasure when anticipating positive future events

With these explanations in mind, we assess 8-11-year-olds' EFT abilities using an EFT interview. We assess cognitive resources using a working memory task and the *AX-CPT* task to measure proactive attentional control, inhibition, and the ability to utilise cue information using *d'-context* (Braver et al., 2009). We also measure, for the first time in a child sample, ratings of pleasure and displeasure when anticipating positive future events. These variables are used as predictors of performance on both cued and non-cued versions of two tasks: a simple delay choice task with real rewards and a temporal discounting task using hypothetical monetary rewards. The difference in scores between the cued and non-cued versions of each task indicates children's ability to benefit from EFT cues.

At the half-way stage of data collection, preliminary analyses ($N = 50$) show no significant overall group difference between scores on the EFT and cued versions of each task, replicated previous findings. Separate hierarchical regressions for each variable while controlling for age and vocabulary show that working memory ability, proactive attentional control and *d'-context* are predictive of more delayed choices in the real rewards delay choice task at baseline. They do not however predict a benefit from EFT cueing. For the temporal discounting task, proactive attentional control significantly predicted steeper discounting of future rewards in the baseline version of the task, yet it also predicted a greater ability to benefit from future thinking cues. The displeasure and pleasure of anticipating future events or children's EFT skills are not, at this stage, predictive of their ability to delay gratification in either task. Cognitive abilities such as attentional control seem to be important in determining whether children choose to delay gratification; the extent to which they are important for applying thoughts about the future to the decision-making process seems to vary by task type.

P1-30 - What variables influence children's metamemory skills for newly learned words?

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Details

Introduction. Metamemory is a crucial component of metacognition because it enables individuals to monitor their learning and/or performance over time (e.g., Maki & Berry, 1984). To our knowledge, there are few studies that have explored whether young children use metamemory skills to monitor new word mappings and whether they can reliably assess their ability to remember newly learned words. The current study addresses this literature gap by starting to build a theory of the metamemory process, such as predicting and monitoring, underlying early word learning.

Methods. 88 4- to 7-year-old children were presented with metamemory and word learning tasks (52 female, age range: 49 – 93 months). Children of this age were chosen because it is when metacognitive abilities emerge (Sperling et al., 2000) and a period when children are learning new words. Parents completed a receptive vocabulary checklist, the Developmental Vocabulary Assessment for Parents (Libertus et al., 201), adapted from the Peabody Picture Vocabulary Test.

In the first half of the study, children were presented with metamemory tasks (Figure 1). These tasks assessed children's understanding of whether different individual or circumstantial variables, such as age, time, or distractions, help or hinder memory for newly learned information. In the second half of the study, children learned eight novel words via a fast-mapping paradigm (Figure 2). In the learning phase, children heard a novel word paired with an object and were asked to make a prediction judgement of learning (JOL). After a 5-minute delay, children completed a two forced-choice recognition test of the novel word/object pairings and provided a monitoring JOL about whether they remembered, forgot, or didn't know if they remembered each pairing.

Results. A multiple linear regression was used to test if children's age, vocabulary score, and metamemory knowledge significantly predicted their correct predictions about whether they would remember the novel words. We found that children's metamemory knowledge significantly predicted their correct predictions about whether they would remember the new words ($\beta = -0.307, p = .011$) above and beyond age and vocabulary size, which were not significant predictors. Another multiple linear regression tested whether children's age, metamemory knowledge, and vocabulary predicted their assessments of which words they correctly remembered at test. None of the variables significantly predicted children's ability to monitor their test performance.

Conclusions. We found that children's metamemory knowledge was the only significant contributor to the accuracy of their word memory predictions. This indicates that the ability to predict which words will be remembered develops independent of children's age and their vocabulary growth, likely through the domain of memory development. For test performance monitoring, we found that neither age, metamemory knowledge, or vocabulary were significant predictors in the model. Taken together, this work suggests that children's ability to predict which words they will remember is more reliant on memory development than language learning, and in the case of monitoring during testing, future research will be needed to identify the cognitive domains and/or experiences that support this ability.

P1-31 - Examining strategy differences to understand the development of young children's mental rotation performance and task understanding

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Details

Reliable and valid assessments of children's spatial abilities are needed for conducting research on the development of spatial cognition and STEM learning. The most used spatial assessment is mental rotation (Uttal et al., under review). Mental rotation tasks are designed to induce mental transformation of stimuli (Shepard & Metzler, 1971). Despite the widespread use of mental rotation tasks, there are inconsistent findings about the developmental trajectory of young children's abilities to complete mental rotation tasks; some studies have found children under the age of 6-years-old don't perform above chance, while other studies have found children as young as 3-years-old can (Dean & Harvey, 1979; Kruger et al., 2014). We seek to understand the causes of these discrepant results. One piece of the puzzle is understanding *how* young children are approaching mental rotation tasks. Differences in strategy use have been found to be related to mental rotation test performance in adults (Hegarty, 2018). However, there has been little work on understanding young children's mental rotation strategies (Quaiser-Pohl et al., 2010). In the present study, 92 children between the ages of 4.5-to-7-year-old children (M age = 5.53 years, SD = 0.71) completed a mental rotation task (Frick et al., 2013). After completing the task, they were asked how they determined which answer to choose on two questions with differing angular disparities. The children's responses were coded and separated into different strategy categories, and analyzed in terms of frequency of use, appropriateness, and correlation to age, sex, performance, and angular disparity. Appropriate strategy usage, defined by whether the reported strategy demonstrated task understanding and could lead to the correct answer, was positively correlated with age (max p = 0.012) and negatively correlated with angular disparity (p = 0.017). Further, a previously undocumented strategy of "flipping", where children reported mentally manipulating the stimuli in three dimensions instead of the two dimensions represented in the task, accounted for 30% of all inappropriate strategy use. In addition to shedding insight about the contribution of strategy usage to the development of children's mental rotation performance, these results also highlight challenges with using traditional mental rotation paradigms with young children. Children's erroneous strategy usage, particularly the "flipping strategy", suggests that children may have difficulty comprehending the mental rotation task paradigm used. Moving forward with measuring children's spatial abilities, researchers should consider the task design and differences in strategy, particularly for young children.

P1-32 - Education is development: findings from an intervention-based immersive learning study to develop intersectional awareness

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Details

Intersectionality provides the “critical insight” that gender, race, ethnicity, socioeconomic status, and other identities exist not as mutually exclusive entities but as reciprocally constructed phenomena (Collins, 2015). Individuals are simultaneously situated in terms of their gender and race (among other things) that position them in social hierarchies (of status and power) that cannot be understood in isolation. Intersectional awareness (IA) assesses how individuals understand social hierarchies as intersecting (Curtin et al., 2015). IA is related to pro-social attitudes towards out-group members and intentions to be politically engaged (Curtin et al. 2015). IA is also related to developing empathy and fostering ally-ship in students identifying as socially privileged (Wallin-Ruschman et al., 2020). Despite its social significance, there is a gap in understanding whether IA can be developed in students. The current study employed critical reflection as a tool (e.g., Nnawulezi et al., 2020) to answer:

- a. Can IA be positively developed in students through a week-long intervention relative to students in a control condition?
- a. To what extent do the constructs of critical consciousness, awareness of oppression and privilege, and experiences of intersectional discrimination in everyday life significantly predict post-lesson IA?

Undergraduate students ($M_{age} = 20.16$, $SD = 2.00$, 62% females) randomly divided into experimental ($n = 24$) and control ($n = 24$) conditions participated in the study. On day one, participants completed pre-test questionnaires assessing intersectional awareness, critical consciousness, intersectional discrimination, awareness of privilege and oppression, and a novel Facial Rating Task (FRT). Guided by the literature that posits that learning of social issues can be latent and, therefore implicit (e.g., Heerey & Velani, 2010), we designed the FRT as a novel paradigm to quantify implicit intersectional awareness. In this task, participants provide subjective ratings of privilege and oppression for artificially generated faces of diverse racial and gender backgrounds. They also provide subjective ratings of their confidence for each answer. After day one, participants received lessons (readings and videos with examples of compound discrimination for women of color) every morning via email from days two to six of the study. They are also instructed to turn in a written reflection about the materials each day. On day seven, participants complete the same tasks and measures as day one.

We employed a 2x2 mixed ANOVA with time (pre- and post-test) and condition (experimental and control) to analyze change over time. Consistent with our predictions, participants who received IA training displayed a significant difference in their implicit understanding of the privilege and oppression of women of color (WoC) as measured through the FRT. Importantly, there was a significant difference in their confidence ratings about the structural oppression faced by WoC [$F(1,23) = .45$, $p = .003$]. Standardized questionnaires did not capture this change. Results will be discussed in light of the relationship between participants’ intersectional identities and their learning of IA, using educational interventions to develop awareness of social injustices, nuances in implicit

learning of social issues, and employing social cognition tools (like critical reflection) to learn about social issues (Higgins, 2000).

P1-33 - Neural processing of children's theory of mind in a naturalistic story-listening paradigm

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Details

In the last two decades, advancements in noninvasive neuroimaging methodologies have enriched our understanding of the neural underpinnings of theory of mind (ToM), where a specific network of ToM brain regions has been found, including the precuneus, medial prefrontal cortex (mPFC), and bilateral temporoparietal junctions (TPJ).

Despite the developmental inspiration driving much of the research in this area, the neural mechanisms of ToM in developing children remain notably less researched and less comprehensively documented compared to adolescents and adults (Schurz et al., 2014, 2021). Many factors contribute to this, with a significant one being limited child cooperation and comprehension, especially given the numerous repetitions of trials and responses typically needed for valid neuroimaging. This factor also leads to increased motion artifacts, resulting in frequent data and child-participant loss. To address these issues, developmentalists have attempted to create more naturalistic paradigms, employing more child-friendly stimuli with the goal of better engaging children while effectively probing their ToM processing (e.g., Gweon et al., 2012; Richardson et al., 2018; Saxe et al., 2009).

Taking these efforts still further, in this talk, we demonstrate a novel neuroimaging technique – a naturalistic story-listening paradigm. This paradigm entails children merely listening to an engaging portion of *Alice's Adventures in Wonderland* while their brain signals are continuously measured using functional near-infrared spectroscopy (fNIRS). Notably, our paradigm capitalizes on an ecologically common childhood activity – listening to stories. Children freely listen to a child-friendly story, with no artificially designed unnatural stimuli involved and no overt task-responses required.

An added advantage of our naturalistic story-listening paradigm is its ability to navigate the intricate relationship between ToM and language processing. Existing research has provided insights into the interdependence/independence of ToM and language, finding unique, largely non-overlapping neural substrates. However, the very different tasks used to explore ToM and language in previous studies pose a question: What would the outcomes be if ToM and language were assessed within the same task? Our paradigm addresses this, concurrently measuring ToM and language within the same task with the exact same stimulus.

In this talk, we will first introduce our naturalistic story-listening paradigm. We will illustrate the advantages of our paradigm in two ways. Methodologically, we will show the feasibility and utility of our paradigm, which successfully captured the neural mechanisms of ToM in young children, including the involvement of the bilateral TPJ. Substantively, we will discuss how our findings confirm and extend previous results by revealing the same ToM brain regions found in the adult and adolescent literature and

how ToM processing has its own specialized neural profile, with language processing potentially supporting its deployment and development.

P1-34 - Number ordering skills: are they a mediator between math vocabulary knowledge and number line estimation performance among children in Hong Kong?

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Details

Prior research has found that US kindergartners' math vocabulary knowledge (e.g., more, above, between) predicts their later number line estimation accuracy (e.g., where is 35 on this 0-100 number line?; Chan et al., 2022)—an important predictor of math achievement (Schneider et al., 2018) and a critical foundation for later learning of difficult concepts (Hamdan & Gunderson, 2016; Sidney & Thompson, 2019). Furthermore, children's number ordering skills (e.g., 3,5,1, place these numbers in order from small to large) has been suggested as a precursor for refining their spatial representation of number lines as well as number line estimation performance (Chan & Mazzocco, 2023; Xu, 2019).

Using longitudinal data collected with Hong Kong kindergartners ($N=245$) across four time points (T1=52 months, T2=59 months, T3=64 months, T4=70 months), we aimed to (a) replicate the predictive relations from math vocabulary knowledge and number ordering skills to number line estimation performance, (b) examine the predictive relation between math vocabulary knowledge and number ordering skills, and (c) explore the longitudinal pathways from math vocabulary knowledge through number ordering skills to number line estimation performance.

First, using regression models, we found that children's math vocabulary knowledge ($\beta=.21$; $ps<.01$), but not number ordering skills ($.01<ps<.89$), consistently predicted their later number line estimation performance. Second, contrary to our hypothesis, children's math vocabulary knowledge did not significantly predict their later number ordering skills ($ps>.17$). Finally, pathway models revealed that number ordering skills were not a significant mediator between math vocabulary knowledge and number line estimation performance. Specifically, children's early math vocabulary knowledge did not predict their intermediate number ordering skills ($p=.748$), and they in turn did not predict later number line estimation performance ($p=.144$).

The results provide novel insights into the development of numerical skills. First, consistent with the findings in the US (Chan et al., 2022), understanding math vocabulary, such as before and after, predicts Hong Kong children's later number line estimation performance. This finding highlights the importance of math vocabulary in supporting aspects of children's mathematical thinking and performance. However, at least in the Hong Kong sample, math vocabulary knowledge does not predict children's

understanding of numerical orders, and this numerical understanding does not predict their number line estimation performance.

Of interest to note is that the correlations among math vocabulary knowledge, number ordering skills, and number line estimation are notably weaker ($r_s < .35$) compared to those reported in the US sample ($r_s > .62$; Chan et al., 2022). While more research is needed to delineate the potential mechanisms underlying children's understanding of number lines, the current findings underscore the importance of examining numerical skills development beyond the Western countries, and the possibility of different developmental pathways across diverse populations.

P1-35 - "Who knows more about how stars shine?": children's perception of black and white men's and women's scientific knowledge

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Details

In the United States, women and Black/African Americans are underrepresented in the STEM workforce (NSF, 2022). This underrepresentation has potential effects on children's beliefs about adults' scientific knowledge as children are less likely to see scientists who are women and/or Black. Children rely on adults to learn scientific information that they cannot acquire via first-hand observation (e.g., Harris & Corriveau, 2011). Children are also sensitive to other's knowledge and social characteristics when seeking out information (e.g., Harris et al., 2018). For example, children as young as 5 associate intelligence with White men over other groups (Jaxon et al., 2019). However, little is known about how social categories like adults' race and gender interact to influence children's perception of those adults' scientific knowledge.

In two studies, 5-to-8-year-olds ($N = 257$; 127 girls; 130 boys; 73% White; 11% Mixed Race; 9% Asian; 5% Black; 1% Native American, 1% did not answer) heard eight "how" questions about a familiar biological ($n = 4$) or physical ($n = 4$) science phenomenon, each paired with a photo of a White man, Black man, White woman, or Black woman, and rated each person's knowledge about the answer to the question on a 1-to-5 scale. In study 1, children chose which of four people (one from each gender and race) knew the most about the answer to a scientific question, across eight trials. After indicating their response, the image of the person they chose disappeared and children then indicated the second-most knowledgeable person from the remaining three people. In study 2, this task was modified so that children saw two faces from different categories together and chose one. Across both studies, children gave similar knowledge ratings to men and women, and to Black and White individuals, when they rated each adults' scientific knowledge separately. In study 1, children ranked White ($p < .001$) and Black ($p = .003$) women significantly higher compared to Black men when they saw all four faces together. With increasing age, boys selected White ($p = .02$) and Black ($p = .046$) men as the most knowledgeable more often than girls. Whereas, with increasing age, girls chose White women ($p = .031$) as the most knowledgeable more often than boys. However, across the age range, boys and girls ranked Black

women similarly ($p = .137$). In Study 2, children chose White men, and White and Black women ($ps < .001$) significantly more often than Black men as the most knowledgeable adult.

Together, these studies demonstrate that children make different knowledge judgments about adults when they independently rate a single adult's knowledge, as compared to choosing between people. Judging individual knowledge may be more similar to children's experiences in everyday life where they encounter one informant at a time. Children choosing Black men as the most knowledgeable adult in the smallest number of trials across both studies is consistent with previous research suggesting that children extend knowledge related stereotypes differently to men and women of different racial backgrounds (Jaxon et al., 2019). These results may also reflect the underrepresentation of Black people in scientific fields and children's higher exposure to women as science teachers in school. These studies shed light on the importance of intersectionality in understanding children's judgments of adults' knowledge.

P1-36 - It's about time! Acquisition of deictic time words in English and Hindi

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Details

Time words like 'yesterday' and 'tomorrow' are abstract, because their meanings are typically understood in the context in which they are produced. The word 'tomorrow' refers to a different point in time now and in 24 hours. How do children learn these deictic time words? One view is that children learn the meaning of these time words by mapping them onto specific events they describe (e.g. party *yesterday* or Christmas *tomorrow*). This might support the inductive inference that 'yesterday' refers to the past, while 'tomorrow' refers to the future (Johnson et al., 1988). Another view is that children infer the past and future features of these words using grammatical cues (e.g. tense markings) and discourse structure to narrow their meanings (Brown, 1957; Gleitman, 1990). To test this, we assessed deictic time word learning in two languages: English and Hindi, which differ in two ways. First, in English, two distinct words are used to refer to yesterday and tomorrow, whereas in Hindi, only one word 'kal' is used to refer to both. Consequently, differentiating yesterday from tomorrow in Hindi relies on tense marking. Second, while Hindi features both a past and future tense, English only has grammatical tense marking of the past, and describes future events through alternative lexical and grammatical cues. These differences are theoretically interesting because if children rely mainly on event mapping to learn these words, then this may be easier in English, since different words can be associated with different events. However, if learning instead relies chiefly on grammatical cues, then Hindi learners may learn these words as early or earlier than English speakers, given the more robust tense marking system. We tested 112 three-to-five-year-old children in India: 50 Hindi learners, and 62 English learners, randomly assigned to one of two English-language groups: tense ($n = 32$) or no-tense ($n = 30$). First, a 'Two-Day Real Events' task adapted from Harner (1975) was administered. Children played with one set of toys the first day, and another set the next day. On the second day, children had to identify the toys associated with 'yesterday' and 'tomorrow' from three sets of toys. Second, a novel 'One-Day Hypothetical Events' task was administered. Children were told a story about a character playing with different toys, and had to identify the toy associated with 'yesterday' or 'tomorrow'. This second task tested the child's ability to reason about the relational nature of these words when

associated with hypothetical events that did not occur in real time.

Results show that overall performance improved with age ($\beta = 0.34$, $SE = 0.08$, $t(107) = 4.01$, $p < 0.001$). Crucially, Hindi learners performed better than English learners ($\beta = 0.58$, $SE = 0.21$, $t(107) = 2.75$, $p = 0.006$) on the Two-Day Real Events task. This might be because in Hindi, children could more easily infer the deictic status of words from syntax, whereas in English, they need to learn two lexical items 'yesterday' and 'tomorrow' and identify the deictic status of each item separately. Interestingly, there were no linguistic differences in performance on the One-Day Hypothetical Events task, suggesting that similar tasks (Tillman et al., 2017; Zhang & Hudson, 2018) may not be as sensitive to children's knowledge as the Two-Day task. These results lend insight into children's early time concepts.

P1-37 - Personally familiar faces facilitate children's perspective-taking ability: role of personal knowledge

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Details

Tacit understanding of mental states of acquaintances is quite common, involving a critical social ability, perspective-taking. It's fascinating how a child who seems to be polite and respectful in front of their teachers can become a mischievous little rascal when they're around their grandparents. Such a phenomenon implies a linkage between perception and social functioning, which suggests that exposure to certain category of faces would automatically facilitate children's social understanding. In the current study, we set to investigate the above question by studying how the visual perception of familiar vs. unfamiliar faces would affect 9- to 11-year-old Chinese children's subsequent perspective-taking ability and the role of an important factor, personal knowledge.

In Study 1, we clarified how face familiarity influenced children's performance of perspective-taking in the Director Task (DT). We manipulated face familiarity by replacing directors' faces in the task with real faces. Children completed two Familiarity conditions (Familiar vs. Unfamiliar), in each of which there were two Trial Types (Experimental vs. Control). Indexes were accuracy (ACC) and response time (RT). Children performed more correctly and less quickly in the Control trials ($M_{acc} = 78.77$, $M_{rt} = 2499.69$) than in the Experimental trials (ACC: $M = 53.68$, $B = -1.35$, $p < .001$; RT: $M = 2411.00$, $B = 171.91$, $p = .001$). Familiarity and Trial Type significantly interacted (ACC: $B = 0.38$, $p = .047$; RT: $B = -308.81$, $p < .001$): only in the Experimental trials, children performed significantly better in the Familiar condition ($M_{acc} = 58.27$, $M_{rt} = 2261.54$) than in the Unfamiliar condition (ACC: $M = 49.08$, $t(33) = -2.62$, $p = .013$; RT: $M = 2592.89$, $t(30) = -3.74$, $p = .001$).

Study 2 explored the role of personal knowledge in the above-mentioned facilitation effect. Children formed familiarity by watching photos of unknown peers, after which they completed the DT with directors' faces replaced by learned faces. They completed two conditions. In one condition they had mere visual exposure (VE condition) and in the other condition they also heard audio personal knowledge (PK condition). Results showed that children responded more quickly in the PK condition ($M = 1984.78$) than in the VE condition ($M = 2157.05$; $B = -132.75$, $p = .010$). Results of RT exhibited a significant Familiarity \times Trial Type interaction ($B = -256.84$, $p = .013$). In the PK condition, there was a

nonsignificant trend that children responded more quickly to the Experimental trials ($M = 1828.52$) than to the Control trials ($M = 1967.26$; $t(22) = 1.67$, $p = .109$).

This research supported the Perceptual-Social Linkage hypothesis. The perception of personally familiar faces automatically facilitated children's ability of perspective-taking. Moreover, this automatic linkage was partly explained by the personal knowledge that children gained in the familiarity forming phase. Theoretical and practical importances of these findings were discussed.

P1-38 - Shape-based noun vocabulary counteracts initial language delays in children who use cochlear implants

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Details

Although vocabulary size has long been seen as an index of children's developing language abilities, an increasing body of work suggests that the composition of a child's vocabulary, particularly with respect to the proportion of shape-based nouns (e.g., cup, spoon) indexes key mechanisms supporting language development. Early-learned English vocabulary is dominated by shape-based nouns, and the proportion of these words in children's vocabularies appears to affect subsequent word learning, later vocabulary size, and linguistic proficiency. Here we test whether vocabulary composition affects future language development for children with hearing loss who use cochlear implants (CIs). Children with hearing loss who use CIs begin to learn spoken language following a period of auditory and linguistic deprivation that leads to language delays. Thus, children with CIs receive increased access to auditory information at a specific point, providing a fixed point at which spoken language development begins. This provides an experiment in nature for understanding how early vocabulary composition shapes subsequent word learning and language development in the context of the clinical provision of auditory experience. We examined initial vocabulary composition in a large sample of children with hearing loss following cochlear implantation ($n=164$; $M=3.0$ years old at study start), which provides auditory experience to children with hearing loss, and age matched controls with normal hearing ($n=90$; $M=2.9$ years old at study start). Data were drawn from the Childhood Development after Cochlear Implantation (CDaCI) study, which is a multi-center, national cohort investigation of the effectiveness of CIs in deaf children in relation to their hearing peers. At the study start, 6 months post-implantation, we measured the proportion of shape-based nouns in children's vocabularies, as measured by the MacArthur-Bates Communicative Development Inventory III (MCDI III). We then predicted vocabulary size (on the MCDI III) and receptive and expressive language abilities (on the Reynell Developmental Language Scales) at follow-up visits 12, 24, and 36 month after cochlear implantation. We found that at the study start, children with CIs ($M=7.87$ words, $SD=19.37$) had a smaller overall vocabulary size than children with normal hearing ($M=59.02$ words, $SD=35.61$), $t(248) = -12.45$, $p < .00001$. The proportion of shape-based nouns in their vocabularies ($M=.28$, $SD=.41$) was also smaller than that of children with normal hearing ($M=.67$ words, $SD=.22$), $t(248) = -9.88$, $p < .00001$. However, a series of mixed-effects regression models revealed that in general, children who had higher proportions of shape-based nouns at the study start subsequently had larger vocabularies and scored higher on standardized tests of receptive and expressive language abilities at the follow-up visits than children with lower proportions of shape-based nouns in their starting vocabularies $ps < .00001$. These effects were stronger for cochlear implant users,

especially 24 and 36 months post-implantation as evidenced by significant interactions between group, visit, and the effect of shape-based nouns $p < .00001$. See Figure 1. Together the results suggest that learning shape-based nouns facilitates children's language development and appears to counteract the initial language delays of cochlear implant users.

P1-39 - Low level cognitive processing explains the unity of executive functions and mediates age-related executive improvement during adolescence

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Details

Executive Functions (EFs) are a set of cognitive abilities that control behavior to reach non-automatized goals people have in mind. One of the most widely accepted theoretical account of EFs is the EF unity and diversity framework: a pattern of intercorrelation (unity) among three domains of EF (inhibition, shifting, updating) that is not near perfect, so indicating separability (diversity) of these three types of EF. These domains are measured as latent factors using Structural Equation Modeling (SEM). Despite being highly popular, the configural structure of this framework has been under debate due to various contentions among researchers. Among other issues, the debate includes difficulties in dissociating executive abilities from lower-level cognitive skills (LLCS: e.g. sensory, naming, psychomotor) which are also recruited to carry out EF tasks. Most studies address this by using *executive cost* measures (i.e. performance on trials of tasks that recruit EF plus LLCS controlled for performance on similar trials that however only involve LLCS, but not EF). This, however, is only consistently done in the literature for inhibition and shifting, but not for updating tasks. Hence, it is unclear to what extent LLCS impacts EF unity/diversity: 1) model configuration; and/or 2) susceptibility to demographic effects such as age. These issues were explored in 407 9-15-year-olds (170 girls) from a developing country (Iran). The EF test battery included two tasks per EF domain to form latent factors. We tested three models using SEM in which indicators were raw scores (accuracy divided by RT to control for speed-accuracy tradeoffs): 1) an oft-found three-intercorrelated latent factor configuration using as indicators scores of trials with executive requirements only (not EF costs); 2) the same model with the addition of a latent factor of LLCS (performance on trials of the inhibition and shifting tasks with no executive requirements) regressed on the three EF latent factors; and 3) a model with the LLCS factor as a mediator of the age effects on the EF latent factors. All models had adequate fit. Model 1 showed high intercorrelation (0.82 to 0.96) between the three EF domains, replicating prior unity/diversity findings in studies that controlled for LLCS only on inhibition and shifting tasks. In model 2, LLCS highly predicted ($\beta_s > 0.90$) all three EF latent factors which, however, were no longer significantly intercorrelated (no "unity", only diversity). In model 3, the direct effect of age was no longer significant (except marginally for shifting), whereas the indirect effect of age through LLCS was significant for all EF factors (LLCS mediated age effects), again with no significant correlation among EFs. We conclude that: 1) the 'unity' account of EFs is an artificial pattern of intercorrelations that no longer holds once LLCS is accounted for in *all three* EF latent domains; and 2) the effects of age on EFs in adolescence can be mostly explained by the improvement in LLCS that contribute to performance in EF tasks.

P1-40 - Children use incurred costs to predict emotion but not actions

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Details

Children consider future costs when anticipating others' actions. For example, preschoolers and even infants expect that agents will choose courses of actions that minimize unnecessary costs (e.g., Gergely & Csibra, 2003; Liu & Spelke, 2017). However, children do not consider *past* costs when predicting others' actions and appear to neglect the sunk cost bias—that is, people's tendency to overvalue projects they invested more time, money, or effort into (Sehl et al., 2021; Webley & Plaisier, 1998). For example, 5-6-year-olds anticipate that, all else being equal, a character is more likely to pursue a low-cost item than a high-cost one. But if the character has both items in-hand and can only keep one, 5-6-year-olds do not anticipate the character will retain the one that was costlier.

Here we test between two explanations for why children neglect sunk costs when anticipating actions. One explanation is that children primarily see incurred costs as effects, but not as causes. If so, children might also neglect other effects of sunk costs, such as negative emotions like regret or sadness. Relatedly, children may lack abilities requisite for mental accounting. They may not tag sought-after items with the costs incurred to obtain them, and so may see items as equal value (e.g., Baron, 2008; Thaler, 1999). Work on children's valuation of items shows that with age, children increasingly tag items in terms of their histories (e.g., Pesowski et al., 2022; Gelman & Echelbarger, 2019), though, it is less clear whether children tag items with the costs invested in obtaining them. Alternatively, children might overlook sunk costs because they do not think future actions can make up for sunk costs. While adults see choosing high-cost items as avoiding major losses of the money and effort invested towards the high-cost items, children may not share this view. On this account, children may still see incurred costs as causally relevant for other effects, like negative emotions.

We tested these accounts in three preregistered experiments. In these experiments, 4-7-year-olds (total $N=320$) and adults (total $N=429$) saw stories about characters who collected items that were easy or difficult to obtain. For example, in one experiment, children and adults saw a girl climb short and tall hills to collect flowers (see Figure 1). The girl then learned she could not keep both flowers, and participants either predicted which flower the girl would be sadder about, or which flower she would keep. Other experiments varied the action and emotion judgments. Across all experiments, children and adults anticipated that characters would feel sadder about high-cost items (all $ps < .001$). However, when predicting which flower they would keep, adults mostly indicated the high-cost flower ($p < .001$) whereas children chose between the flowers at chance, $p > .999$.

These findings show that children are not insensitive to sunk costs. Children see these costs as causal, and our findings also suggest that costs are integrated into children's and adults' theory of emotions. Moreover, the findings suggest that developmental differences in sunk cost reasoning because children complete some aspects of mental accounting, but not all. We will also discuss children's reasoning about rational and irrational action.

P1-41 - A cross-linguistic analysis of abstractness effects in early vocabulary

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Details

Why are abstract words challenging for children to learn? Various factors could contribute to this challenge. Early word learning may rely on sensorimotor experiences (e.g., Yu & Smith, 2012), making words difficult to learn when they refer to things children cannot see or touch (e.g., Gleitman, 1990). Relatedly, abstract words frequently evoke unobservable emotions and tap into social knowledge (e.g., “share”), potentially exceeding young children's conceptual knowledge. Further, some of the earliest learned words (onomatopoeia; Laing, 2019) depict their referent through phonology; if this form-meaning correspondence boosts word learning (Laing, 2019), then arbitrariness of form-meaning mappings could contribute to the difficulty of abstract words. Lastly, some abstract words (e.g., “go”) appear in diverse contexts (Schwanenflugel, 1981), which could limit the effectiveness of strategies like cross-situational word learning. In light of recent work on the multidimensionality of abstract concepts (e.g., Binder, 2016; Muraki et al., 2022), our study explores four potential challenges of abstractness in early word learning: the absence of sensorimotor experiences, social-emotional referents, arbitrary form-meaning mappings, and word versatility in various contexts.

To measure effects on early word learning, we leverage word production data from the Communicative Development Inventory, a parent-report measure of children’s early vocabulary. Using Wordbank (Frank et al., 2017), we pulled data from 82941 children (8-36mo.) across 36 languages. We combine this data with a range of word-level ratings, each indexing a dimension of abstractness, namely, (1) the absence of sensorimotor experience (concreteness, imageability, body-object interaction, perceptual associations), (2) social-emotional referents (emotional arousal, socialness), (3) form-meaning arbitrariness (iconicity), and (4) variability in word usage (context diversity). To measure context diversity, we scraped data from each language-specific Wikipedia collection and counted the number of distinct Wikipedia articles each word appeared in. Imputation techniques were used to fill in missing values across languages, and all lexical properties were re-scaled to enable comparison.

For each lexical property, we use logistic regression to measure how consistent their effects are across languages, controlling for age, frequency, phonological complexity, and part-of-speech. Our results suggest while some variables have consistently strong associations with word production across languages (i.e., lack of sensorimotor experience with referent, iconicity), the effects of others are more inconsistent in strength and direction (e.g., in some languages, the social/emotional content of a word is associated with earlier word production in some languages and later word production in other languages); see Figs. 1-4.

Thus, one consistent challenge of abstract word learning seems to be sensorimotor unavailability of the referent, but this may be an oversimplification. Rather, the global language context (which intersects with culture) may influence what experiences are prioritized in word learning. This study contributes to a more nuanced understanding of the multifaceted nature of abstractness and its impact on early word learning across languages.

P1-43 - "They didn't know any better!" – Children's judgement of others' choices

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Details

We are often judging the choices that others make, especially when those choices result in a bad outcome. To do so we may consider the alternative choices someone could have made. For example, we might judge someone less harshly if they had no other choice but to cause a bad outcome. Reflecting on choice in such a way involves an ability to imagine counterfactual outcomes that could have eventuated. Past work shows that at least by age 6 children consider whether someone could have done something else when judging how nice or mean their actions are (Gautam et al., 2023). This shows that children understand that choices can be constrained by availability of physical options. However, it is unclear to what extent they consider *knowledge* of options to be a constraint. Specifically, what if someone simply didn't know there was another choice that would have led to a better outcome? In other words, do children represent choice as happening in the mind, and something that can be constrained by knowledge?

In the present study we test children across the US (N = 117, 5- to 8- year- olds), China (N = 133, 6- to 10- year- olds) and India (5- to 8- year- olds, data incoming November 2023) to explore this question. We ask children to judge three characters who are all causing a bad outcome – they are bringing food to a birthday party that the birthday child doesn't like. Of the three characters: one had a choice to bring food the birthday child liked but chose to bring food they didn't like; one had no choice but to bring the food the birthday child didn't like; and one didn't know they had a choice and thought they had to bring the food the birthday child didn't like. Findings across the US and China suggests that children consider both physical constraint (there was no other option) as well as knowledge (they didn't know there was another option) when making judgements of how nice or mean the characters are being. Specifically, children tended to rate both the character who physically had no choice and the character who did not know they had a choice as being nicer than the character who could have chosen to do the nice thing and bring the food the birthday child liked.

These findings provide the first evidence that children consider choice to be happening in the mind, such that they judge knowledge of options to be equally as important as actual physical options when rating how nice or being someone is acting. Furthermore, this work provides initial evidence that this finding is generalizable across diverse cultures.

P1-44 - From pages to pixels: science books predict children's science vocabulary but not TV shows and apps

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Details

Early exposure to scientific concepts can foster curiosity in young children and lay a robust foundation for their future academic and professional success (Eshach & Fried, 2005). As children delve deeper into science exploration, the tools they utilize to grasp these concepts become essential. Recent studies have indicated the significance of science-specific vocabulary, suggesting that it predicts children's science knowledge beyond general vocabulary and sociodemographic status (e.g., Lazaroff & Vlach, 2022). One primary avenue for children to acquire such vocabulary is through educational media. Children today have unparalleled access to diverse learning opportunities, ranging from traditional print books to TV shows and interactive apps. Yet, the efficacy of different types of media in fostering science vocabulary knowledge remains unclear. While the positive effects of book reading on general vocabulary acquisition are well-documented (e.g., Schlesinger et al., 2019), the impact of digital media on children's vocabulary growth has yielded mixed results (e.g., Jing et al., 2023). The current study addresses this gap in the literature by investigating the link between children's science media exposure and their domain-specific vocabulary knowledge.

96 parents of 3- to 5-year-old children ($M_{age} = 51.9$ months; $SD_{age} = 11$ months; 50 males) in the United States completed a questionnaire via Qualtrics. We collected data on children's general and science vocabulary, child factors, family factors, and environmental factors that could potentially contribute to the growth of science vocabulary knowledge. Specifically, we used an expanded version of the Science Vocabulary Checklist (Lazaroff & Vlach, 2022) to assess children's science vocabulary and the DVAP Checklist (Melissa et al., 2015) to measure general vocabulary. Parents were asked to mark all the words they have heard their children produce. In addition, parents were asked to report their children's general exposure to a list of science-related activities: TV shows, digital games, books, non-digital games (e.g., puzzles), other science activities (e.g., gardening), and science places (e.g., museums). For science TV shows, apps, and books, a 20-25 item list was created to include the most popular options currently available on the market for each type of media; parents reported their children's specific exposure to items in the past two weeks.

Hierarchical regression models revealed that frequency of children reading science books, playing non-digital science games, engaging in science activities, and visiting science places predicted their science vocabulary, while controlling for age, gender, and socioeconomic status (SES). In contrast, exposure to science TV shows and apps did not. Notably, social factors, including SES, parent mediation during screen time, parental attitudes towards science, and co-viewing behaviors, didn't mediate this relationship. Exploratory analyses found higher SES families read more science books, while digital media use was consistent across SES groups. Our findings establish a link between science media exposure and children's domain-specific vocabulary, and reveal the strength of this relation varies across media platforms. Next steps include conducting a content analysis of popular science books, shows, and apps and examining the contributions of specific content exposure to science vocabulary.

P1-45 - Children cheat more after observing a hard-working model and persist and cheat more when their caregiver values hard work

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Details

Persistence in the face of challenges is associated with many positive outcomes (Chang & Olson, 2016; Eisenberg et al., 1997; Mokrova et al., 2013), but much remains unknown about how persistence develops and the extent to which it is a malleable trait. Social processes may support the development of persistence; toddlers who observe a model persist and succeed in achieving a goal themselves persist longer on a challenging task compared to toddlers who observe a model easily achieve a goal (Leonard et al., 2017). Children also persist longer in delaying gratification if they believe group members do or if they believe they will be evaluated (Doebel & Munakata, 2018; Ma et al., 2020), but persist less if expected outcomes are less reliable (Kidd et al., 2013).

Prior work thus suggests children persist when it is rational to do so; however, children may also learn to persist because doing so is valued and practiced by others around them. Our study asked: Do children persist if they observe a hard-working model, even in the absence of outcome information? We also explored whether children persist longer on a challenging task if their caregiver values hard work and effort and if children themselves moralize those who use effort.

Fifty-three 4- to 6-year-olds were shown a challenging puzzle task that assesses persistence in this age group (Oeri, 2022). The puzzle was hidden inside a box, accessible via sleeves on one side. In all conditions, an experimenter explained that she worked on the puzzle with her hands, not her eyes, and briefly demonstrated by putting her hands in the sleeves and feeling around for the pieces. Children were randomly assigned to one of three conditions: 1) a hard-working-model condition in which they observed the experimenter attempt the task while talking about being a hard worker; 2) a model-only condition in which the experimenter attempted the task for the same duration but did not talk about being a hard worker; and 3) a demo-only condition. Children were then told they could try the puzzle if they wanted to while the experimenter went to another room for 5 minutes to get something.

There were no condition differences in persistence, as indexed by time on task, contrary to our preregistered hypothesis. However, children in the hard-working model condition engaged in more peeking and other looking strategies than those in the other two conditions, $t(52)=3.88$, $p=.02$. Moreover, caregiver values related to work predicted both time on task, $r(52)=.27$, $p<.05$, and peeking, $r(52)=.37$, $p<.01$, respectively. Peeking and time on task were not correlated. Children also moralized effort, with those as young as 4 years indicating a preference for those who complete tasks using effort over those who do not; however, this was not related to persistence on the puzzle task.

These findings suggest children may learn to persist via various social mechanisms, but that there can be unintended consequences of encouraging hard work. Implications for interventions to promote persistence and associated outcomes are discussed.

P1-46 - From possible to pause-able: children's hesitancy may mark implicit skepticism of incorrect intuitive beliefs

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Details

Does air weigh anything at all? Although adults would answer “yes,” most young children would answer “no” and falsely claim that “air is nothing” (Shtulman, 2022). Young learners eventually revise these naive beliefs throughout development; however, some aspects are retained in adulthood. Thus, adults exhibit longer response times (RTs) when correctly answering items that are incongruent with the naive theory (e.g., “Air weighs something”) than when answering items that are congruent with the naive theory (e.g., “Rocks weigh something”) (Shtulman & Valcarel, 2012). However, even prior to learning scientific principles, learners may (at least implicitly) recognize that aspects of their naive beliefs conflict with other related beliefs. For instance, a belief that “air is nothing” may conflict with a learner’s other knowledge that “we need air to breathe.” Hence, individuals wrestling with incongruent beliefs may demonstrate slower RTs even *before* explicit learning of the scientifically correct response has occurred. We explore whether early elementary children, at the cusp of revising beliefs about the material world, demonstrate longer RTs on incongruent items as compared to congruent ones, and whether such RT differences are related to executive function (EF), cognitive reflection, and domain knowledge. We presented 79 5- to 9-year-olds with a battery of 36 questions about ten different entities and their physical properties (i.e., whether the entity is material, takes up any space, and has any weight). We then asked children yes-or-no questions about each entity (e.g., “Are cats made of stuff?”), and both on theoretical and empirical basis, we identified 5 questions for which *most* children gave correct responses (congruent items; e.g. “Do rocks weigh anything at all?”), and 5 questions for which *fewest* children gave correct responses (incongruent items; e.g. “Does electricity take up any space?”). We then coded children’s RTs responding to these incongruent and congruent items. In addition, we computed a “belief hesitancy” score for each individual child by subtracting congruent from incongruent RTs. Importantly, for all incongruent items, we coded only the inaccurate responses (i.e., responses “accurate” under the naive theory), and for all congruent items, we coded only the accurate responses. Children were slower in responding to incongruent items than congruent ones (mean difference = 225 ms, $t(79) = 2.08$, $p = .041$). Next, we explored how this individual difference in children’s RTs (“hesitancy”) related to their domain knowledge and three cognitive resource measures. Children’s hesitancy and EF scores significantly correlated, $r(79) = .28$, $p = .021$, as did hesitancy and matter understanding (even after accounting for age), $r(78) = .31$, $p = .005$, but hesitancy did not correlate with their error monitoring (“Inconsistent Stories” task; adapted from Markman, 1979) or cognitive reflection (CRT-D; Young et al., 2018) abilities. These findings indicate that young children hold varying degrees of sensitivity to the shortcomings of their intuitive responses, even before having explicitly acquired a scientifically correct theory of matter, and that this “belief hesitancy” is related to EF and knowledge in the domain. Such measures may be a good indicator of whether children are at the cusp of overturning beliefs.

P1-47 - Relevance of perceived shape information to child's view and in 6-24-month-old children's vocabulary development

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Details

By an ostensive definition of word learning, infants extract the shape of the object they look at (Landau et al., 1988; Samuelson & Smith, 1999; Smith, 2000) and associate speech sound to that referred object in the visual scene (Gogate, Bolzani & Betancourt, 2006). In recent years, multiple studies using head-mounted eye-tracker systems recorded infants' eye gaze behaviors during interactive object play and documented early visual experiences that may support in generating this association during a natural activity. These visual experiences are typically through parental scaffolding - which is the way parents guide their child learning, by parental gaze cueing to the objects (Flom & Pick, 2003; Namy et al., 2000; West & Iverson, 2017), holding the object (Clark & Estigarribia, 2011; Yoshida & Burling, 2013), and naming the object (Flom & Pick, 2003; Namy et al., 2000; West & Iverson, 2017) in the child's egocentric view (Pereira, Smith, & Yu, 2014; Yoshida & Smith, 2008; Yu & Smith, 2012, 2013). Despite these studies making it clear the importance of early social scaffolding for generating object-name associations, we know relatively little about the accessibility of object shape and size, their roles to language development and whether they change as the child reaches different milestones in language development. To address these questions, the present study utilized a small set of camera devices attached to 40 infants and young toddlers' (6-24 months) foreheads during an interactive parent-infant object play and quantifies the object viewing by calculating object shape percentage and pixel counts in relation to infant's egocentric viewing field frame-by-frame, and explored the role of such quantified shape and size information in infants' vocabulary development. The children's vocabulary size was measured with MacArthur-Bates Communicative Development Inventory (Fenson et al., 1994) for the words they understood and produced. The results showed that while there is an overall significant positive effect of object shape percentage inputs on infants' vocabulary size ($R^2 = 0.09$, $p < 0.05$); infants at 9-12-month-period typically received less fully-shaped input as their vocabulary grew than the other age-period groups ($\beta = -18.78$, $SE = 6.78$, $p = .006$). Infants at 12-15-month-period typically received the lowest object size in their view compared to the rest ($\beta = -24.38$, $SE = 10.73$, $p = .02$). Furthermore, the object size in the child's view significantly decreased in pixel counts once the child learned the object name ($t = 17.08$, $p < 0.001$). These findings suggested that object shape information is not only supporting the object viewing but also changing in the relation to the child's object knowledge. The results will be discussed in relation to the documented role of object shape in novel word learning literature to speculate potential developmental processes through which the benefit of viewing object shape information for early word learning changes over time.

P1-48 - Differential development of recognizing places versus navigating through them

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Details

Recent neural evidence suggests that the human brain contains dissociable systems for “scene categorization” (i.e., recognizing a place as a particular kind of place; for example, a kitchen versus a beach), including the parahippocampal place area (PPA), and “visually guided navigation” (e.g., finding our way through a kitchen, not running into the kitchen walls or banging into the kitchen table), including the occipital place area (OPA). However, converging behavioral data – for instance, whether scene categorization and visually guided navigation abilities develop along different timelines – would provide even stronger support for this two-scene-systems hypothesis. Thus, here we tested scene categorization and visually guided navigation abilities (Figure 1) in 131 typically developing children between 4 and 9 years of age, and found that visually guided navigation is later to develop than scene categorization (Figure 2). Next, we asked why visually guided navigation may be so late developing, and hypothesized that 4-year-olds, unlike 9-year-olds (and adults), are using visual information from central – not peripheral – vision to navigate through their immediately visible environment. To directly test this hypothesis, we monitored the eye movements of participants while they performed the scene categorization and visually guided navigation tasks (Figure 1). Consistent with our hypothesis, we found that unlike the 9-year-olds (and adults), the 4-year-olds used central – not peripheral – vision during the visually guided navigation task. By contrast, all groups used central vision during the scene categorization task (Figure 3). Taken together, these findings provide the first developmental evidence for dissociable cognitive systems for recognizing places and navigating through them, and also reveal that the visually guided navigation system relies on peripheral visual input, while the scene categorization system relies on central visual input.

P1-49 - Young children recognize that peer groups base friendship preferences on wealth and ethnicity

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Details

Objectives

Experiencing exclusion and discrimination in childhood has a negative impact on one’s health and well-being with long-lasting consequences. Most empirical research on children’s social exclusion has focused on race or ethnicity. However, recent studies have demonstrated that children also display wealth-based biases. The intersection of ethnicity and wealth bias has received little attention despite these variables often being confounded in societies. Thus, more research is warranted to consider both how conceptions of wealth and ethnicity emerge in childhood and how these perspectives develop in various contexts.

The present study, guided by theory stemming from group dynamics and social reasoning, investigated the emergence of ethnicity and wealth concepts regarding friendship preferences in young Chinese

children growing up in Singapore, an island country in Southeast Asia with a majority (75.9%) Chinese ethnic composition. We hypothesized that participants would expect peers to prefer same-ethnicity friendships when only ethnicity was manipulated. Second, we expected that participants would expect peers to prefer same-wealth friendships when only wealth was manipulated. Third, we hypothesized that participants would expect peers to display a preference for wealth when both ethnicity and wealth were manipulated. Finally, we expected that participants' reasoning for their expectations would be informative about their decisions.

Methods

Young Singaporean Chinese participants ($N = 103$; 4 - 7 years old, $M_{age} = 5.79$; 49% girls) reported: 1) whom they expected a peer group to pick when provided with new peers that were similar or different in ethnicity and wealth from the group; 2) the strength of their prediction, and 3) their reasoning behind their prediction (see Figure 1).

Results and Conclusions

ANOVAs and t-tests were conducted to test the hypotheses. The ethnicity condition revealed that children expected groups to prioritize same-ethnicity friendships. They also had high expectations that the Chinese group would prefer a Chinese peer to join but were split on how much they thought an Indian group would prefer an Indian or Chinese peer. Although they displayed an expectation for a same-ethnicity peer, it was stronger for their ingroup than it was for the outgroup Indian peer group.

The wealth similarity condition demonstrated that children expected groups to prioritize high wealth as a basis for inclusion. When ethnicity and wealth were independently manipulated and children had to choose between both, they similarly predicted that groups would prioritize high wealth. They expected high-wealth groups to prefer a high-wealth peer, even when they were of a different ethnicity, but expected low-wealth groups to prefer a high-wealth peer. Children's reasoning displayed an awareness that preferences exist for high-wealth groups. Yet for low-wealth groups, children expected a preference for cross-wealth inclusion. We attribute this to their recognition that upward social mobility is desired. Children had strong expectations that the low-wealth group would prefer a high-wealth same-ethnicity peer but were divided on how much they expected the high-wealth group to prefer a high-wealth peer of a different ethnicity. The findings reveal children's complex knowledge about social inequities and provide a basis for promoting inclusive friendships for all children.

P1-50 - Late development of "walking selectivity" in the occipital place area

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Details

Human adults are exquisite at moving about their immediately visible environment, avoiding boundaries and obstacles (e.g., walking around a kitchen, not running into the kitchen cabinets, or banging into the kitchen table) — a process referred to as “visually-guided navigation”. But how does the visually-guided navigation system develop? Does this system emerge early in life, when children first begin to crawl? Or does it emerge later in childhood, either when children first begin to walk or even later when they walk like adults? A recent fMRI study in adults suggests that OPA may develop late as it only represents visual

information about walking, not crawling. Based on this finding, one intuitive hypothesis is that OPA develops when children first begin to walk. By contrast, several behavioral studies found children's walking skills significantly improve until around 8 years of age. Thus, these studies lead to another, perhaps counterintuitive, hypothesis that OPA develops much later in childhood, not until around 8 years of age when children are adult-like walking. Here, we tested these two hypotheses by using functional magnetic resonance imaging (fMRI) in two groups of children: 4- to 5-year-olds and 8-year-olds. We measured the responses in OPA to first-person perspective videos through scenes from a “walking” perspective, as well as three control perspectives (i.e., “crawling”, “flying”, and “scrambled”). Consistent with the later development hypothesis, we found that the OPA in 8-year-olds, like adults, exhibited “walking selectivity” (i.e., responding significantly more to the walking videos than to any of the others, and no significant difference across the crawling, flying, and scrambled videos), while the OPA in 4- to 5-year-olds exhibited *no* walking selectivity at all. Importantly, these differences between the 4- to 5-year-olds and the 8-year-olds were not explained by data quality differences (i.e., head motion or temporal signal-to-noise ratio) and were not present in other scene-selective regions, such as the parahippocampal place area (PPA) and the retrosplenial complex (RSC). Thus, these findings i) reveal that the OPA undergoes protracted development, not even supporting walking in early childhood, and only emerges around 8 years of age when children are adult-like walking, ii) suggest that “early” walking is processed by a different neural system altogether, and iii) raise the intriguing possibility that the development of visually-guided navigation is a discontinuous process.

P1-51 - Children pay high expected value costs to explore

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Details

People regularly make consequential decisions between exploiting known options and exploring novel ones, a dilemma referred to as the *explore-exploit tradeoff* (Sutton & Barto 1998). Past research suggests that preschool-aged children tend to be more exploratory than adults (Liquin & Gopnik, 2021), at times discovering information that adults miss. However, we still know relatively little about the determinants of these decisions in childhood, and the ways in which they develop past the preschool ages.

In this pre-registered investigation, we assessed children and adults’ decision-making across five studies, utilizing a novel task in which participants must choose between visibly displaced certain rewards and invisibly displaced uncertain rewards. In Study 1, we asked if children (N=122, 3-8-year-olds) were sensitive to expected value costs and explicit goals in their exploration. Across three conditions, children were instructed to either maximize rewards (stickers), learn about the mechanism, or given no explicit goal. Trials also varied in their expected value cost: they either had no cost, a low cost (e.g. one sticker guaranteed or a 50/50 chance of one sticker — an expected value cost of 0.5 stickers), all the way up to high cost (an expected value cost of 1.5 stickers). We found that children were insensitive to both increasing expected value costs and explicit goals, choosing the exploratory side in nearly half of the trials, independent of condition or cost. Our control trials suggest that children were accurately tracking

reward location and seeking to maximize rewards, suggesting their behavior was not random. In Study 2 (N=36 3-8-year-olds), we confirmed that the order of the cost trials did not influence behavior.

In Study 3, we ran an online version of our protocol from Study 1 among adults on Prolific (N=107). In contrast to the children, we found that adults only explored when there was no cost, quickly switching to the exploit option when costs were introduced. Adults were similarly insensitive to explicit goals, exploring at (relatively low) rates in all conditions.

In Study 4 (N=80 3-8-year-olds), we examined whether children were sensitive to social context, specifically assessing whether they make more exploratory decisions for themselves than for others. Here, we also found that children were insensitive to the recipient, exploring at high rates in both conditions.

Data collection is ongoing for Study 5 (N=60 3-8-year-olds), in which we examine a causal mechanism for these patterns: whether the benefits of information value are outcompeting the costs of exploration. In this study, we boost the information value of exploration by suggesting a correlation between box color and the presence of rewards. We anticipate that children will explore more when information value is made salient.

Taken together, these studies demonstrate clear differences between children and adults in their approach to the explore-exploit tradeoff: children appear to be insensitive to cost, explicit goals, and social context, exploring at significantly higher rates than adults across a number of studies. Our findings suggest that motivations for exploration may vary by age, and that reward value may not be the most influential determinant of exploratory behavior in childhood.

P1-52 - Infants' early word meanings include both typical and atypical category members

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Details

Children's vocabularies grow exponentially in the second year of life. While many studies have examined the number and kinds of words learned early in development, few have examined the content of early word meaning representations. That is, what referents do infants link with familiar words and what experiences may support this word extension? There are two general accounts of early word extensions. On the broad-to-narrow account, infants initially link words with broad categories of referents, and subsequently refine their word representations based on experience. By contrast, the narrow-to-broad account proposes that early word meanings are restricted to highly familiar exemplars, gradually expanding to include the entire category. We investigated whether either of these accounts could explain infants' processing of familiar nouns in the context of typical and atypical exemplars in a registered report.

14- to 18-month-olds (N=86; M=15.8 mos) completed a two-session (48 trials) looking-while-listening (LWL) task administered asynchronously via Lookit. On each trial, infants viewed two images from different animal categories (e.g., a dog and a bird) and heard a noun labeling one of the animals. We

manipulated typicality such that each noun was heard in the presence of three typical and three atypical category exemplars. On a given trial, however, the images were matched for typicality (e.g., a pug appeared with a kookaburra). We also measured variability in infants' individual experience with each image stimulus through caregiver report.

To examine how broadly infants extended the meanings of familiar words, we fit a linear mixed-effects model predicting word recognition accuracy (baseline corrected proportion of target looking; BC-PTL) from exemplar typicality including the maximal converging random effects structure. Infants successfully recognized the target words in the context of both typical ($b=0.08$; 95% CI: [0.06,0.10], $t(153)=7.59$, $p<.001$) and atypical exemplars ($b=0.06$ [0.04,0.08], $t(153)=5.49$, $p<.001$). Word recognition did not significantly differ between typical and atypical exemplars ($p=.07$; Figure 1). Similar results were obtained using speed of fixating the target (reaction time) as the DV.

What factors support broad early word extension? To investigate this question, we examined whether age or experience with specific exemplars explained performance on the LWL task. We fit a LMEM predicting BC-PTL from age and exemplar typicality, including the maximal random effects structure. Infants' overall word recognition accuracy improved with age ($b=0.01$; $t(90)=2.23$; $p=.03$), but there was no significant interaction between age and typicality ($p=.36$). Individual differences in infants' experience with each exemplar (via caregiver ratings) also did not significantly predict word recognition accuracy ($p=.20$).

Our results suggest that word representations are broad early in development, allowing infants to extend word meanings to both typical and atypical exemplars. These findings also demonstrate the feasibility of collecting rich, multi-session, frame-by-frame looking data online via the Lookit platform. We will also report on ongoing work investigating whether other aspects of infants' individual experience with category members (e.g., book reading) predict individual differences in word meanings.

P1-53 - "The nurse knows what's good and bad for you": the impact of the pandemic on children's trust in expert testimony about food safety

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Details

Making safe food choices is an essential aspect of daily life. At young ages children begin feeding themselves and making autonomous choices about what to eat. Between ages 3 and 8, children develop an understanding of food safety or contamination sensitivity (Siegal & Peterson, 1999). However, they still lack the nuances of adolescent and adult reasoning about food safety (Apicella et al., 2018) and often use social cues, such as group membership, to guide their choices (Li et al., 2021). Children as young as age 3 default to trust in testimony (Jaswal et al., 2010) and this trust is selective as trust is unequal (Harris, 2007). Weak prior knowledge leads to a greater trust in expertise (Chan & Tardif, 2013) which may explain why children selectively trust those with domain-specific expertise (Lutz & Keil, 2002). Furthermore, research demonstrates that the pandemic may have impacted children's knowledge and reasoning about germs (Leotti et al., 2021). Given that nurses are directly connected to

issues related to health, such as germ knowledge, the current study set out to investigate how the pandemic may have impacted children's evaluation of food based on testimony from a mom vs nurse.

Two age groups, 4 - 6.5 years ($N = 26$; $M_{age} = 63$ mos) and 6.5 - 9 years ($N = 30$; $M_{age} = 95$ mos), participated pre-COVID-19 in 2018-2019 ($n = 25$) and during the pandemic in 2021-2022 ($n = 31$). Pre-pandemic participants were tested in schools and pandemic participants were tested on Zoom or in-person in a lab using the same protocol. Children were shown a series of videos with an expert/nurse and non-expert/mom providing opposing testimony on the safety of food in a bowl. An unidentified individual then placed an unrecognizable object in a bowl of the participant's favorite food. When the informants returned, one said the food was safe to eat and the other said it was not. Prior to hearing conflicting testimony, children were asked whether they would like to ask the mom or the nurse (*Ask*) if the food is OK to eat. After watching the two informants give opposing statements regarding food safety, children were asked if the food was safe to eat (*Endorse*). After four trials, children were asked who was better at answering the questions about the food (*Explicit Judgment*). Children also explained their answers, which were coded for mentions of expertise and/or contamination.

We ran 2 (age: younger vs older) X 2 (time: pre- vs during-pandemic) ANOVAs on expert-based (nurse) responses for the *Ask*, *Endorse*, and *Explicit Judgment* questions. Older children chose to *Ask* the nurse more than younger children, $F(1, 50) = 8.13$, $p = .006$, $\eta_p^2 = .14$, but only during the pandemic, $p = .002$ (see Fig). Both age groups similarly *Endorsed* the nurse and in both time periods. Only younger children, $p = .05$, increased choosing the nurse as better at answering the questions (*Explicit Judgment*) from pre- to during-pandemic, $F(1, 51) = 4.11$, $p = .05$, $\eta_p^2 = .08$. Children's explanations about why they chose the nurse/mom were not impacted by the pandemic, however, older children used expertise reasons, $F(1, 44) = 5.77$, $p = .02$, $\eta_p^2 = .12$, and a combination of expertise and contamination, $F(1, 43) = 4.55$, $p = .04$, $\eta_p^2 = .10$, more than younger children. Being in the pandemic may be impacting children's explicit decisions about a nurse's expertise in food safety, but implicit choices (*Endorse*) may remain consistent.

P1-54 - Children prioritize purely exploratory actions in observe-vs.-bet tasks

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Details

In life, we often need to decide between selecting actions that are familiar and have previously yielded positive results (exploitation), and seeking new information that could allow us to uncover more effective actions (exploration). Children have long been argued to be active and exploratory information seekers (e.g., Gopnik, 2020; Schulz, 2012; Piaget, 1954). However, there is no clear test that investigates how children select between reward and information when they are presented as independent options across varying probabilities of causal structures. Most previous studies use environments in which the reward and information that participants receive on each step are confounded (Meder et al., 2021; Schulz et al., 2019). In this study, we adopt an observe-vs.-bet task that separates "pure exploration" from "pure exploitation" by giving participants the option to either observe an instance of an outcome and receive no reward, or to bet on one action that is eventually rewarding, but offers no immediate feedback.

In this study, we investigated the behavior of children in a setting where "pure exploration" (i.e. actions that do not supply any reward at all) was juxtaposed with "pure exploitation" (i.e. actions that do not come with any information) (Tversky & Edwards, 1966). 33 children aged 5 to 7 years old completed a game that required them to either watch which of two available actions provided a reward, or bet on one of the actions to receive a reward. Exactly one of the two actions paid out on every trial. Participants were randomly assigned to one of three different bias levels in the environment: reward was either totally predictable and deterministically associated with a single action ($p=1.0$), largely predictable such that one action provided reward more frequently than the other ($p=0.75$) or totally unpredictable such that both actions were equally likely to provide reward ($p=0.5$). We compared how children performed with both approximate solutions to the partially-observable Markov decision process and meta-reinforcement learning models that were meta-trained on the same decision making task across different probability levels. We found that the children *observe significantly more* than the two classes of algorithms and qualitatively more than adults in similar tasks. Although they *observe just as much* irrespective of environmental predictability, they do adapt their behavior to the environment by *changing how much they bet based on most recent evidence*. This suggests both that children model the causal structure of the environment and that they show a "hedging behavior" that would be impossible to detect in standard bandit tasks.

The results shed light on how children reason about reward and information, providing an important developmental benchmark that can help shape our understanding of human behavior in environments of varying predictabilities.

P1-55 - Problems of reliability with common cognitive developmental tasks

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Details

When conducting research on young children's cognitive development, researchers frequently use forced-choice behavioural tasks (tasks comprising one or several trials where children must choose between two or more answer options). This task format is used partly for convenience: These tasks are typically easy to administer and code, and responses do not require strong verbal skills. These tasks were frequently designed to measure group performance on a specific skill, when average responses, rather than individual performance, were of interest. However, it is now also common for researchers to use the same highly familiar tasks in research on individual differences. Unfortunately, although researchers usually consider statistical reliability when administering other types of measures (e.g., questionnaires), they often fail to consider reliability when selecting behavioural tasks; and, unbeknownst to many, forced-choice behavioural tasks are poorly suited for individual differences research. This talk will aim to demonstrate this problem in two ways. First, a small simulation study will be presented to demonstrate the lack of reliability inherent to typical forced-choice tasks. In this simulation, results from a hypothetical task with either four or six forced-choice trials with two answer options (e.g., yes/no) are simulated under various scenarios. It is assumed that children vary in their underlying competence on the construct being measured: Some children do not possess the competence being measured and therefore score at chance (correct 50% of the time), and others who possess the competence to diverse degrees answer correctly somewhere between 50% and 100% of the

time. If one is to administer two identical tasks (i.e., same format, measuring the exact same construct twice, and children's underlying competence on this construct is completely stable across administrations), correlations and odds ratios are, even in the best case scenarios, far from impressive. This is because the forced-choice format introduces the possibility of guessing correctly by chance, which results in statistical noise and therefore low reliability. Therefore, if trying to use such a task to predict (or be predicted by) any other construct that is not completely identical, observed relations will necessarily be weak. Second, real data on test-retest and parallel test reliability on selective social learning tasks will be used to demonstrate empirically that children's performance can vary substantially across administrations. Cognitive development researchers interested in individual differences are thus encouraged to pay greater attention to task reliability when designing new research in order to avoid a situation where the relations between constructs of interest are nearly impossible to detect.

P1-56 - Circle of life: a simple card game to support relational reasoning in children

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Details

Variability is a "big idea" in the biological sciences. Yet, many children underestimate the degree of variability between members of a species and the life stages of individual organisms (Hermann et al., 2013). Educational materials often lack opportunities to appreciate this biodiversity; for example, by using a single exemplar to represent an entire species in a diagram (Menendez et al., 2020) or museum display (Jee & Anggoro, 2021). The present study tests a new way to promote children's biological understanding, one that capitalizes on the structure of simple card games and the power of caregiver-child play. Simple card games, like *War*, involve *relational* rules, such as "higher value wins." Players must compare their cards to determine the winner of each round. Based on the structure of *War*, we created a game, *Circle of Life*, to engage child and adult players in relational reasoning about biological variability (i.e., changes across the lifespan). Our game cards depicted monarch butterflies and ladybugs at different life stages (see Figure 1). In each round of play, the player whose card showed a later stage would win. To examine whether *Circle of Life* promotes relational reasoning and sensitivity to biological variability, we recruited 42 caregiver-child dyads (child age: 3-12 years) from two local museums to play the game. All participants watched a short video lesson on the ladybug life cycle before playing to introduce the concept of metamorphosis. The game session was video recorded and coded for: 1) *adult relational reasoning* (e.g., 'Which one is more advanced?', 'This one [ladybug pupa] is similar to that one [monarch pupa]'), 2) *adult error corrections* (e.g., 'That is what? That is not a cocoon'), and 3) *child talk about life stages* (e.g., 'This is a pupa', 'This [larva] hatches from the egg'). All participants were also asked to complete a pretest and posttest about metamorphosis. Our analyses revealed that adults' use of relational reasoning varied with the age and performance of the child, with adults more likely to express relational reasoning (number of statements) when playing with younger children ($r(39) = -0.71$, $p < .001$) and when children made more errors ($r(39) = 0.68$, $p < .001$). Thus, adults appeared to use relational reasoning to scaffold gameplay when needed. Furthermore, when adults expressed higher levels of relational reasoning during the game, children tended to talk more about the life stages ($r(39) = 0.78$, $p < .001$). Thus, adults' scaffolding of gameplay was conducive to children's thinking about relevant

biological concepts. However, we did not observe a link between adults' use of relational reasoning and children's pretest-posttest gains in understanding metamorphosis, even after controlling for age-related increases ($r(39) = -0.002, p = .989$). Altogether, our findings suggest that the *Circle of Life* game provides a playful setting for children to think and talk about biological variability. However, one round of game play might not be enough for young children to learn about a complex concept like metamorphosis, even with parent scaffolding.

P1-57 - Neurocognitive basis of episodic memory binding across childhood and adolescence

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Details

Although the hippocampus is generally thought to mature early, the protracted development of cortico-hippocampal networks across childhood and adolescence suggests that there may be continual changes in episodic memory function. In the present study, we investigated age-related changes in the binding of *what*, *where*, and *when* information to create full, adult-like episodic memory. In Experiment 1, we conducted a behavioral test with 40 children between 4 to 8 years of age; in Experiment 2, we collected both behavioral and fMRI data from a sample of 69 adolescents, ranging from 11 to 17 years of age.

Results revealed both age-related and performance-related neural correlates of episodic memory. Behavioral results showed that despite the gradual improvement in performance across childhood and adolescence, children of all ages showed high levels of accuracy in recognizing the correct objects (*what*) and locations (*where*), they had much more difficulty in binding them to each other and across time (*when*). Neuroimaging results showed that, first, that spatiotemporal binding of episodic memory across all age groups was associated with increased activation of the right hippocampus. Furthermore, there was a developmental shift from posterior to anterior hippocampal engagement, accompanied by a change in connectivity of the posterior and anterior hippocampus with temporal and frontal regions, respectively.

These findings suggest that the development of mental "time travel" - the seamless reconstruction and sequential ordering of memory that we experience as adults - is rooted in the functional maturation and specialization of the hippocampus and its network activity with the rest of the brain.

P1-58 - Fraction nonsense to fraction sense: impact of a fraction sense intervention on 6th grade students with math learning difficulties in an authentic classroom setting

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Details

A solid understanding of fractions is the cornerstone for acquiring proficiency with rational numbers and paves the way for learning advanced mathematical concepts, such as algebra. Fraction failure limits not only students' educational and vocational opportunities but also their ability to solve everyday problems. Students who exit 6th grade with an inadequate understanding of fractions may experience far-reaching repercussions that lead to a lifelong avoidance of math. It is imperative to prioritize the development of fraction interventions tailored to at-risk learners. This submission presents the initial results of the first two cohorts of a large efficacy investigation. Our primary objective was to design an intervention that can be easily implemented by teachers within their classrooms. Participants ($N = 199$) included 109 students in the experimental intervention condition and 90 students in the control intervention condition across 25 classrooms in 8 schools across 4 districts. All schools in the sample served under-resourced communities. Randomization occurred at the teacher level. Teachers implemented the fraction sense intervention (FSI) within their intervention classes. These classes consisted of students who tested at least two grade levels below their grade on standardized math tests. The set of 24 animated PowerPoint lessons draws from research in the cognitive and learning sciences, emphasizing gestures, concreteness fading, interleaved and distributed practice, meaningful contexts, mathematical equivalence, and linear representations. The intervention also centers around fractions students are likely to see in everyday life (i.e., $1/2$, $1/4$, and $1/8$). The fidelity of implementation was 79%. Our team administered assessments before and after the intervention, which measured proficiency in fraction concepts, fraction arithmetic, applied fraction problems, fraction comparisons, measurement, and fraction number line estimation. At the pretest, many students exhibited conceptual misunderstandings and relied on inappropriate fraction procedures. For example, for a simple problem such as $2+3/8$, students responded with answers less than 1, such as $5/8$ or $5/10$. After participating in the FSI, most FSI students understood that this addition problem results in a number greater than its parts, 2 and $3/8$. Multilevel modeling revealed a significant effect of the intervention on the posttest scores of the fraction measures, after controlling for pretest fraction scores, working memory, vocabulary, proportional reasoning, and classroom attentive behavior. Students in the FSI group outperformed their counterparts in the control group with noteworthy effect sizes on all individual fractions measures except fraction comparisons. Although these initial results do not include the full sample of participants as data collection will continue in the spring of 2024, our findings show that students who are far behind their peers in mathematics can learn to interpret and operate with fractions. The findings suggest that the FSI can be carried out effectively by classroom teachers but also shed light on the challenges of conducting school-based intervention research, which will be discussed. Our research team is continuing to examine the efficacy and will examine the durability of results over time. We also plan to use more thorough analyses of factors that affect intervention success.

P1-60 - 'Five' is the number of bunnies and hats: children's understanding of cardinal extension and exact number

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Details

Children as young as 2 can count by pointing to items while reciting the count list ('one', 'two', 'three'), but they don't grasp that the last word in a count labels the exact cardinality of a set until much later. Some suggest children learn this through a bootstrapping process (Carey, 2004; Sarnecka & Carey, 2008) where they notice that counting up one word in the count list corresponds to adding one item to the counted set (the "successor principle"), leading to the ability to accurately count and label large sets. Another view is that children gain the ability to accurately count, label, and construct sets first, and only infer the cardinality principle (CP) from using these procedures, noticing that, e.g., counts of "five" always result in the same number of things (Barner, 2017; Carey & Barner, 2019). A key problem with differentiating these theories is that in the past, accurate counting was interpreted as evidence of CP knowledge. Because this ability might also be explained as a rote procedure in absence of CP knowledge, alternative tests that probe this understanding are needed.

We present 2 studies that investigated this question using a "cardinal extension" task (Frydman & Bryant, 1988; Sarnecka & Wright, 2013; Muldoon, Lewis & Freeman, 2003), which probes whether children infer that two sets in 1-to-1 correspondence should receive the same number label. Children aged 2-6 were shown sets of animals (e.g., bunnies) and items (e.g., hats) in 1-to-1 correspondence. After hiding the animal set, we tested whether children could infer the number of animals by selecting and counting the visible item set in 1-to-1 correspondence, and not the non-matching item set. Study 1 showed that children who could accurately count large sets (typically called "CP-knowers", but here called "Counters") performed significantly better than those who could not (typically called "subset knowers"), with the latter group uniformly failing. However, age explained this advantage, with older children having a higher success rate. Nonetheless, many Counters also failed at the task. In Study 2, we tested whether children who succeeded at the task used 1-to-1 correspondence or relied on approximate representations. We compared the performance of Counters between conditions where the competing visible sets were presented in perceptually discriminable ratios allowing use of approximation (e.g., 6:12), or were off-by-one and thus required use of 1-to-1 correspondence (e.g., 11:12). In both conditions, the animal set's 1-to-1 correspondence to the matching item set and their discrepancy from the non-matching item set were highlighted, so children's failure cannot be attributed to them not noticing the 1-to-1 correspondence. We found that Counters performed above chance in the perceptually discriminable condition, but not in the 1-to-1 condition.

In summary, children only succeed at cardinal extension after becoming Counters. When they succeed, they initially extend number words approximately and are insensitive to exact equality, as indexed by 1-to-1 correspondence. This suggests that children previously called CP-knowers may not have adult-like understanding of the cardinality principle, and this knowledge may emerge gradually after acquiring rote counting procedures. We propose future research questions investigating factors influencing children's ability to use 1-to-1 correspondence to infer equality of counted sets.

P1-61 - Using a dynamic neural model to understand the role of learning in executive function development

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Details

A primary challenge facing theories of neurocognitive development is to explain how experience impacts neural function and changes in behavior. Over the last decade, a dynamic neural field (DNF) model has made important strides in addressing this challenge in the context of executive function (EF) development. This model explains and predicts behavioral performance and neural activation measured in the context of a canonical probe of the developmental status of EF: the dimensional change card sort (DCCS) task. In the DCCS, children are first instructed to sort cards by shape or color and then to switch to sort by the other dimension. Typically, 3-year-olds will continue using the initial set of rules when instructed to switch, but older children will have little difficulty switching. The explanation provided by the model is grounded in real-time complex neural dynamics that take place in a neural architecture that binds visual features to spatial locations and labels (e.g., “color” or “blue”). Stronger coupling between label representations such as “color” and neural populations encoding the color dimension enhances processing of task relevant object information more robustly. This enhancement can eventually overcome factors such as stimulus salience or habits that might impair the ability to execute task rules or internally represented goals across a wide array of manipulations to the task. The ability to switch rules in the DCCS is associated with increased frontal cortex activation. The model explains this increase in activation but also predicted the observation that frontal cortex activation is also influenced by a child’s previous experiences in the task, demonstrating how children’s neurocognitive function is impacted by their immediate experiences. Thus, the central hypothesis of this theory is that learning labels for visual features and dimensions guides the formation of neural representations that can be used to enhance task-relevant information.

We ran a longitudinal study examining how different measures of neurocognitive function predict the development of EF as measured on the DCCS task. At 30 months of age children completed dimensional label comprehension and production tasks, a dimensional understanding task, and a response selection task. At 54 months of age, children completed these same tasks in addition to the DCCS task. During all tasks functional near-infrared spectroscopy data were collected from bilateral frontal, temporal, and parietal cortices. We predicted that EF development at 54 months of age would be better predicted by neurocognitive measures of dimensional label learning at 30 months of age relative to measures of cognitive control or dimensional understanding. Our analyses revealed constellations of cortical regions involved in performance on these tasks and developmental changes associated with improvements on these tasks, providing some of the first insight into the neurocognitive mechanisms involved in these domains. Most importantly, we found that EF at 54 months of age was best predicted by measures of neural function in right inferior frontal gyrus during color production, right superior parietal cortex during shape comprehension, and left inferior parietal cortex during color comprehensions. These results reveal the shifts in neural activation associated with learning dimensional labels and implicate these changes in the emergence of attentional control skills.

P1-62 - Equal gestures counteract gender stereotypes perpetuated by language

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Details

Past research has found that subject-complement statements (SCS, e.g., "*Girls are as good as boys at math*") were commonly used by caregivers, teachers, and public figures (Chestnut et al., 2015). Despite the intention to advocate for equality, the use of SCS often backfires (Chestnut & Markman., 2018). This is because the syntactic structure of SCS establishes the group in the complement position (or the reference group, e.g., boys) as being more naturally skilled than the group in the subject position (e.g., girls), perpetuating the pre-existing stereotypes. Moreover, these statements even transmit new stereotypes to young generation (Chestnut et al., 2021).

Given that gestures distinctively work together with speech to convey speakers' intended meaning and shape how speech is perceived (Goldin-Meadow & Brentari, 2017); this research provided the first evidence suggesting gestures can counteract the stereotypes communicated through language. Specifically, we tested whether the presence of equal gestures could uniquely ameliorate children's learning of gender stereotypes through SCS.

Across 2 pre-registered studies, 8-to-11-year-old participants were introduced to a fictional group from a faraway planet and completed 4 trials. In each trial, children watched a short video of an actress reading an SCS about gender equality in a novel domain (e.g., "*Girls are as good as boys at yuzzing*") and then answered questions gauging the endorsement of gender stereotype (e.g., "*Are boys or girls naturally better at yuzzing?*").

In Study 1 ($N = 160$), Participants were randomly assigned to one of two conditions. In the Equal Gesture (EG) condition, the actress made an equal gesture while reading the SCS by raising both hands vertically to the chest level with hands facing towards each other and fingers perpendicular to the palm (Figure 1 left). In the No Gesture (NG) condition, the actress read the SCS only with no gestures. As predicted, when SCS were accompanied by equal gestures, children were less likely than children in the NG condition to associate the greater natural ability to the reference group (Wald $\chi^2 = 11.66$, $p < .001$; Figure 2 left).

An alternative explanation to this result is that any gestures accompanied with the SCS would undermine children's endorsement of stereotypes. The procedure of Study 2 (planned $N = 160$, now $N = 82$) remained identical to Study 1 except that participants were randomly assigned to one of two conditions: Unequal Gesture (UG), or EG condition. In the UG condition, the actress made an unequal gesture by sequentially lifting each hand to different vertical levels when each group was mentioned (Figure 1 right). For consistency between the two conditions, the equal gesture in this EG condition was produced by sequentially raising each hand to the same vertical level. The final display of the equal gesture stayed identical to that of Study 1. As expected, children were less likely to attribute the greater natural ability to the reference group when SCS were in conjunction with equal (vs. unequal) gestures (Wald $\chi^2 = 10.06$, $p = .002$; Figure 2 right).

Together, these findings highlight the strikingly unique contribution of equal gestures in shaping children's stereotypes and thus communicating equality. Specifically, this work presents equal gestures as a novel intervention in combating gender

P1-63 - Temporal coordination of visual attention between parents and 9-month-old infants

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Details

There has been increased interest in understanding how infants and caregivers coordinate their attention in the moment. Researchers have leveraged technological innovations to collect high-density behavioral data with fine-grained temporal resolution during parent-infant play. These studies have revealed a tight temporal coordination of parent and infant looking and provided insights into how partners lead the interaction (e.g., Suarez-Rivera et al., 2019; Yu & Smith, 2013). However, much of this research has focused on children in the second year of life, and studies often include wide age ranges. We investigated the coordination of attention between caregivers and their 9-month-old infants. During this age, infants become increasingly active in exploring their environments, due to developing language and motor skills (Bertenthal et al., 2014; Karasik et al., 2011). We examined the coordination of parent-infant attention using statistical techniques such as auto-correlation, cross-correlation, and dynamic structural equation modeling (DSEM).

Fifty parent-infant dyads (16 girls and 34 boys; $M_{age} = 9.15$ months, $SD = .78$) from middle-class, racially diverse families participated in a 3-min naturalistic puzzle play session. We recorded infant and parent gaze using head-mounted eye trackers (Positive Science, LLC). We coded the datastream for instances of looking at the partner's face, partner's hand, and puzzle and divided the datastream into 500 ms bins.

Analyses of the overall frequency and duration of looking behaviors corroborated the literature with toddlers. Infants rarely looked at parents' face and their looks were shorter, indicating that mutual gaze was relatively rare. Compared to parents, infants had fewer looks at the puzzle but their looks were longer for both looking at the puzzle and partner's hand.

We examined changes in looking behaviors over time. First, we used partial auto-correlations to examine the rate of change of attention episodes. These analyses test the relation between two observations in a time series of a behavior while controlling for other lags. We observed sharp fall-offs as the lags increased, indicating looking behaviors changed rapidly. Additionally, comparing the autocorrelations for parents and infants revealed that infants tended to stay looking at one target longer. Next, to determine both whether parent-infant looks were coordinated and who led episodes of attention, we examined cross-correlations. Parent-infant look at partner's face and puzzle revealed the highest correlation value at lag 0, indicating the tight coordination of mutual gaze and joint attention. Furthermore, the comparison of positive and negative lags of parents and infants suggested that both partners led mutual gaze and joint attention, but there were stronger effects for parents leading. Ongoing analyses using Actor-Partner Interdependence Models within a dynamic SEM framework support these conclusions and extend them to reveal how parents' and infants' looking behavior affects their own and their partner's looking across time.

Overall, 9-month-old infants and parents have tight temporal coordination of looking behaviors during play, yet infant looks change slower than their parents with longer looks within bouts. Both play partners lead the play with their looks, whereas parents were slightly more likely to lead. Taken together, parents' and 9-month-old infants' visual attention is temporally tight and bidirectional.

P1-64 - Transmission of gender stereotypes through play

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Details

Children show awareness of cultural stereotypes about gender by three years of age (Weinraub et al, 1984). At this early age, parents are a key influence on children's developing beliefs (Croft et al, 2014). One way parents may communicate ideas about gender to their children is through play; for example, studies have found that parents and children prefer gender-stereotypical toys (Cherney & London, 2006; Kollamayer et al, 2018). The current study aims to connect these findings, examining the relationships between parent's gender beliefs, children's gender beliefs, and behaviors during parent/child play. Specifically, we hypothesized that parent's choice of gendered toys during play with their child mediates the relationship between parent and child gender stereotypes.

The current sample includes 12 parent/child dyads (planned $N=30$). Mean age of the children was 41.7 months (Range: 36.1–49.6; 8 girls, 6 boys). Nine children were white; three identified as more than one race. The sample included five mother/daughter dyads, two father/son, three father/daughter, and two mother/son. Average annual household income was \$122,750.

Parents and children engaged in a 15-minute free play session. They were provided with toys that were traditionally masculine (e.g., trucks), traditionally feminine (e.g., dolls), and neutral (e.g., farm animals). We scored the proportion of time that parents and children spent playing with each type of toy.

Afterwards, parents completed three measures of gender stereotypes. The *Implicit Associations Test* measured the stereotype of women/household and men/careers (Greenwald et al, 1988). The *Bem Sex Role Inventory* (Bem, 1974) measured parents' identification with stereotypically feminine and masculine traits. The *Child Gender Socialization Scale* (Blakemore & Hill, 2008) measured parents' endorsement of traditionally feminine and masculine activities for their child. Children completed a sorting task modeled on Weinraub et al. (1984) to assess their gender stereotypes.

For all measures, we calculated difference scores between gender-consistent and gender-inconsistent items. Positive scores indicate adherence to gender stereotypes and negative scores indicate counter-stereotypical responses.

There was a large, significant correlation ($r=.61$, $p=.035$) between the gender socialization scale ($M=0.24$; Range: -2.57 to 2.29) and parents' gender stereotypical toy choice during play ($M=0.32$; Range: -0.33 to 1.00). Parents who explicitly endorsed stereotypical activities on the survey selected stereotypical toys for their child during play. Parent toy choice was marginally related to children's gender stereotypes ($M=3.33$; Range: -1.00 to 8.00), $r=.56$, $p=.059$.

There was a moderate, nonsignificant correlation between the gender socialization scale and children's gender stereotypes ($r=.31, p=.32$). This correlation shrank to near zero after controlling for parent toy choice (partial $r=-.04, p=.90$). These results are consistent with our mediation hypothesis, although more data is needed to confirm these patterns. No significant patterns emerged from the IAT or BSRI, but these will be explored in the full sample.

In sum, our data show that parents' behavior during play with their children is related to their own explicit gender stereotypes and to their children's gender stereotypes. These results support a possible mediation model whereby parents are transmitting their ideas about gender to their children through shared play.

P1-65 - Preschoolers use new information to appropriately maintain or overcome a pre-existing bias on a treasure hunting game

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Details

When children interact with the world, they often do so based on incomplete information and are reliant, at least in part, on cognitive and behavioral biases that help to guide their behavior. During exploration, these pre-existing biases may play an important role in determining what children explore and how children learn from the results of their explorations. Reliance on biases may be cognitively efficient for children, however it will not lead them to make the most adaptive exploratory decisions in all contexts. To the extent that new information disagrees with a child's biases, children may need to override their initial ways of approaching a problem. Integrating new information with a pre-existing bias may be challenging, because biases, unlike beliefs, need not be available to conscious reflection and can motivate children's behavior without the child's awareness. Thus, research is needed to better understand the processes by which children integrate new information to override their pre-existing behavioral biases during active search.

The present study investigated preschool-aged children's ability to overcome a pre-existing behavioral bias during an active search task administered over Zoom. Children between the ages of 3.5 and 5 years ($N = 64$), were recruited for participating in an online treasure hunting game. At the start of the game, children were informed that they needed to help a treasure hunter find hidden diamonds. On each trial, children were shown three treasure boxes, one of which contained a diamond. Boxes varied along the dimensions of color (i.e., red, green, blue) and location (i.e., righthand, center, lefthand side of the screen). Unbeknownst to the participants, diamonds could always be found by searching according to one of the two dimensions (e.g., check the red box). Children were randomly assigned to condition. Half received evidence that was consistent with a location-rule, and half received evidence that was consistent with a color-rule. Over twenty trials, children then had the opportunity to search the boxes for diamonds.

Prior work has shown that, in the absence of other information, young children tend to show a location bias and search for rewards in the same spatial location (e.g., Bell & Livesey, 1985). Focal analyses demonstrated that children in both conditions initially showed the predicted location bias ($X^2 =$

27.13, $p < .001$). General linear models were then fit to children's search data to track changes in children's search strategies over time. Results of these models showed that while children in the location-rule condition of the study maintained their location bias across trials, those in the color condition gradually revised their search strategy to adopt a color-rule over time (Figure 1). Results are discussed in terms of their implications for understanding how children negotiate the conflict between their pre-existing biases and new, bias-inconsistent, information. We speculate that gradual adoption of new search strategies during exploration-led learning may be generally adaptive when overcoming a pre-existing bias.

P1-66 - Children's reasoning about the impact of incidental and integral emotions on attention

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Details

Emotions influence all cognitive processes that enable learning. Intriguingly, even preschoolers acknowledge this interplay between affect and cognition. Despite their limited experience in formal educational settings, 5-year-olds possess adult-like intuitions about the detrimental effects of negative emotions on learning performance (Amsterlaw et al., 2009). However, compared to adults, 8-year-olds struggle to recognize the potential downsides of positive emotions. For instance, they have trouble understanding that being exceedingly happy could make it harder to focus and maintain attention on a topic (De la Viña et al., 2023). Although these findings suggest that 5- to 8-year-olds have an overly optimistic view of positive emotions, they may have underestimated children's awareness of the drawbacks of positive emotions. However, the vignettes did not mention the cause of the character's emotion. Perhaps omitting this information prevented children from demonstrating a more nuanced understanding of positive emotions. In a within-subjects preregistered study, we explored how children's reasoning about the impact of emotional states on attention is influenced by the emotion's origin: incidental (from unrelated events) or integral (from the academic task itself). Five- and 8-year-old children ($N = 80$) and adults ($N = 80$) heard stories in which a character must pay attention to an academic topic. In the incidental scenarios, the characters receive news that makes them happy or sad just before the teacher requests the class attention to a new topic. In the integral scenarios, characters feel happy or sad as a result of the teacher's announcement of the class topic. Participants were asked how easy or hard it would be for the character to pay attention using a 4-point Likert scale employed in previous studies. The first part of the study included 12 randomized trials, three for each combination of condition (incidental, integral) and valence (happy, sad). In the second part, we asked participants to provide ratings and explanations to four additional trials (one for each combination of condition and valence). A mixed-effects linear regression model indicated that, regardless of age, participants gave similar ratings across all items except for the incidental happy ones. Aligned with our preregistered predictions, 5-year-olds were the only group who said that paying attention would be equally easy on the incidental and integral happy items ($p = .87$). Meanwhile, 8-year-olds ($B = .80$, $p < .001$) and adults ($B = 1.15$, $p < .001$) said that attention would be significantly harder on the incidental happy items compared to the integral happy ones (see Figure 1). Analyses of participants' explanations further underscored developmental differences in children's conceptual understanding of emotion, particularly

regarding the likelihood they cited distracting thoughts as the mechanism through which positive and negative emotions disrupt attentional processes. These findings are among the first to show that 8-year-olds not only distinguish the effects of incidental and integral emotions on cognition, but also recognize the detrimental impact of positive emotions on cognitive performance.

P1-67 - Latine caregivers' storytelling with their preschoolers about science, nature, and identity

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Details

Our work centers on Latine caregivers' storytelling as a cultural practice and resource for supporting science learning for young children. The overarching goal is to identify cultural strengths that support early engagement with science in this growing population, amid continuing concerns about the underrepresentation of Latine students in science. Family storytelling can play a foundational role in the growth of cognitive skills, including literacy and science learning, as well as in children's developing sense of identity and understanding of family, cultural heritage, and values. Among Latin American heritage communities with firmly rooted oral traditions, oral storytelling may be an especially common practice for conveying knowledge to young children. Our work focuses on uncovering (1) the range of stories Latine caregivers share with their children when asked to share a nature or science-related narrative, (2) children's roles in these tellings, and (3) the reasons caregivers offer for telling these stories.

As part of a larger, ongoing study of science and stories among Latine families, 60 caregivers were video recorded sharing a nature or science-related story with their 3- to 5-year-old child and interviewed about their story-sharing practices. Families were recruited from Head Start centers in New York City (n=30) and an Educare preschool and family resource center in San Jose, CA (n=30). Most caregivers were immigrants from Mexico (52%) and spoke Spanish at home (99%). Narratives and interviews were transcribed by bilingual Spanish-English researchers who used thematic analysis to code for the genre and content of stories, child participation, and functions of the story. We used qualitative methods allowing codes to emerge from the data, so as not to impose cultural biases.

Several main genres emerged. The majority (65%) were personal narratives, including stories about the caregiver's childhood experiences, the child's origin stories, reminiscing caregiver-child lived experiences, and recounting child experiences unshared with the caregiver. The remaining 35% were fictional stories including invented stories, fictionalized personal experiences, and retellings of folk stories and popular stories. All stories covered a broad array of science and nature topics, including animals, plants, astronomy, environmental challenges, and outdoor recreational activities. Additionally, most also included connections to family and cultural heritage (74%) and explicit lessons (11%) about social relationships (e.g., obeying parents), care and respect for the environment, and the value of hard work. Children participated in the storytelling as a quiet listener, a responsive audience, an engaged audience, or co-narrator. With regard to functions of the story, caregivers reported choosing stories that: (1) constructed individual identity and were based on child's interests, (2) constructed families' autobiography and identity (e.g., family heritage, immigration), or (3) supported learning about nature and science.

Our continuing analyses will seek to understand and explain connections between family storytelling genre, content, child participation, and function. Our presentation will feature multiple illustrative examples and offer a window into the ways that Latine caregivers' storytelling practices provide family learning opportunities that can broaden children's understanding of science, their families, and themselves.

P1-68 - Exploring acquired distinctiveness and acquired equivalence as phonetic category learning mechanisms through perceptual attunement

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Details

Infants begin life able to discriminate both native and non-native speech sounds. By 10-months, infants improve at discriminating similar sounding native speech sound differences (e.g., English voiced 'ba' vs voiceless 'pa') and decline at discriminating speech sound differences that are not used to contrast meaning in the native language (e.g., Hindi retroflex 'ɖa' vs dental 'ɗa'; Werker & Tees, 1984). "Acquired Distinctiveness" (AD), in which two similar speech sounds are consistently paired with two different objects, is a perceptual learning mechanism that boosts discrimination (Yeung & Werker, 2009). "Acquired Equivalence" (AE), in which two similar speech sounds are inconsistently paired with two objects, is a learning mechanism that diminishes discrimination (Honey & Hall, 1989). AD (Yeung & Werker, 2009) has been shown to be effective in changing non-native speech sound discrimination in infants aged 6-8 months. In a recent study using the same EEG discrimination paradigm employed here, we found that a passive statistical learning mechanism, distributional learning, effectively changed speech sound discrimination at 6-8 months, but not after 10 months of age (Reh et al., 2021), consistent with the possibility of a critical period that begins closing by 10-months (Werker & Hensch, 2015). The current study was designed to test whether the efficacy of AE and AD similarly changes across the first year of life or, because AE and AD involve linking sound to meaning, they remain effective even at the older age. We are testing this by comparing English-learning 6- and 12-month-old monolingual infants. As in Reh, et al. (2021), we are using a native English, but acoustically difficult, phonetic contrast (English 'ra' vs 'la'). At first, infants are presented with three sequential trials labelling a familiar object (e.g., "Look at the banana/dog/hand!") to signal an object labelling task (Yeung et al., 2014). Then infants are presented with either consistent or inconsistent speech sound/object pairings, following which phonetic discrimination is assessed. As in Reh, et al. (2021), discrimination is assessed by measuring the ERP (event-related potential) response to change trials in an oddball task. If AE/AD are effective learning mechanisms across all ages, then AD will boost, and AE will diminish, discrimination of 'ra' vs 'la' at both ages. If the efficacy of these learning mechanisms is delimited to a 6–10-month sensitive window in perceptual development (Werker & Hensch, 2015), then these mechanisms will only be effective in the younger age group. We have completed data collection with 86 infants, 41 at 6-months and 45 at 12-months. With preliminary analyses, the 6-month-olds are following the expected pattern, while the 12-month-olds are showing the opposite pattern than predicted. We expect to finish data analysis of monolingual infants by the end of 2023. The results of this study will advance our knowledge of how infants become adept "native language listeners" and will provide insight as to whether the kind of

learning opportunity infants encounter (passive listening versus word learning) impacts the timing of plasticity. We are currently testing a bilingual cohort to determine whether the findings generalize to a population that is suggested to have an extended window of perceptual attunement (Petitto et al., 2012) to ensure generalizability and advance inclusivity.

P1-69 - Social contingency between parent object handling and early attention experiences at perceptual and neural levels

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Details

Sustained attention (SA) is an essential skill for early learning and development. An increasing number of developmental studies using head-mounted cameras indicate the important role of parent object handling in supporting infants' SA during object play (Yu & Smith, 2016; Sun & Yoshida, 2022). A separate line of research using electroencephalogram (EEG) recordings demonstrated the tight link between EEG oscillations (e.g., alpha and theta rhythms) and active visual exploration (Xie et al., 2018; Wass et al., 2018). Despite the importance of social scaffolding and neural correspondence in maintaining infant attention, we know relatively little about how children's SA on objects is socially embodied at the perceptual and neural levels. The present study investigates the social contingency between parental scaffolding and infant attention with three main goals: (1) to examine the structural and temporal relationship between parent object handling and infants' SA, (2) to characterize the visual properties (saliency) of infant's scenes during SA, and (3) to document the neural correlates of socially coordinated SA. Here, we applied an innovative approach integrating eye-tracker and EEG recording in a naturalistic interactive context, which can precisely capture infants' moment-to-moment gaze behaviors while tracking neural oscillatory activities simultaneously (Fig. 1A). 30 parents and their infants, including 18 6-month-olds ($M=6.6$, $SD=0.5$) and 12 12-month-olds ($M=12.4$, $SD=1.0$) participated in a 12-minute object play in which parents were asked to freely use six toy objects to play with the infant. First, we annotated infants' and parents' gaze allocation, vocalization, and hand actions (Fig. 1B), and found that parents had a similar proportion of object handling ($M = 52\%$) as object looking ($M = 41\%$) that co-occurred with infants' SA, $F = 2.60$, $p = .15$; meanwhile, cross-correlation analyses suggested that parents timely adjusted their handled actions upon the objects in response to infants' SA, $t = 18.71$, $p < .001$. Next, we characterized the perceptual variabilities in infants' viewing experiences by assessing the salience change in the scenes (Fig. 1C). The salience value was significantly higher during the SA instances with parent object handling relative to SA without object handling, $t = 3.14$, $p = .002$. Third, to examine the neural correspondencies underlying socially coordinated SA, we extracted the episodes of the infant's SA for ERP-like EEG analyses. For example, the time-frequency plot presents an enhanced power change (6-10 Hz) occurring around 1000 ms after the onset of SA along with parent object handling (Fig. 1D). Cluster-based permutation analysis further compared neural oscillatory activities during SA accompanied by various scaffolding. The present study characterizes the variabilities of perceptual properties in infants' visual fields and their associated neural responsiveness during free object viewing in a real-world context. We will further document the developmental change in infants' initiativeness in social coordination with others from multimodal perspectives and pose the significance of social contingency on communication and learning for further discussion.

P1-70 - Development of a behavioral measurement of children's intellectual humility

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Details

Intellectual Humility (IH) is the ability to recognize, acknowledge, and act on the fallibility of one's own knowledge (e.g., Porter et al., 2021). Although there are several ways to measure IH in adults, very little research has investigated whether children display IH characteristics nor assessed how to measure these abilities. Adapting work by Danovitch et al. (2019) as well as the Comprehensive IH Scale (Krumrei-Mancuso & Rouse, 2017), the current work aimed to develop a comprehensive behavioral task for IH and investigate the ways in which IH differs among children.

Our procedure assessed 4 components of IH: knowledge assessment, confidence, respect for others' viewpoints, and willingness to revise beliefs. Participants were children ages 6-10 (N = 80) who were told they would be playing a question-and-answer game. Recognizing that IH might vary based on experience or knowledge, caregivers of participants were asked to identify their child's high, medium, and low knowledge domains from a list of topics. These domains were used to determine which questions would be assigned to children for the three counterbalanced test trials. Children were trained on a 5-point rating scale on 3 practice trials before starting the test trials with a knowledge assessment question ("How much do you know about X?"). Children were then read a general knowledge question that corresponded to one of their knowledge domains. After children responded, they rated their confidence in their response. Next, a virtual player was introduced into the game environment. Children were shown a blank user icon and a name but received no other information about the player. To assess respect for other's viewpoints, children rated how much they wanted to hear the new player's response. On each test trial, children were told that their answer did not match the other player's answer. Children were asked to reassess their confidence before finally demonstrating their willingness to revise beliefs by rating how much they wanted to switch their answer to the other person's answer.

Results demonstrated that children responded in ways that aligned with appropriate displays of IH. In each domain, the two confidence judgments were intercorrelated and negatively associated with willingness to revise beliefs, suggesting that children recognized the accuracy of their responses and responded appropriately by changing or keeping their response. All items except for respect for other viewpoints (which had consistently high scores across all three domains) were combined to create an average IH score for each domain. IH scores in the high knowledge domain (M = 6.03) were significantly lower than both medium (M = 8.05) and low domains (M = 8.48) suggesting that children do have differential displays of IH based on their prior knowledge. There was no relationship between IH and age. These preliminary results show promise for the continued use of this procedure to assess children's IH. Future studies can refine this methodology, track developmental change in IH, and provide an entry to study how IH can play a role in children's learning and education.

P1-71 - Using number book intervention to train flexible attention to magnitudes in preschool-age children

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Details

Early math skills are critical to academic success in childhood and future career and life outcomes (Jordan & Levine, 2009). Flexible attention to magnitudes (FAM) is a math skill that has been shown to predict children's future math abilities over and beyond other math skills (Wagner et al., 2023). FAM is defined as the ability to switch flexibly between attending to different dimensions of magnitude, such as attending to size and then switching to attend to numerosity. In the current study, we created an intervention using number books to test, for the first time, the malleability of children's FAM ability. A randomized experiment was conducted to test our hypothesis that FAM ability is malleable and can be trained using number books. We recruited 116 preschool-age children (Mage = 55.6 months; 54.3% female) and assessed each of them over the course of a week, including two days of assessment and three days of intervention. Assessments included the FAM task (Fuhs et al., 2021; Wagner et al., 2023) as well as assessments of overall math achievement, number line estimation ability, and executive functioning skills. The number book intervention included four conditions to which children were randomly assigned: non-numerical, conventional counting, mixed, and size-to-number. The experimental conditions were mixed and size-to-number, while the non-numerical and conventional counting conditions served as controls. In the size-to-number condition, children were first shown 10 different scenes and asked to compare the size of the objects on the page. Then they were shown the same 10 scenes but asked to compare the number of objects on the page. In the mixed condition, children are asked either to compare the number or the size of objects on the pages in an arbitrary order. For the primary analyses, we conducted a 2 (timepoint: pre-intervention, post-intervention) x 4 (condition: counting, mixed, non-numerical, size-number) repeated-measures ANOVA with FAM performance as our outcome of interest, but a significant interaction was not found. We then examined planned contrasts which revealed that children significantly improved FAM task performance from pre- to post-intervention within the experimental groups, but not within the control groups. We next examined changes in math achievement, number line estimation, and executive function skills from pre- to post-intervention to observe any transfer effects for the experimental conditions. We found no significant differences in overall math achievement from pre- to post-intervention. A marginal effect in the size-number condition was found for number line estimation scores, and the two experimental conditions combined significantly improved NLE scores from pre- to post-intervention, unlike the combined two control conditions. A marginal interaction effect was also detected for executive function skills and interestingly, in planned contrasts, only the non-numerical book condition was found to improve executive function skills. These findings were consistent with our hypothesis that FAM ability is malleable and can be improved through innovative intervention; however, future research is necessary to better understand how FAM skill improves. Additionally, more research is needed to determine if interventions targeting FAM ability are a viable way to improve math achievement in young children.

P1-72 - Neural signatures of learning in social and non-social contexts

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Details

In any situation, infants are presented with more information than they can learn about at once. Pedagogical interactions help solve this problem. Cues from social partners can signal the relevance of particular objects or information, helping infants prioritize what to learn. For example, infant-directed speech improves learning of statistical speech patterns (Thiessen et al., 2005), and joint attention enhances infant object encoding. When an adult looks from the infant to an object and back (i.e. engages in joint attention), infants subsequently recognize that object better and spend more time looking at a novel object instead (e.g. Cleveland & Striano, 2007). We are using neuroimaging data to test if enhanced learning in the context of joint attention is supported by the same or different neural mechanisms as learning that occurs in its absence. Are specific regions of the prefrontal cortex more active during episodes of joint attention to an object? Are there regions in which activation is predictive of object encoding, and if so, are they the same or different depending on joint attention context? Different neural correlates could indicate that typically developing infants engage distinct learning processes or goals in social and non-social contexts, with implications for understanding of developmental disorders that affect social learning.

Results from an online behavioral pilot including 50 9- to 12-month-old infants ($M_{\text{age}}=10.1$) replicated the finding that when an object is presented in the context of joint attention, infants do show a stronger subsequent preference for novel objects, compared to trials without joint attention ($F(1) = 5.17$, $p = .02$). We are currently conducting a preregistered version of this study using fNIRS to collect data on prefrontal cortex activation during object encoding with and without joint attention (current $N=33$; target $N=50$). In preliminary data analysis, there's a marginal increase in left medial prefrontal (MPFC) activation during joint attention trials relative to "no joint attention" trials ($F(1,50)=3.12$, $p=0.08$); however, this increased activation does not correlate with the novelty preference observed during these trials ($r(24)=-.15$, $p=0.47$). Interestingly, during trials without joint attention, a positive correlation was found between left lateral prefrontal activation and novelty preference ($r(24)=0.42$, $p=0.03$), in line with previous research on this region and subsequent memory (Wagner et al., 1998; Turk-Browne et al., 2009). However, this correlation is not significant during joint attention trials ($r(24)=0.16$, $p=0.43$), and activation in this region during joint attention trials is also marginally lower ($F(1,50)=2.77$, $p=0.10$). These differences imply the engagement of different neural mechanisms during social versus non-social learning contexts. Furthermore, MPFC activation in joint attention trials may not exclusively signal learning, given the region's broad involvement in various cognitive functions. This activation might instead reflect reward or social evaluation triggered by a social partner's attention. These results shed new light on how pedagogical contexts impact early learning, and point to new targets for investigation with infants at risk of developmental disorders, especially regarding learning in social contexts.

P1-73 - Tinkering here and there: how families talk about informal STEM learning activities in museums and at home

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Details

In line with constructivist (Piaget, 1970) and sociocultural (Vygotsky, 1978) perspectives, tinkering activities involving hands-on problem-solving and social interactions may foster engineering learning. In addition to engaging visitors in tinkering exhibits, many museums now are designing online activities to engage families from home (Ennes et al., 2022). Studies across learning settings (Geerds et al., 2015; Gupta et al., 2019) emphasize that physical learning environments impact families' learning interactions, so this study examined whether families used more engineering and spatial talk during and after tinkering if participating in their homes or in a museum.

Fifty-eight families with 4-10-year-old children ($M = 7.08$ years; 59% boys; 52% white, 15% Asian, 11% black, 11% Latine) completed a tinkering challenge either in their homes ($N = 36$) or in a museum tinkering exhibit ($N = 22$). All families were invited to use everyday materials (e.g., cardboard, straws, tape, clips) to construct a ramp to move something from "here to there." Museum educators prepared a video to introduce the tinkering activity to families participating at home, who viewed it with a researcher before engaging in the activity. Families who visited the museum were recruited at the tinkering exhibit and received an orientation to the activity from a museum educator. After the activity, researchers interviewed children about their projects. Families' tinkering conversations and children's post-tinkering interviews were coded for talk about engineering practices (i.e., goal-setting, planning, testing, identifying problems, redesigning) and use of spatial language (e.g., locations, dimensions, features, patterns, shapes). We also identified how many unique materials families used in their projects.

Families at home spent a greater proportion of time talking about engineering during tinkering ($M = .80$, $SD = .26$) than families at the museum ($M = .51$, $SD = .60$), $F(1, 41) = 10.85$, $p = .002$. However, families at the museum used a greater variety of materials in their projects ($M = 6.86$, $SD = 2.97$) than families at home ($M = 4.82$, $SD = 2.40$), $F(1, 54) = 16.01$, $p < .001$. Tinkering in novel museum exhibits may foster exploration of new objects and materials, but tinkering with everyday materials in familiar home settings may encourage families to focus on engineering processes. Children's engineering talk in post-tinkering interviews did not differ between the museum and home, $F(1, 52) = 1.57$, $p = .215$. However, children at the museum talked more about shapes ($M = 1.80$, $SD = 2.01$) than children at home ($M = 0.23$, $SD = 1.32$), $F(1, 47) = 25.64$, $p < .001$, possibly because they were describing novel materials. Children at home ($M = 1.26$, $SD = 1.75$) talked more about spatial features (i.e., angles, surfaces, edges) than children at the museum ($M = 0.27$, $SD = 2.69$), $F(1, 47) = 10.12$, $p = .034$, likely because talk about spatial features was associated with talk about engineering practices ($r(52) = .36$, $p = .008$).

Families talked differently about STEM-related information when tinkering at home and at a museum. Ongoing analyses are exploring families' spatial talk and collaboration during tinkering, and children's

memory in follow-up reflections. We will discuss how the features of home and museum learning environments may shape parent-child conversations and impact children's STEM learning processes.

P1-74 - True belief errors persist into adulthood: evidence from the sandbox task

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Details

In the classic False-Belief Task, children choose whether Sally will look for an object where she last saw it or in its true location (which changed while Sally was absent or present). If Sally was absent when the ball moved (false-belief question), 3-year olds answer incorrectly by saying that Sally will look for the ball in its true location. If, however, Sally is present when the ball moves (true-belief control question), they answer correctly (Wellman, Cross, & Watson, 2001; Wimmer & Perner, 1983). A puzzling U-shaped data pattern has emerged with these false-belief and true-belief questions from ages 3 to 11: while 3-year olds answer false-belief questions incorrectly and true-belief questions correctly, 4- and 5-year olds answer false-belief questions correctly and true-belief questions incorrectly. Older children (and adults) answer both questions correctly (Oktay-Gür & Rakoczy, 2017).

The Perceptual Access Reasoning (PAR) account holds that 4-year-olds answer the false-belief question correctly because they recognize that Sally's lack of perceptual access leads to not knowing, and therefore searching in the wrong location. Older children develop belief-based reasoning that goes beyond only using perceptual access to infer beliefs: Sally sees the ball moved to the box. She, therefore, knows the ball is in the box. So, she'll look in the box (Fabricius et al., 2021; 2023). Conversely, the Pragmatics account holds that older children use belief-based reasoning and answer pragmatically: they try to make the most sense out of conversational conventions and conclude that the 'obvious' true location must be wrong (Grice, 1975; Oktay-Gür & Rakoczy, 2017).

A major difference between these accounts is that PAR holds that errors on the true-belief questions should cease once participants develop belief-based reasoning. The Pragmatics account holds that errors might decline but could still exist in older participants. To test between these theories, we conducted several experiments using a task that measures false-belief and true-belief performance on a continuum. In the Sandbox task, Sally puts an object in a continuous space (e.g., sandbox). Sally then either leaves and doesn't see Ann move the object within the sandbox (false-belief condition), or Sally stays and sees Ann move the object (true-belief condition). Participants judge where Sally will look for the object (Sommerville et al., 2013). We measured error or bias continuously as the distance away from the correct location toward the incorrect location. We found less false-belief bias than true-belief bias, a data pattern resembling 4- and 5-year olds' performance in the classic task (Fabricius et al., 2021). We replicated this data pattern in 6 more experiments (N = 431), manipulating different variables, including pragmatics where we warned participants that our questions were not meant to trick them; trial order presentation; within vs between subject comparison; and computerized vs in-person task presentation.

Our results partially support the Pragmatics account for true-belief bias, and by extension, Rakoczy and Oktay-Gür's (2020) claim that the trivial nature of true-belief trials is confusing. However, our failure to eliminate the true-belief bias in adults suggests factors other than pragmatics are also at play.

P1-75 - Relational reasoning in play: a simple card game elicits relational language and gesture about the life cycle

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Details

In the elementary grades, children are expected to learn about biological variability, including variability within species, across individuals, over the lifespan, and across generations. An appreciation of biological variability sets the stage for understanding evolution by natural selection. At its core, understanding biodiversity involves *relational reasoning*: discerning relevant relationships within and among biological kinds. These relationships are rendered salient when children compare examples within or between biological categories. This research examined whether simple card games can promote comparisons relevant to understanding biological relations. We developed a version of the game *War* that used cards depicting organisms at different stages of development (e.g., insect egg, larva, pupa, adult). In a museum setting, children (ages 3-12) and their caregivers (N = 76) played a version of the game involving two species (ladybug and monarch butterfly) and were provided a reference card that showed the life cycle stages of the ladybug. In this paper, we aimed to capture the ways in which relational reasoning was expressed through players' spontaneous use of language and gesture during game play.

We drew on audio and video recordings of a subsample of dyads (N = 40) to code the ways in which caregivers and children pointed out relations and highlighted correspondences through speech and gesture. We identified 6 types of relations that caregivers and children talked and gestured about in the context of the game. Three of these types focused on the relation between the two cards in a given round: (1) **game mechanism relations**, which are relations between cards in terms of game play (e.g., "my card wins") or who "gets" the cards (e.g., "mommy gets them"); (2) **comparisons between the stages** depicted on the two cards, typically cast in terms of either size ("bigger", "smaller"), age ("older", "younger"), timing ("comes before", "later stage"), or number of "steps" between the stages ("one step above"), often supported by pointing gestures to the two cards; or (3) a focus on the **transformation** that could turn one of the depicted organisms into the other (e.g., the larva "hatches from" the egg). Two additional types of relations focused on the relation between the organism depicted on one of the cards and an organism depicted on the reference card, and were frequently supported by pointing gestures to one of the game cards and to an image on the reference card: (1) **identity relations**, which noted that the game card depicted the very same organism and stage as the reference card, and (2) **parallel stage relations**, which noted that the game card depicted a different species at the same stage (e.g., monarch larva and ladybug larva) as the reference card. Finally, in some cases, caregivers and children focused on **analogies** to non-game organisms or contexts (e.g., stating that the pupa is like a "teenager").

Caregivers and children used language and gesture reflecting at least one of these relations on nearly every round of the game. Thus, this “biologized” card game is a powerful way to promote relational language and gesture during caregiver-child play.

P1-76 - If at first you don't succeed: parental feedback and the transmission of gender stereotypes about intellectual ability.

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Details

The Brilliance Stereotype associates raw, innate high intellectual ability to men, but not women (Leslie et al., 2015). Such gender stereotyped beliefs about intellectual abilities emerge early (by the age of six, e.g., Bian et al., 2017), extend into adulthood (e.g., Storage et al., 2020), and can have pernicious effects on behaviour (e.g., Bian et al., 2018; Master et al., 2016). The present research investigates the influence of early social experiences on children's gendered beliefs about intelligence by taking a closer look at the association between gender stereotypes about ability and the transmission of intelligence mindsets (i.e., implicit beliefs about intellectual ability) in middle childhood.

Specifically, we are investigating how parent-child interactions shape the way children think about intelligence. We recorded feedback provided by parents to their 5- and 6-year-old children ($N = 136$) as they attempted to complete a challenging puzzle activity to examine whether parents' feedback differed across gender. We developed a coding scheme based on previous work on mindsets (e.g., Haimovitz & Dweck, 2016) and social categorization (e.g., Rhodes et al., 2012). All feedback utterances were transcribed and coded as person-oriented messages (i.e., fixed, e.g., “you are so good at this”), process-oriented messages (i.e., growth, e.g., “you are learning”), or other messages (e.g., statements, “the puzzle looks like a bunny”). The feedback was then analyzed to explore whether children's gender predicted the type of messages received.

Results suggest that parents provided an equal amount of overall feedback to girls and boys, but surprisingly provided more process-oriented (i.e., growth) messages to boys than to girls: specifically, more strategy related feedback (e.g., “try moving the pieces around in a different way”, $2.76 > 2.09$, $b = -0.40$, $SE = 0.19$, $IRR = 0.67$, $CI = 0.47 - 0.97$, $p = 0.033$). Interestingly however, strategy feedback was positively correlated with person-oriented messages (i.e., focused on performance and fixed ability) ($r_s = 0.394$, $p < 0.001$) as well as with false growth messages about ability (i.e., underlying fixed messages about ability expressed in growth language, Barger, Xiong & Ferster, 2022) ($r_s = 0.17$). Further, we found that parents' own mindsets were related to their gendered beliefs about brilliance and social roles. Parents who held more fixed views of intelligence endorsed stronger brilliance stereotyping and traditional views of gender.

Explicit expressions of gender bias are less common than they once were, yet negative gender stereotypes about intelligence are still deeply ingrained in our society, emerging early (Bian et al., 2017) and affecting children's behaviour (Zhao et al., 2022). Our findings highlight the need to investigate the socialization of individual beliefs about intellectual ability in tandem with the development of gender

stereotypes. By taking a closer look at how the actual messages children receive about ability differ by gender, we can better understand one of the many subtle ways stereotyped beliefs may be acquired.

P1-77 - "I'll give it a go!" — when children try to solve the unsolvable or please the experimenter.
Qualitative analysis of Polish-American bilingual children's erroneous replies in sentence repetition task

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Details

This small-scale analysis is a result of serendipity observation of children who tried dealing with the difficult task of repeating a grammatically complex sentence in a language they were not proficient in by doing something other than saying "I do not know".

The data comes from a study on morphosyntactic development in bilingual children who live in the USA and speak Polish as their heritage language and English as the majority language. In the study, 30 children aged 5;0-5;11 will have been tested (at the moment of submitting the abstract, 10 participants were tested within the group). Children are tested with the Short Polish Sentence Repetition Task (SRep-PL) and the English version (SRep-EN), designed specifically for bilingual children. The SRep tasks assess language development and familiarity with morphosyntax. In addition to the SRep tasks, a demographic and language background questionnaire is administered to the parents, so that variables such as language exposure, and parental language proficiency can be controlled for. During the Sentence Repetition Task, children hear prerecorded sentences of varying morphosyntactic complexity and length and are asked to repeat them, one by one.

This seemingly simple task provides a window into numerous linguistic processes and competencies and can provide insights into the depth and breadth of linguistic capabilities in mono- and bilingual children (Pratt, Peña & Bedore, 2020). Sentence Repetition Task (SRep) is a widely used tool, serving as a proxy for children's syntactic and morphological development (Klem et al., 2015; Marinis & Armon-Lotem, 2015).

I noticed that some children who were not able to repeat the sentence, tried providing a reply by e.g.: producing nonwords and mimicking the rhythm and intonation of the prerecorded sentence or by introducing semantic additions and simplifications of grammatical structures. Some children merged their understanding with information from preceding sentences.

A qualitative analysis of children's erroneous responses (responses that are, according to the scorebook, scored as incorrect) that go beyond "I do not know" will be analyzed. The examples will be provided and categorized.

This approach might provide valuable insights into how young children navigate linguistic complexities and respond when faced with uncertainty.

P1-78 - Infant and maternal interoception - exploring the role of parental functioning

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Details

Interoception, the perception of internal bodily signals such as heartbeat or respiration, is supposed to play an important role in early development. Theoretical accounts highlight that early interactions between infant and primary caregiver, which arise around the regulation of interoceptive signals, might shape early minimal self and social cognitive abilities. However, we are lacking empirical results on infant interoception and its relation to caregiver interoception as well as results on potential underlying mechanisms. Here, we present results investigating whether the relationship between maternal and infant interoception is potentially mediated by parental functioning. We used two preferential looking paradigms to measure 9- and 18-month infants cardiac- (iBEATs task) and respiratory (iBREATH task) interoceptive sensitivity. In both paradigms infants were presented with stimuli pulsating either synchronously or asynchronously with the infant's respective interoceptive modality. As an index of infants interoceptive sensitivity we used absolute proportional scores, which indicate how strong of a preference infants had for either synchronous or asynchronous stimuli in the paradigms. To operationalize maternal interoceptive accuracy we used a heartbeat detection task in which mothers had to indicate whether a series of tones was synchronous or asynchronous to their heartbeat. To measure parental functioning, we used the parental reflective functioning questionnaire. We predicted that there is a direct effect of maternal interoceptive accuracy on infant cardiac and respiratory interoceptive sensitivity, as well as an indirect effect via parental functioning. For our confirmatory statistical analysis we used two Bayesian mediation models utilizing a beta error distribution. Results indicated a direct effect of maternal interoceptive accuracy on cardiac (N = 33, Figure 1A), but not respiratory (N = 34, Figure 1B), interoceptive sensitivity. We do not find evidence for a mediating effect of parental functioning. In sum, these results indicate that there is a relationship between maternal and infant interoceptive perception. However, this relationship might depend on the interoceptive modality investigated, as we find a relationship between maternal and infant cardiac scores, but not maternal cardiac, and infant respiratory scores. Further, parental functioning might not show a strong relation to either maternal interoception, or infant interoceptive sensitivity. These results might help in providing an empirical basis for theoretical approaches on interoception early in life. Further, given that interoception has been related to autism spectrum disorders, or mental health outcomes, these results might help in improving our understanding of such concepts.

P1-79 - Adults tailor their emotional expressions to infants through “emotionese”

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Details

Adults adjust their behaviors when engaging with infants. They use simplified, slower, and more dynamic speech (infant-directed speech or “parentese”) and more expansive and repetitive movements (infant-directed actions or “motionese”). These modifications enhance infants' attention and

comprehension of language and actions (e.g., ManyBabies Consortium, 2020; Brand & Shallcross, 2008). Yet, it remains unknown if and how adults adapt their emotional expressions to infants, an aspect we call infant-directed emotion expressions or “emotionese.”

This study explores how adults express emotion to infants. In Exp 1, 25 parents with infants aged 6-14 months viewed positive and negative pictures (Fig. 1A) and described their feelings to either their infants (infant-directed) or an adult experimenter (adult-directed). We coded their facial expressions every half-second on a -5 (negative) to 5 (positive) scale (ICC=.83). We found an interaction between condition (infant vs. adult-directed) and picture valence (positive vs negative; $F(1, 72)=8.24, p=.005$). In the adult-directed condition, participants showed positive expressions regardless of discussing positive ($M=.86$) or negative ($M=.85$) pictures ($t(24)=0.19, p=.85, d=.04$), suggesting these expressions may serve social functions (e.g., to appear polite); they used language instead to convey their feelings (e.g., “I feel scared”). When communicating with infants, participants relied more on facial expressions. They were less positive (though not negative) when discussing negative pictures ($M=.37$) compared to positive ones ($M=.89; t(24)=-3.36, p=.002, d=.67$; Fig. 1B), indicating that infant-directed expressions provide richer emotional information compared to adult-directed ones.

In Exp 2, we tested if the effect from Exp 1 could be due to varying levels of intimacy between the participant and their partner and their partner: In the adult-directed condition, the partner was an unfamiliar experimenter, while in the infant-directed condition, it was the participants’ infants. To address this, another group of parents ($N=37$) with infants aged 6-14 months discussed their feelings about the same pictures as in Exp. 1, either with a close adult (e.g., spouse) or their infants. We coded participants’ facial expressions the same way as in Exp. 1 (ICC=.83). An interaction was found between condition and picture valence ($F(1, 96)=19.42, p<.001$). When talking to a close adult, participants showed varying facial valence when discussing positive vs negative pictures: their expressions were less positive for negative pictures ($M=.81$) than for positive ones ($M=1.20; t(31)=-2.84, p=.008, d=.50$). Yet, this difference remained much larger in the infant-directed condition (negative: $M=-.15$; positive: $M=.81; t(35)=-6.87, p<.001, d=1.14$; Fig. 1C). The results suggest that emotional expressions directed to close adults provide some emotional information, but those directed to infants remain more informative.

In sum, adults’ facial expressions convey richer emotional information when talking to infants than to adults. Like infant-directed speech and actions aid language and action understanding, infant-directed emotional expressions likely play a role in early acquisition of emotion knowledge. The findings shed light on “emotionese,” expanding our understanding of the richness and benefits of parent-infant interactions.

P1-80 - The role of reciprocity in children’s understanding of friendship

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Details

Having high-quality and stable friendships is beneficial for children’s social development (Berndt et al., 1999; Ladd et al., 1996). Children have a multifaceted concept of friendship; they understand the importance of various factors in friendship, such as spending time in proximity, similarity, prosocial

behaviors, and loyalty (Afshordi & Liberman, 2021). However, do they understand that prosocial behaviors and loyal behaviors need to be reciprocated between friends to sustain friendships? We hypothesize that reciprocity is important at the beginning stage of friendship, and children would predict that two individuals who engage in reciprocal prosocial behaviors would become better friends than two individuals who engage in unidirectional prosocial behaviors.

In Experiment 1, 4- to 8-year-olds ($N = 116$) completed 2 *reciprocal vs. provider* trials and 2 *reciprocal vs. recipient* trials, in counterbalanced order. In each trial, participants were introduced to a protagonist and 2 other children who just met each other at their new school. The protagonist engaged in reciprocal interactions with one child – they each showed 3 prosocial behaviors towards the other. The protagonist engaged in non-reciprocal interactions with the other child: in *reciprocal vs. provider* trials, the protagonist showed 6 prosocial behaviors towards the other child; in *reciprocal vs. recipient* trials, the other child showed 6 prosocial behaviors towards the protagonist. Then, participants were asked to predict *with whom the protagonist would become better friends* (Figure 1).

The proportions of trials that children chose the reciprocal pair are shown in Figure 2. Mixed-effects logistic regression showed an interaction of trial type and age on children's choices. Children were more likely to predict the reciprocal pair would become better friends in the *reciprocal vs. provider* trials than in the *reciprocal vs. recipient* trials ($p < .001$). Children's performance increased with age in the *reciprocal vs. provider* trials ($p = .002$), but not in the *reciprocal vs. recipient* trials ($p = .46$). Exact binomial tests showed that in the *reciprocal vs. provider* trials, children's overall choices were at chance ($p = .39$), and 7- and 8-year-olds chose the reciprocal pair above chance ($p < .05$). In the *reciprocal vs. recipient* trials, children's overall choices were below chance ($p < .001$), and no age group performed above chance.

Experiment 1 showed that by 7 years of age, children start to understand the importance of reciprocity in friendship. Children were less likely to predict the reciprocal pair would become better friends in the *reciprocal vs. recipient* trials, possibly because they were putting themselves in the protagonist's shoes – in *reciprocal vs. recipient* trials, the protagonist was in a more advantageous position in the non-reciprocal interaction (she received 6 prosocial behaviors) than in the reciprocal interaction (she received 3 prosocial behaviors). This trial difference might parallel the development of disadvantageous vs. advantageous inequality aversion in the fairness literature (Fehr et al., 2008). In Experiment 2 (ongoing), we aim to extend the results of Expt. 1. We deemphasized the role of the protagonist and asked participants to predict which *pair of children* would become better friends.

P1-81 - Maternal reflections on the birth and diagnosis of their child with Down syndrome: age-related changes in perspectives from infancy to adolescence

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Details

Background. Parents' thoughts about the important life events involving their children likely change over time. There is a paucity of research examining whether parents of children with developmental disabilities, and Down syndrome (DS) in particular, differentially reflect on the birth and diagnosis of

their child as children age (although see Nelson Goff et al., 2016, for work in this area). The present cross-sectional analysis was conducted to determine whether mothers differentially rated and reported on the diagnosis and birth of their child with DS based on child age at the time of the study.

Method. Forty-six mothers of children with DS completed a video chat interview with a research assistant. During the interview, mothers were asked to discuss their memory of their child's birth and DS diagnosis, among other events. Mothers also rated various aspects of each event, including how often they thought about it, how significant it was at the time of its occurrence and at the time of the study, and how positive or negative it was when it occurred and at the time of the study, among others. Mothers also provided three emotion states to reflect how they felt about each event at the time it occurred and at the time of the study.

Results. Children were classified into one of four groups based on their age at the time of the study: infancy (≤ 36 months; $n = 11$), early childhood (37-60 months; $n = 14$), childhood (61-108 months; $n = 10$), or adolescence (≥ 109 months; $n = 11$). A main effect of age group indicated that mothers of adolescents thought less about the birth and diagnosis of their child with DS relative to mothers in the three youngest age groups, whose ratings did not differ. When considering the significance of the reported events, a main effect of age group was qualified by an interaction with time. Mothers of adolescents reported that these events were less significant at the time of their occurrence relative to mothers of children tested in childhood; at the time of the study, mothers of adolescents reported that these events were less significant than mothers of children in the three youngest age groups, whose ratings did not differ. When considering the valence of the event, a main effect of group indicated that mothers of infants reflected on the reported events more positively than mothers of children in early childhood or childhood, whose scores did not differ. Different patterns of results were also found by group, valence, and time on the feeling states variables when separately considering the birth and diagnosis events.

Discussion. Mothers of children with DS differentially reflect on the birth and diagnosis of their child depending on the age of their child. Results indicating that mothers think less about these events and find them to be less significant in adolescence suggests that mothers may shift their focus to upcoming developmental milestones navigated by all individuals during this period of time (e.g., living independently, acquiring employment, romantic relationships). These results are comparable to those reported previously, in which parents of children with DS reported greater coping during middle childhood and adolescence relative to when children were younger (Nelson Goff et al., 2016). Taken together, these results may be useful in helping families and medical professionals understand the ways in which parents navigate the transition from childhood to adolescence along with their child with DS.

P1-82 - Can the poor become rich?: children's and adults' beliefs in social mobility

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Details

The idea of upwards social mobility is a critical part of the “American Dream”. Yet, despite the prevalent cultural narrative about the *possibility* of change in socioeconomic status, *actual* social mobility remains low. Social mobility beliefs could have a host of downstream social consequences, such as increased system justification beliefs (Day & Fiske, 2016) and negative attitudes towards less privileged people (Koo et. al., 2023), but it could also affect important life decisions such as pursuing higher education (Harris, 2008). To examine how children (3- to 10-year-olds) and adults think about social mobility, we conducted three pre-registered experiments ($N=524$). All participants were introduced to two novel groups with opposing financial backgrounds (financially advantaged vs. disadvantaged). We measured participants' initial baseline social mobility beliefs (the extent to which they believed members of the disadvantaged group could become rich and vice versa) and fairness beliefs (the extent to which they believed the status quo was fair). Participants were then randomly assigned to view evidence of social mobility in one of four conditions: 0/10, 1/10, 5/10, and 1/2 conditions, each of which represented the number of individuals from the disadvantaged group who eventually became wealthy. For example, those in 5/10 Condition, participants were told that 5 out of 10 individuals are born into the disadvantaged group but grow up to become rich. We then assessed their social mobility and fairness beliefs again at post-test to compare their beliefs from pre-test.

Children and adults generally had *low* baseline upward social mobility beliefs before manipulation: they tended to believe strongly that people *cannot* change socio-economic groups and also that it was unfair that the poor were poor. After the manipulation, children and adults had increased upwards social mobility beliefs. However, while adults rationally responded to the evidence shown – social mobility beliefs increased significantly more in 5/10 and 1/2 Conditions than in 1/10 Condition – children's social mobility beliefs increased across all conditions, suggesting that even one example of a poor person becoming rich was sufficient to induce change in social mobility beliefs. In addition, children increased their beliefs about fairness following viewing evidence of social mobility, while adults' beliefs did not change. Children did not show this change in a 0/10 condition, suggesting that they were not *simply* increasing their beliefs in response to *any* new information. Thus, we found that children seem to be hypersensitive to evidence of social mobility: even one example of social mobility increases their beliefs in social mobility and their corresponding beliefs about fairness surrounding economic inequality.

The current work provides insight into the developmental trajectory of social mobility beliefs and fairness beliefs in relation to wealth. We now understand that children's beliefs about social mobility are low but could be manipulated with the introduction of upward mobility evidence. Future work examining children's social mobility beliefs about themselves could potentially serve as a groundwork for understanding their long-term decision-making processes in relation to education, occupation, and finance.

P1-83 - Children and their mothers differ in valuation and decisions about human lives

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Details

While all human lives are inherently valuable, there are instances where one has to value and prioritize some lives over others. Choices are context-dependent, and as a result, different framings can potentially influence decisions about human lives made by both children and their mothers. This study examines: 1) how children and their mothers make decisions about saving vs. giving up human lives and whether the saving vs. giving up contextual framing has an impact on decisions; 2) whether and how children and their mothers differ in such choices, and 3) how children's and mothers' perceptions of different attributes of human lives correspond to their decisions respectively (e.g., how much help the person needs).

Mother-child(ren) pairs (N = 290, children aged 5-10) participated in the study. Mothers provided demographic information and completed the study online. They were randomly assigned to saving or giving up conditions. Their child(ren) completed identical tasks via Zoom with experimenter guidance. The study included two main parts. First, in the choice task, all 66 two-alternative combinations of 12 different human head silhouettes representing lives from 6 age * 2 gender groups were presented individually. For each combination, participants decided to either save or give up one of them. Texts were shown under each silhouette, specifying the age and gender group of that life: baby girl/boy, little girl/boy, young girl/boy, teenage girl/boy, middle-aged woman/man, and old woman/man. Second, in the valuation task, participants rated each of the 12 silhouettes on how much the person needs help, is helpful to others, looks familiar, looks like themselves and how much time the person can live.

Mixed effects regressions revealed that framing the question as saving or giving up significantly influenced mothers of all ages and 5-year-old children, but not older children. Specifically, mothers and 5-year-olds tended to prioritize younger lives in general, and this tendency was more pronounced when asked to save lives than to give up lives (Fig 1 & 2).

Another mixed effect linear regression showed that children were more likely to save and less likely to give up younger lives irrespective of the life's specific age. In contrast, mothers prioritized toddlers over babies and put lower priorities than children on middle-aged and older lives (Fig 3). Pearson correlation analyses indicated that "time to live" had a moderate positive association with chance of saving (not giving up) the life in both children and mothers. Weak positive associations were found between "help needed", "look familiar", "looks like you", and chances of saving (not giving up), though "looks like you" had no significant impact in mothers (Fig 4 & 5).

This study revealed differences in how children (aged 5-10) and their mothers value human lives. Children prioritize the youngest and those who resemble them, while mothers favor toddlers over infants and show a greater preference for younger lives when saving compared to giving up. This framing effect is less prevalent in children, suggesting that developmental changes and social influences during adolescence or young adulthood may amplify the decision discrepancy in these two contexts. These findings underscore the role of individual attributes and contextual framing in trade-off decisions

between individuals, shedding light on the cognitive and developmental processes in valuation of human life.

P1-84 - Preschoolers' trust in non-verbal information provided by a robot

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Details

Research on how young children acquire information from various agents has been the subject of extensive examination. However, most past studies have focused on how children acquire information conveyed through verbal communication. Additionally, the majority of studies explore how children acquire knowledge from human sources of information. Young children tend to choose who to learn from and trust by weighing the potential informants' displayed epistemic (i.e., accuracy, competency) and social (i.e., in-group status, benevolence) characteristics. With age, children start to rely on epistemic over social characteristics. This study aimed to explore how 3-year-old children ($N = 45$) learn from and establish trust in a competent, non-human-looking robot compared to an incompetent human when competence was demonstrated using a pointing paradigm. In this design, neither informant displayed the ability to speak. This study sought to investigate who young children would choose to learn from when the stronger social characteristics of the human informant are directly conflicted with the epistemic characteristics displayed by the robot. First, children saw a 'hider' hide a toy in one of two boxes while the robot and the human informants watched. A curtain ensured that the boxes were hidden from view of the child while the hiding event took place. In the induction phase (4 trials), the robot informant then pointed to a toy within a see-through container, while the human pointed to an empty container; thereby establishing the robot's competence. During the subsequent test phase (4 trials), both agents pointed to containers that were opaque, thereby the correct location of the toy was never revealed in the test trials. Before the agents pointed, children were asked who they would like help from to find the toy (ask questions). After the agents had pointed, children were asked where the toy was located (endorse questions). Finally, after all 4 test trials, children were asked who pointed at the right boxes (judgment question). Results show that 3-year-old children preferred to ask the competent robot for help finding the toys (ask) and indicate that the robot pointed at the correct boxes (judgment). However, children were unsure who they should trust and endorse. This suggests that 3-year-old children are sensitive to the epistemic characteristics displayed by informants, even when the informants displayed social properties are minimal. Perhaps goal-directedness and autonomous movement, as displayed by the robot in this study, are the most crucial social characteristics triggering animacy judgments in young children, more than physical appearance or speech. Furthermore, this study suggests that 3-year-old children are transitioning from a reliance on both social and epistemic characteristics to prioritizing epistemic characteristics.

P1-85 - Developmental changes in children's intuitive reasoning about physics while building block towers

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Details

A key component of cognition is intuitively reasoning about the behaviors of things in the physical world. Traditionally, intuitive physical reasoning is considered an early appearing, abstract, *symbolic process*, independent of bodily interaction with the environment. In support of the traditional perspective, previous developmental research shows that long before infants acquire manual actions, independent mobility, or broad experience with the physical environment, infants already possess basic, intuitive knowledge about physics. For example, infants in their first months of life look longer at scenes that violate the physical laws of gravity (Spelke, 2000). However, this “symbolic-process” view relies heavily on looking-time studies that quantify differences in how long infants look at physically possible or impossible visual displays. It does not assess the practical manifestations of children's *bodily actions while they interact with objects*.

To test physical reasoning during active behavior that involves more than moving the eyes, we assessed children's intuitive reasoning about physics during tower building. Children (2-, 4-, 6-, and 8-years of age) and adults built flush and offset towers with interlocking Duplo blocks. When building a block tower, participants must translate their intuitive physical knowledge into flexible action plans across the two hands. Their plans must update from moment to moment as the tower grows in height and instability. We used novel, computer-vision algorithms to track the real-time movements of each Duplo brick and participants' hand kinematics as a direct readout of their intuitive physical reasoning *based on their behaviors*. We then used advanced unsupervised machine learning (time-series clustering) to identify time intervals in which participants incorporated physical reasoning into their action plans.

With development, children tailored their movements to the growing block tower. When adding each block to the tower, older children and adults aligned the new block with the top block on the tower in a more physically-efficient manner compared to younger children. Older children and adults displayed hand poses that decoupled the control of task-related forces across the two hands. In addition, older children changed the orientation of the tower and the new brick earlier in time compared to younger children. Earlier action plans led to reduced physical effort and less motor variability that benefited their role-differentiated bimanual actions. And better physical reasoning led to taller towers before the structure broke or collapsed.

Our findings demonstrate the importance of studying intuitive physical reasoning during active behavior. We suggest that intuitive physics is grounded in bodily interactions with the environment. Thus, these cognitive processes show important developmental improvements long after the infancy period.

P1-86 - Using a metacognition-driven, experiential early childhood learning program to improve science education and children's self-regulated learning in rural Idaho

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Details

Objective

This study aims to improve rural early childhood science education using a metacognition-driven, experiential early learning program. Science is a much less emphasized subject in rural early childhood education (ECE) as compared to literacy and mathematics. A promising way to address this issue is to conceptualize science learning within a metacognition framework (i.e., awareness and regulation of one's cognition). Metacognition is a critical cognitive skill that drives scientific thinking and self-regulated learning (SRL; i.e., a cyclical process that involves planning, monitoring, and reflecting).

We created an early science education program that included a 10-month curriculum and teachers' professional development (PD) training program rooted in research on metacognition. Each month, teachers receive a kit containing curriculum materials and locally-grown vegetables/fruits featured in the curriculum. Metacognitive teaching strategies are embedded in the curriculum (e.g., prompts, webbing, think-aloud) to foster children's SRL (Figure 1). Each month prior to curriculum implementation, teachers are required to complete an online training module, including explanations and video examples of those teaching strategies. To investigate this curriculum's effectiveness, we asked these research questions (RQs):

RQ1. Do children's SRL skills and food/plant science knowledge improve after the program (controlling for children's age)?

RQ2. Do teachers' science teaching efficacy and metacognitive awareness improve after the program (controlling for teachers' education and teaching experience)?

RQ3. What are children's learning behaviors as observed by teachers?

Methods

Twenty ECE teachers and 110 children ($M_{age} = 60$ months) from rural areas of North Idaho, U.S., participated in this mixed-methods study from September 2022 to May 2023. We collected pre- and post-test data on children's SRL (Child Independent Learning Development Checklist [$\alpha = .97$]), children's science knowledge (researcher-created direct knowledge measure), children's learning behaviors (teachers' reflection journal), teachers' metacognitive awareness (Metacognitive Awareness Inventory for Teachers [$\alpha = .91$]), and teachers' science teaching efficacy (Teacher Efficacy and Attitudes Toward STEM-Science Subset [$\alpha = .87$]).

Results

We conducted multilevel repeated measure ANCOVA to answer RQ1 and RQ2. Results showed an increase in teachers' science teaching efficacy ($F_{efficacy}(1, 19) = 11.12, p = .003, \eta^2 = .37$; $F_{expectancy}(1, 19) = 4.33, p = .003, \eta^2 = .37$) and metacognitive knowledge awareness ($F_{efficacy}(1, 19) = 4.97, p = .04, \eta^2 = .$) but not in metacognitive regulation skills. There is an increase in teacher-reported children's cognitive skills ($F(1, 109) = 20.08, p < .001, \eta^2 = .16$) and learning motivation ($F(1, 109) = 13.50, p < .001, \eta^2 = .11$),

however, not in their food/plant science knowledge. Thematic analysis revealed authentic evidence of children's learning behavior (e.g., prediction, observation, investigation).

Conclusions

Our findings suggest that an experiential early science education program grounded in research on metacognition improved children's SRL as well as ECE teachers' metacognitive awareness and confidence in teaching science. Given the lack of empirical evidence about metacognition in ECE, our study could lead to an emerging line of research on metacognition's application in early science education.

P1-87 - Solution-relevant gesture predicts analogical transfer in children

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Details

Analogical transfer requires inferring similarity in abstract structure across superficially different contexts. Gestures have been suggested to support identification and transfer of abstract concepts by stripping away superficial details and packaging relevant information so it can be flexibly applied across contexts (i.e., gesture-for-conceptualization hypothesis; Kita et al., 2017). Here we ask: (1) Do children's spontaneous gestures predict analogical transfer? and (2) Does the content of the gesture matter?

In Experiment 1, 85 5-7-year-olds listened to three superficially distinct stories that shared a common abstract problem and solution. The first two stories included information about both the problem and solution, and participants were asked to retell each story to a naïve listener. We recorded children's spontaneous speech and gesture(s) during retelling. In the third story, only the problem was provided, and participants were asked to generate the solution themselves. Finally, children completed a memory task to measure overall attention and engagement. We found a significant positive correlation between children's analogical transfer and their gesture production during the retelling task ($r = 0.26$, $p = 0.015$), with children who spontaneously gestured more likely to engage in analogical transfer, compared to those who did not.

In Experiment 2, we manipulated exposure and access to gesture in order to assess whether gesture production caused increased analogical transfer. We used a similar procedure, but children also observed the experimenter retell the story—with or without gesture—prior to their own retelling task. In the Watch-Gesture condition, children observed the experimenter produce co-speech gestures and were encouraged to gesture themselves ($n = 94$). In the Control condition, children observed the experimenter retell the story without gestures, and were asked to sit on their hands during their retelling task, preventing access to gestures ($n = 84$).

In Experiment 2, we replicated the correlation between gesture production and analogical transfer ($r = 0.30$, $p = 0.003$). Additionally, among children in the Watch-Gesture condition, we found that those who produced gestures *relevant* ($n = 35$) to the analogical solution were more likely to transfer compared to those who did not produce gestures ($n = 44$, $p < 0.001$), and those in the Control condition ($p = 0.025$). However, we found no difference in the transfer rate between children who produced gestures that

were *irrelevant* ($n = 15$) to the solution and those in the control condition. No differences were observed on the memory items, indicating that the effects of gesture cannot be reduced to overall differences in attention or engagement.

Overall, we found that children who gestured during retelling analogical solutions performed better in analogical transfer than those who did not gesture, regardless of their prior exposure to gesture. Most importantly, children who produced gestures relevant to the solution were most likely to transfer, compared to those who did not or could not gesture. We conclude that gesturing relevant structural information (not mere production of gesture) is what matters for analogical transfer. This work provides strong evidence that children's gesture production provides a window into their developing abilities in analogical reasoning.

P1-88 - "The Hair Club for Boys": how children and adults judge disparate impact rules

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Details

Many laws in the US and around the world are formally neutral but covertly discriminatory. For example, some local governments employ tactics like literacy tests to block specific demographic groups from voting while avoiding explicit declaration of malicious intent. These tactics are examples of *disparate impact* rules: rules that adversely affect a protected group (e.g., gender, race) without explicit intent to do so (Carle, 2010). The current work examines the developmental origins of *skepticism* about disparate impact rules and the factors that influence it.

Existing literature points to at least two factors that may affect how children and adults judge the intention of disparate impact rules: (1) whether justification for the rule is provided, and (2) the inclusion of a token disadvantaged member. First, prior work has found that justifications shape moral reasoning. For example, children and adults are more likely to accept inequality if it is justified by differences in effort (Starmans et al., 2017). Young children also evaluate certain transgressions (e.g., breaking promises) more positively when there is a prosocial justification (e.g., to help someone; Kanngiesser et al., 2021). Second, disparate impact rules raise competing hypotheses for their true intention: either the rule has inherent instrumental value *or* is intended to exclude a social group. We therefore consider how observing exceptional cases provides evidence against intentional exclusion (akin to tokenism; Lee, 2020), leading participants to privilege the possibility that the rule itself has value.

The present study examines the impact of these factors on children's and adults' reasoning about a disparate impact rule that excludes girls: "Only kids with short hair are allowed in the club". A total of 175 adults ($n_{\text{women}} = 125$) and 45 children ($m_{\text{age}} = 8.14$, $n_{\text{girls}} = 21$, planned $n = 150$) participated in a 2 (Justification/No Justification) x 2 (Inclusion/No Inclusion) between-subjects design. Adults who (1) heard a reason for the rule and (2) saw a short-haired girl included in the club judged the rule-maker's intention as more benign compared to those who observed neither manipulation, $t(93.997) = -2.10$, $p = 0.04$. Children's responses trend in the same direction. Justification *alone* is also powerful: participants who heard a justification for the rule, regardless of club composition, rated the rule as more morally

acceptable than those who heard no justification, $F(1) = 18.66, p < 0.001$ (children), $F(1) = 16.50, p < 0.001$ (adults).

Demographic factors also impacted judgments of the rule: adults' judgments were influenced by an interaction between their gender and condition, with women being more skeptical of the rule and its maker, $F(1) = 2.94, p = 0.03$. Older (vs. younger) children, $F(1) = 14.36, p < 0.001$, and girls, $F(1) = 7.8, p = 0.006$, also judged the rule and its maker more harshly.

Overall, providing justification reduces children's and adults' skepticism about disparate impact rules, but less so for members of the marginalized group, who are already skeptical. These initial findings have important implications for studying the power of justification and tokenism in social contexts. Future work will explore the impact of these factors and social group identities on judgments of race-centered and real-world disparate impact rules.

P1-89 - When is it okay to be angry? A cross-cultural examination of children's judgments

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Details

Climate activist Greta Thunberg often cites anger as a force fueling her protests (Lee, 2021). Indeed, the emotion has been associated with a willingness to participate in collective action towards causes ranging from BLM (Selvanathan et al., 2018) to climate justice (Stanley et al., 2021). Anger can be a response to appraisals of unfairness (van Doorn et al., 2014), motivating action by exaggerating the perception of benefits and reducing perceived costs (Lerner & Tiedens, 2006). But anger is not all rosy: on the individual level, anger predicts participants' self-reported likelihood and desire to aggress (Wyckoff, 2016), and can lead to reduced well-being and psychosocial functioning (Okuda et al., 2015). When is it appropriate to feel angry, despite the downsides?

Individuals' normative evaluations of emotions are likely shaped by their culture (Nussbaum, 2000). Prescriptions and proscriptions of anger, in particular, are thought to vary between Western and East Asian cultures. The different valuing of social harmony against individual needs and desires may influence the degree to which cultures endorse anger (Boiger et al., 2013). Examining the developmental trajectory of children's understanding of these norms will illuminate the understudied normative pathway through which culture shapes emotion.

Our pre-registered study probes the intuitions of 5-12-year-old children in the US ($N = 85$) and China (pre-registered $N = 80$) regarding the normativity of anger across contexts. In Study 1, participants are presented with storybook descriptions of resource distribution contexts involving two children. One child always receives one resource, while the other receives five. In a 2x2 design, we manipulate whether the distribution in question came about through a fair procedure (i.e., a spinning wheel) or an unfair one (i.e., one party decides), and whether the disadvantaged recipient responded with anger or sadness. We then ask the participant how appropriate it was for the target character to respond with

the respective negative emotion – with sadness serving as a control to distinguish judgments of anger from negative emotions more broadly.

We have finished data collection for Study 1 in the US sample, and data collection in China will be completed through the fall of 2023. Our preliminary results suggest that children in the US evaluate anger in a nuanced way: they believe that anger is more appropriate in response to unfair distribution procedures than fair ones (see Figure 1; $t(252) = 6.436, p < .0001$), a distinction which grows with age ($\chi^2(1) = 5.517, p = 0.0188$). Further, children also moralize the experience of sadness, with sadness being deemed less appropriate in response to fairly than unfairly decided distributions ($t(252) = -2.73, p = .034$), while still being more appropriate than anger in response to these distributions ($t(252) = 5.265, p < .0001$).

Study 2, which will be completed through winter 2024, examines the relationship between the two characters, asking: Is it more or less okay to feel angry when a friend treats you unfairly, as opposed to a neutral peer?

These studies are among the first to examine children’s understanding of cultural norms surrounding the experience of emotions. Our cross-societal approach will allow us to infer the degree to which cultural values penetrate emotional development, with implications for our understanding of the relationship between culture, emotions, and morality.

P1-90 - Mindfulness practice relates to improvement in delaying gratification in preschoolers

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Details

Mindfulness (i.e., directing attention in the present moment without judgment, Kabat-Zinn, 2003, has been proposed to aid self-regulation (Diamond & Ling, 2019). However, empirical results supporting this proposal have been mixed—especially during early development (Mak et al., 2018; Pearce et al., in preparation). Inconsistent findings may be related to the multidimensional nature of mindfulness and executive function (i.e., EF or the conscious regulation of behavior). For instance, mindfulness involves two components, focused attention (i.e., focusing attention on a chosen object in a sustained manner) and open monitoring (i.e., monitoring and non-reactivity of experience from moment to moment, Holas & Jankowski, 2012). EF tasks may consist of “hot EF” involving regulatory skills evoking affect and motivation, whereas “cool” EF refers to skills used in more decontextualized and less emotional situations (Zelazo & Carlson, 2012). Thus, it is possible that mindfulness may differentially improve EF (e.g., open monitoring involving non-judgment may be effective for “hot” EF involving affect), with interventions incorporating both elements of mindfulness as the most effective across EF.

One hundred preschoolers recruited from the southern US (54 girls, 46 boys, M age=5.06, SD = .42, range= 4.10-5.80 years) completed two EF tasks. The Dimensional Change Card Sort (DCCS, cool EF) examined cognitive flexibility (passing= 9+/12 correct on rule switch trials) and the gift delay (hot EF) examined delayed of gratification (i.e., 0=did not peek, 1= peek). We manipulated the type of mindfulness instruction provided to children before the critical EF trials in each task, see Table 1.

Gender and age were dropped from analyses as they did not show any main effects or interaction with the mindfulness condition on EF ($p>.38$). *Gift Delay*: Although a chi-square test exploring mindfulness effects on peeking in the gift delay task found no significance difference between mindfulness conditions ($p=.16$), a Mantel-Haenszel chi-square test indicated a significant decrease in peeking as the instruction incorporated more mindfulness instruction ($p=.02$). Follow-up planned contrast comparisons revealed a significant difference between the control and combined mindfulness conditions, $\chi^2(1)=5.09, p=.02$, see figure 1. *DCCS*: A chi-square test examining the effect of mindfulness on DCCS passing behavior did not reveal significant differences in DCCS performance ($p=.80$), though performance may have been at floor with just 6% passing the task.

Results partially supported hypotheses suggesting that engaging in both elements of mindfulness may be a useful intervention to improve EF (Holas & Jankowski, 2012), as we found combining mindfulness elements improved preschoolers' gift delay performance. We did not find evidence for individual elements of mindfulness (i.e., focused attention or open monitoring) impacting EF relative to the control, possibly indicating that open monitoring and focused attention may not individually be sufficient because it does not provide enough guidance for children to direct attention needed in the regulation of behavior (Hölzel et al., 2011). Future work replicating and extending findings to other hot and cool EF tasks will be important to better understand multiple measurement and intervention factors impact the role of mindfulness on EF.

P1-91 - The importance of infant sex in early visual attention and vocabulary development

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Details

Visual attention plays a critical role in early learning, such as social, cognitive, and language development [1-5]. Previous screen-based tasks have documented prevailing sex differences in attention behaviors and their developmental significance amongst school-age children and adults [6-8]. Despite the importance of attention in learning and development, we know relatively little about what experiences or processes through which sex differences may emerge and how sex may impact the relationship between early attention and developmental achievement.

The present study uses head-mounted eye-tracking devices during parent-infant play to investigate (1) sex differences in infant attention (attention distribution, attention shifting, and joint attention [JA]) and (2) the moderating effect of infant sex on the relationship between attention behaviors and vocabulary achievement. 103 typically developing infants between 3-18 months (Males: $n=44, M=10.87, SD=3.86$; Females: $n=59, M=11.35, SD=4.48$) and their parents participated. Participant views were coded for what targets they looked at (objects, parent hands, infant hands, and face), shifting between targets, and JA (initiation of JA [IJA] and response to JA [RJA]). Receptive and productive vocabulary was measured using the MacArthur-Bates Communicative Developmental Inventory (MCDI) Words and Gestures [9].

MANCOVA analysis (age covariate) revealed significant sex and age effects. Males looked marginally more frequently at targets, $F(4,94)=2.128, p=.083, \text{partial } \eta^2=.083$. Specifically, males more frequently

looked at parent hands, $p=.023$, and infant hands, $p=.041$. Males marginally shifted attention more frequently, $F(4,96)=2.127$, $p=.083$, partial $\eta^2=.081$. Specifically, males more frequently shifted their attention from social targets (face, hands) to non-social targets (objects), $p=.024$, from non-social targets to social targets, $p=.024$, and from social to social targets, $p=.049$. Females had longer average overall JA instances, $F(3,87)=2.942$, $p=.037$, partial $\eta^2=.092$. Specifically, females had longer average JA instances, $p=.008$, and RJA instances, $p=.023$. Older infants looked at objects more frequently ($p=.006$) and longer ($p=.043$). Specifically, older infants looked more frequently at infant hands ($p=.030$) and less frequently at their parent's hands ($p=.043$).

Preliminary moderation analysis (age covariate) was conducted on a subset of 60 infants between 8-18 months (Males: $n=28$, $M=12.40$, $SD=2.76$; Females: $n=32$, $M=12.84$, $SD=3.11$). A positive and significant moderating effect of infant sex was found on the relationship between RJA duration and receptive ($b=.027$, $t=.013$, $p=.049$) and productive ($b=.010$, $t=.005$, $p=.037$) vocabularies.

The findings indicate the early emergence and rapidly changing characteristics of infant sex differences in visual attention within social contexts, and how this relates to vocabulary development. This also opens the door to exploring the role of parental scaffolding behaviors (e.g., verbal output, object handling) in guiding the dynamics of infant visual experiences and therefore contributing to the resulting sex differences. Discussion will include how the results may relate to documented sex differences in the neural development and activation of brain regions associated with attentional and social processing [14] and their developmental significance.

P1-92 - Relevant and irrelevant advantages: children's developing ideas of fairness in bargaining with outside options

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Details

An extensive literature demonstrates that children have an early-emerging bias for equality when it comes to resource distributions, making exceptions only for cases where one agent is more meritorious than the other. By the time children are 4-5 years old, they divide up resources equally in first- and third-party tasks (Smith et al., 2013; McAuliffe et al., 2015; Shaw & Olson, 2012), and consistently reject unequal offers in simple ultimatum games (Castelli et al., 2014). While adults also reject unequal offers, their behavior in ultimatum games takes into account not only the degree of inequality in the central offer, but also the options available to the proposer—including any outside options, or resources that players can take advantage of if bargaining fails (Schmitt, 2004; Hennig-Schmidt, 2018). Perhaps unsurprisingly, 5-year olds do not exhibit such nuanced bargaining behavior in first-party ultimatum games (Wittig et al., 2013). They do not consider the options available to other players and fail at predicting the other player's response to their own offers.

Few studies have examined how and when these more complex fairness principles emerge during childhood. Some work has found that children engage in strategic behavior only by the age of 8, and consider the intentions of others when responding to offers (Steinbeis et al., 2012; Güroglu et al., 2009).

These results motivate the prediction that older children may be more successful at considering outside options when bargaining with others themselves.

In the present study, we examined how children respond to and propose offers in an ultimatum game with asymmetric outside options, i.e. games where one person has more outside options and therefore more leverage. Specifically, we asked whether children would be more likely to accept disadvantageous bargains, and propose advantageous bargains, when they had higher outside options. 75 children, aged 8-15 years old, played an in-person, child-friendly version of the ultimatum game with a confederate, where they bargained over 6 tokens that could be exchanged for prizes. Children completed all trial types with both symmetric (1 token for both players) and asymmetric outside options (4 for the proposer and 1 for the responder). During an initial block of trials, children responded to unequal splits, where the confederate offered 1/6 or 2/6 tokens. Children then proposed offers themselves. Finally, children were asked to evaluate the fairness of the confederate's offers during the initial block of trials.

We found that participants took outside options into account when responding to, but not proposing, offers. Specifically, children were more likely to accept both unequal splits when they also had fewer outside options than the proposer. However, children did not take outside options into account when proposing offers themselves, and their evaluations of the fairness of unequal offers did not vary with outside options. These results indicate that by the age of 8, children begin to behave strategically by considering both players' outside options in ultimatum games, but they may be doing so selectively and may be using different strategies to propose and respond to offers. These results contribute another piece of the puzzle in understanding how children transition from equality-preference to a more complex model of fairness.

P1-93 - Do you see what I see? Children's understanding of others' visual perspectives over video chat

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Details

Introduction: Visual perspective-taking, the ability to reason about how others see things differently, provides a crucial foundation for children's social reasoning and social interaction (Piaget & Inhelder, 1967; Wellman, 2014). Video chat poses a unique learning problem: Children typically expect that people see things in front of their eyes, but during video chat the eyes' location (on-screen) does not determine what others can see. To adapt to this new environment, children must inhibit their usual understanding (gaze = sight) and learn that visual access can come from a location other than the eyes (the camera). Video chat also provides a unique opportunity to learn about others' perspectives: The self-view, a frame that directly displays the scene *as the other person sees it*. During in-person interaction, others' perspectives cannot be directly observed, and are difficult for children to infer (Moll & Meltzoff, 2011). The self-view may provide powerful evidence to young children of how their view differs from that of another person, scaffolding their learning about others' perspectives. The current work asks: (1) Do young children mistakenly believe that people over video chat see through their eyes on-screen? (2) Do children use the self-view to learn what their partner can see?

Methods: N=68 four-year-old children (Mean age = 4.5 years; 28 female, 40 male) were tested over Zoom. On each trial, the child was asked to show a small toy to their video chat partner (the experimenter), and then asked to help them “see it closer” (4 trials per child). We coded where children reached to show the toy: Toward the camera; Toward the partner’s face on-screen; or toward the self-view on-screen. We also manipulated (between-subject) whether the self-view was present on-screen (turned on, vs. turned off).

Results: We found that over video chat, most 4-year-olds mistakenly expected that people see through their eyes on-screen: The majority of children showed toys to their partner by holding them up to the partner’s face — out of view of the camera (mean % of trials = 78%; SEM = 5%). When the self-view was turned off, nearly all children made this error (mean % of trials = 96%; SEM = 3%). However, as predicted, we found that children used the self-view to learn what their partner could see: They more often (correctly) reached toward the camera when the self-view was on vs. off (mean % of trials = 26% vs. 4%; $t(66)=2.67$, $p < 0.01$).

Conclusions: Children initially generalize their perspective-taking strategies from in-person interaction to video chat, expecting that people see through their eyes on-screen. This leads to systematic failures in social interaction. In addition, our data show that some 4-year-old children understand that the self-view shows their partner’s visual perspective, and use it to learn what their partner can see. Children’s perspective-taking strategies are not fixed, but dynamic and flexible, allowing them to learn that visual access can come from a location other than the eyes, and adapt to video chat as a novel social environment.

P1-94 - Precursors of privilege: the availability heuristic in guiding children’s perceptions of wealth

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Details

Social inequalities are, in part, difficult to address because people have different worldviews regarding the degree to which inequalities persist (or even exist). One explanation for these asymmetrical worldviews is a reliance on mental shortcuts (i.e., heuristics) to make estimates about the state of the world. For example, the availability heuristic describes people’s tendency to rely on information that is most readily available (e.g., personal experiences) to make probability judgments. We examined the availability heuristic in 5- to 10-year-old children, exploring whether children from different socioeconomic backgrounds come to occupy increasingly asymmetrical worldviews about wealth.

Children participated in several tasks eliciting their perceptions of their own and others’ wealth. In the ***Wealth Estimates: Goods and Experiences*** task, participants sequentially saw eight items spanning four tiers, varying in exclusivity: Tier 1 (i.e., most exclusive): personal driver, private jet; Tier 2: fancy restaurant, personal tutor; Tier 3: traveling on an aeroplane, vacationing; and Tier 4 (least exclusive): backpack, shoes. Items were determined based on an adult MTurk sample (N = 100). Children estimated how many people have access to each item on a 4-point Likert scale from “Almost all people” to “Very few people”. In the ***Wealth Estimates: Public Goods*** task, children made estimates about people’s access to public goods (e.g., good doctor, safe neighbourhood) using the same 4-point Likert scale. Our

current findings (N = 120/150) indicate that compared to older children, younger children overestimate people's access to exclusive goods (e.g., younger children overestimate how many people go on private jets or go to fancy restaurants) but underestimate people's access to less exclusive goods (e.g., younger children underestimate people's access to shoes). In addition, whereas children from lower-income families overestimated people's access to the most exclusive goods (i.e., private jet, personal driver), children from higher-income families overestimated people's access to the least exclusive goods (e.g., owning a backpack).

In the **Wealth-Self** task, participants were reintroduced to the items they saw earlier, and asked whether they had access to these items (responses were corroborated by parents in a follow-up survey). Preliminary analyses reveal that for the middle tier categories (i.e., Tiers 2 and 3), participants who had access to the item (e.g., participants who have traveled on an aeroplane) were more likely to overestimate compared to participants who did not themselves have access to the item.

Finally, in an adapted version of **Maslow's Hierarchy of Needs**, children were presented with a lower- and higher-income target, and made judgments about how much each target cared about basic needs (food, water), psychological needs (friends, family), and self-actualized needs (art, music). Analyses are ongoing. We predict that participants from more privileged groups (i.e. higher socioeconomic backgrounds) would predict that lower-income targets would care less about self-actualized and psychological needs than higher-income targets. In contrast, we predict that lower-income participants would predict that both targets care equally about these needs.

These findings offer insight into the development of children's thinking about privilege and the increasingly asymmetrical worldviews they come to occupy about economic inequality.

P1-95 - How the first 100 words emerge through bilingual learning experiences: a case study with Japanese-English infants

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Details

One common question in early bilingual language development is: will learning two languages simultaneously help or hinder language development? Previous studies have documented the facilitating role that learning one language may have on learning a second language. More specifically, having two labels (one in each language) for similar meanings, known as translation equivalents (TE), can be recognized as a supportive role of each language.^{1,4,10} However, it has been also shown that TEs may not always exist for every word⁵ and some experimental studies documented the difficulty associated with infants learning two languages simultaneously.⁹ These studies often measure average TEs in vocabulary, novel word learning performances, and/or involve bilingual children learning relatively similar languages, (e.g., Spanish and English).^{2,6,8} There is much left to understand on how similar meaning words emerge when infants are exposed to two languages at a distance. The present study focused on emerging words in infants who are learning two distinctive languages –English and Japanese– and documented how each pair of TE enters into each child's lexicon. The study took a case study approach and investigated the temporal relation of TEs in the first 100 words. A parent of the two

infants kept a diary for each child describing how each word was produced for the first time including dates, place, and the context in which each word was used. For the present study, we tracked the dates for each TE pair (e.g., “dog” in English and “inu” in Japanese) and analyzed the pattern for each child separately. We used the context information in which each word was produced to further investigate the impact of word use (e.g., words being used as nouns, verbs, and adjectives) on the TE relationship. This is an important aspect of the study as TE studies exclusively focus on nouns, yet words are used more flexibly by infants before their understanding of the relationships between words and grammar.^{7,11} The results indicate three key findings. First, the proportion of TEs among each of the infants falls into a similar range of previously reported TEs³ (16.67; 11.96), indicating that TEs from two distinctive languages emerge early. Second, there were strong positive correlations among the temporal relationship between TEs for both infants ($r=0.678$; 0.741) demonstrating the semantic facilitation role in learning two languages. Third, there was an effect of word type (defined by the lexical category) on the relation between each pair of TEs. While there was a strong positive relationship among nouns, interjections, and adjectives/adverbs, there was a negative relationship among the development of TE verb words. The present case study used a micro-level analysis on how learning one meaning via one label from one language may help in learning another label from another language. The results support the facilitative role of bilingual language exposure for each infant’s first 100 words across English and Japanese, yet the facilitation role is limited to nouns, interjections, and adjectives/adverbs and the potentially competitive relationship for TE for verbs – indicating different processes through which similar meaning verbs are learned from two languages.

P1-96 - Robust heterogeneity in cognitive development: A large-scale investigation

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Details

In recent years, strong challenges have arisen to the theory of fluid and crystallized intelligence (Hampshire, Highfield, Parkin, & Owen, 2012; Hartshorne & Germine, 2015). The fluid/crystallized dichotomy posited that the development of our ability to reason about the world depends on two primary factors: an unlearned facility to think quickly and flexibly about novel situations (fluid intelligence), and a practice-dependent ability to bring learned knowledge to bear, primarily in familiar situations (crystallized intelligence) (Cattell, 1963; Horn, 1968; Salthouse, 2004). While both develop during childhood, fluid intelligence was believed to peak in early adolescence and then decline rapidly, while crystallized intelligence peaked in middle age and declined more gradually.

While the data underlying the theory are reasonably robust, it is increasingly clear that the fluid/crystallized dichotomy is an over-fitting to data that are too narrow and too coarse-grained (Hartshorne & Germine, 2015). As researchers have considered a wider range of cognitive abilities, many follow developmental trajectories that are difficult to fit into the dichotomy, peaking at a variety of ages and declining at different rates or not at all. Moreover, the early studies were not large enough to track development with much precision: participants were binned into wide age ranges, masking substantial heterogeneity within the “fluid” and “crystallized” measures.

Unfortunately, “it’s a mess” is not a solid empirical basis for developing a replacement theory. Here, I begin the process of systematizing recent findings. I compiled data for 22 cognitive tasks reported in (Chen & Hartshorne, 2021; Erb, Germine, & Hartshorne, 2023; Halberda, Ly, et al., 2012; Hartshorne & Germine, 2015; Hartshorne & Pinker, *in prep*; Logie, Brockmole, et al., 2020). Depending on task, I have anywhere from 9,576 and 929,078 participants, ranging roughly 8 to 80 years old. The tasks include measures of working memory, long-term memory, social cognition, and language, among others.

I adapted an analysis method first applied to cognitive development data in Erb et al. (2023). For each task, I used Bayesian spline regression to determine the range of ages at which performance is significantly increasing, significantly decreasing, or not changing. This reveals patterns that are clearly visible to the naked eye. Vocabulary measures and two cognitive control measures increase continuously until the 50s or 60s and then remain stable (the third cognitive control measure reaches plateau in the early teens). Some measures of working memory, including complex span and spatial working memory, pattern with digit symbol coding, peaking in late adolescence and then declining sharply. However, other measures of working memory such as digit span and visual working memory peak in the late 20s before declining. Most of the social cognition measures also develop into the late 20s, but then remain stable for decades before substantial decline. A handful of measures show idiosyncratic patterns not obviously matching any others.

A limitation of this study is that there is currently no statistical method for determining whether these clusters --- though readily apparent in graphs --- are statistically justified. It is, however, a critical step.

P1-97 - The best start video project study: effects of an oral language professional development program (ENRICH) on educator-child language quality

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Details

Background: The quantity and quality of language to which children are exposed in early childhood are linked with important developmental outcomes such as later vocabulary size and school success (Anderson et al., 2021; Gómez & Strasser, 2021; Hart & Risley, 1995; Hoff, 2003). Conversation-eliciting language and decontextualized language (such as conversations about the past and future) are particularly beneficial for children’s language development (Reese et al., 1993; Rowe, 2008; Salmon & Reese, 2016). Young children are spending increasingly more time in early childhood education and care (ECEC; Paschall et al., 2022), so it is important for children to be exposed to high-quality language in these environments. However, past observational research in the US and in New Zealand has identified low rates of language-enhancing talk use by educators (Dickinson et al., 2008; Dickinson & Tabors, 2001; Justice et al., 2008; Swearingen et al., 2023; Turnbull et al., 2009). So, professional development (PD) programs are needed to enhance the linguistic environment of children who attend ECEC.

Method: This study is a part of a larger randomized controlled trial, Kia Tīmata Pai (The Best Start Study in te reo Māori, the indigenous language of Aotearoa New Zealand), aimed at enhancing young children’s language and self-regulation through two professional development programs for educators,

ENRICH (for oral language) and ENGAGE (for self-regulation). This project used data from the first year of the trial, in which ECEC centers were randomly assigned to receive either ENRICH or to be part of an Active Control group (see Reese et al., 2023). A subset of centers (n = 24; 110 educators, 183 children) out of the total 138 centers from the main trial were selected for this project. Educator-child interactions were video-recorded at baseline and one year later across five target activity settings: book, group, diapering/ toileting, play, mealtime. Approximately 25 minutes at each visit of educators' child-directed talk was transcribed and coded for conversational function (conversation-eliciting utterances and conversation-directing utterances) and temporal reference (present, future, past).

Results and Implications: Preliminary analyses revealed a condition effect for educators' conversation-eliciting language during diapering/ toileting, group time, and book time, such that centers in the ENRICH condition had educators who used more conversation-eliciting language compared to centers in the Active Control. There was also a condition effect for educators' directive language during mealtime, such that ENRICH centers used less conversation-directing language in this routine compared to the Active Control. Further, a condition effect was found for child utterance frequency in book time and playtime, with children in ENRICH centers talking more frequently during these routines relative to children in Active Control centers. We are continuing to conduct analyses of the temporal references and as a function of the implementation of ENRICH. Overall, these initial findings suggest encouraging outcomes of the ENRICH professional development program for educators' and children's language.

P1-98 - The role of perceptual and conceptual knowledge in graded notions of impossibility

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Details

Adults see some impossible events as more impossible than others. It might seem unlikely that young children would also distinguish between degrees of impossibility, as they often struggle to differentiate improbable events from impossible events (Shtulman & Carey, 2007). Nonetheless, children do see impossibility as graded (Shtulman & Morgan, 2017). For example, like adults, children think it is harder to levitate a bowling ball than a basketball.

How might children decide which events are more impossible than others? Perhaps they draw on their understanding of real-world explanatory knowledge and apply it to impossible events. Relying on real-world explanatory knowledge is broadly consistent with past work that highlights the importance of conceptual knowledge in children's judgements about possibility (see Harris, 2021 for a review). Alternatively, children may rely on shallow perceptual information, as superficial similarity is also known to contribute to children's possibility judgements (Goulding et al., 2022; Goulding, 2021).

We tested between these two accounts in three experiments by asking 4-7-year-olds (N=206) and adults (N=426) about magical transformations. Participants saw vignettes where a wizard could transform target objects into either of two other things: a perceptually similar object and a categorically related object. For each pair, children were asked which magical transformation would be easier or harder. For

example, they were asked whether it would be easier for the wizard to turn a toy cat into a real cat (perceptual match) or a toy elephant (categorical match).

In the first experiment, we found a main effect of item, $p=.004$, and an interaction between item and group (children and adults), $p=.025$, but no main effect of group, $p=.489$. Across all ages, children and adults performed at chance and did prioritize the perceptual or categorical match. However, younger children did show a pattern compared to older children of more often selecting the perceptual match, $p=.028$. In the second experiment, children showed the opposite pattern and were more likely to select the perceptual match with age, $p=.005$. Adults' results in the third experiments again showed that they did not consistently select the perceptual or the categorical match. These findings suggest that while children initially rely on surface-level features to inform their possibility judgements, they become less reliant on this shallow reasoning with age and begin to mirror the reasoning pattern of adults and do not consistently prioritize either perceptual or conceptual information.

P1-99 - Why do older children learn second languages faster than younger children?

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Details

As the number of bilinguals all over the world is increasing, understanding the impact of an individual's first language (L1) on acquiring a second language (L2) is crucial. Previous research indicates that the L1 can both facilitate and hinder L2 learning (Mitchell et al., 2019). Surprisingly, while adults are generally less successful at acquiring an L2, studies suggest that older children with more L1 knowledge actually learn L2s more quickly (Chan & Hartshorne, 2022; Mayberry & Kluender, 2018; Snow & Hoefnagel-Höhle, 1978). This may be because L1 proficiency supports L2 acquisition (Cummins, 1979) or due to positive transfer outweighing negative transfer.

In the most comprehensive study to date, Chan & Hartshorne (2022) investigated L2 English learning in international schools (as measured by standardized test scores), finding that older L2 learners did learn faster, but that this was specific to children whose L1 was more closely related to English. This suggests that the age effect is driven by positive transfer. However, the statistical results were weak. Here, we double the size of the dataset, increase the diversity of L1s, and use more precise metrics of linguistic similarity (Littell et al., 2017).

Building on Chan & Hartshorne (2022), we investigated English standardized test scores of students at international English schools (1,596 students, 4,263 observations, 32 distinct L1s), with age of acquisition (AoA), English experience, and linguistic similarity as dependent variables. Replicating Chan & Hartshorne (2022), when controlling for duration of English study, students with a later AoA tend to have a higher proficiency score than the students with early AoA ($b = 2.16$, $p < .0001$). Critically, there was an effect of linguistic similarity: the closer the phylogenetic relationship between their L1 and English, children with later AoAs learned more quickly ($b = 4.71$, $p < .05$).

To increase statistical power, we ran a secondary analysis that additionally considered students for whom we lacked AoA information, resulting in a total of 2,707 students, 7,066 observations, and 44

distinct L1s. The dependent variable is learning rate and we controlled for proficiency at test rather than AoA. Consistent with the above results, older children learned faster than younger children of the same proficiency level ($b=0.003$, $p<.0001$). Again, this effect was larger when the L1 was phylogenetically closer to English ($b = -0.017$, $p<.001$). This time, we found that the age effect on oral scores increased with phonological similarity ($b = 0.002$, $p<.0001$).

This is the strongest confirmation to date that greater L1 proficiency leads to faster L2 acquisition, and that this is driven by positive transfer. The results also extend previous research: the positive transfer is not restricted Mandarin (Pasquarella et al., 2011), Spanish (Anthony et al., 2009), or French (Sohail et al., 2022) native speakers, but rather extends across many L1s in proportion to the similarity between the L1 and English. We discuss potential limitations, such as the focus on L2 English and the lack of a precise measure of morphosyntactic knowledge. We also discuss how these findings could be reconciled with critical period effects.

P1-100 - Omission as the modern form of bias against Native Peoples: a developmental investigation

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Details

Native Peoples in the United States have historically and continually been overlooked and misrepresented as peoples who ceased to exist after the 1900s (“people of the past”). As children engage with their world, they are confronted with these depictions, or lack thereof, in multiple domains. For example, in the K-12 school system, 87% of state history standards do not mention Native American history after 1900 (Shear et al., 2015) and in primetime media, less than .5% of characters are Native (Tukachinsky et al., 2005). In this talk, we will explore how 4-6 year old children think and feel about Native Peoples and the consequences of representing Native Peoples as people of the past. Across three studies, we demonstrate that being represented as “people of the past” is related to more negative attitudes towards Natives and that contemporary Native representation may promote more positive intergroup attitudes. In Study 1 ($N=108$), children liked historical portrayals ($M=2.78$) less than contemporary portrayals of Native Americans ($M=3.13$), ($t(113.44)=2.24$, $p=0.027$, $d=0.21$). Similarly, children like historical portrayals ($M=2.64$) less than contemporary portrayals of Alaska Natives ($M=3.12$), ($t(112.0)=3.35$, $p=0.001$, $d=0.32$). Together, these suggest that representing Native Peoples solely, or predominantly through a historic lens may contribute to greater Native bias, starting in childhood. Fortunately, there have been recent pushes for more contemporary Native representation, including in children’s television (i.e. PBS’ Molly of Denali). In Study 2 ($N=111$), we aimed to understand how exposure to contemporary representations of Natives could affect young children. We found that children with some exposure to contemporary Native representation, operationalized as recognition of Molly, tend to have lower anti-Native bias (i.e., greater liking of Native kids relative to White children) ($M_{diff}=0.473$) compared to children who have no recognition ($M_{diff}=0.592$), although the difference was non-significant ($t(109.00)=-0.714$, $p=0.477$). In Study 3, we replicate this pattern ($t(80)=-1.280$, $p=0.204$). Again, however the differences are non-significant but in the expected direction. Expanding on this cross-sectional evidence, Study 3 experimentally investigates how exposure to contemporary representations of Native peoples might impact anti-Native bias ($N = XX$, expected ~ 100), we investigate

this effect through an experimental, longitudinal design. Families were given Molly of Denali episodes over the span of 4 weeks. Attitudes were tested at the beginning, middle, and end of the study. Preliminary evidence reveals that anti-Native bias marginally decreased over the time ($t(125.16)=-1.66$, $p=0.099$). Together, these studies demonstrate that the omission of contemporary Native representation may feed into anti-Native bias and that the inclusion of such representation may act to lessen it. Not only is this work the first investigation of bias towards Natives in childhood and another step into understanding how Native bias develops, but it also has theoretical implications for our understanding of how bias and inequality are maintained through representation. While research has generally focused on how what is represented conveys bias (i.e., misrepresentations and stereotypes), the data presented here demonstrates that children also make meaning from what is not there (i.e., omission) with important intergroup consequences.

P1-101 - Cognitive reflection and children's social thinking

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Details

Cognitive reflection is the tendency to reflect on one's own thinking, allowing a person to identify and correct judgments that are grounded in intuition rather than logic. Individual differences in cognitive reflection predict a diverse range of adult psychological and behavioral outcomes, including rational decision making on heuristics-and-biases tasks (Toplak et al., 2011) and understanding of counterintuitive STEM concepts (Shtulman & McCallum, 2014). Recent research using a developmental test of cognitive reflection (the CRT-D) has found cognitive reflection is a similarly strong predictor of school-aged children's rational thinking and STEM understanding (Gong et al., 2021; Young & Shtulman, 2020). The present research extends the study of children's cognitive reflection to social reasoning. In adults, cognitive reflection is associated reduced stereotyping (Blanchar & Sparkman, 2020), fairness in economic games (Corgnet et al., 2015), and efficient social learning (Vostroknutov et al., 2018). This research asks whether cognitive reflection also predicts children's reasoning in three social domains: gender stereotyping, fairness, and social learning.

Five- to 12-year-olds (current N = 139; 48% Female; 43% White, 19% Asian, 18% Multiracial/Other, 15% Hispanic/Latinx, 5% Unreported) participated in an preregistered study via Zoom. Children first completed a children's cognitive reflection test (CRT-D), along with control measures of executive functions (i.e., inhibitory control, set shifting, working memory) and fluid intelligence (Raven's Matrices). To measure stereotyping, children completed a shortened activities scale from Liben and Bigler's (2002) COAT-AM (e.g., "Who should babysit? Only boys, only girls, or both boys and girls?"). To measure fairness, children completed a one-shot dictator game used by Chajes et al. (2022) in which they decided how to share a \$1 USD bonus with a partner from two options: (fair choice) - 2 quarters for self & 2 quarters for partner; (selfish choice) - 3 quarters for self & 1 quarter for partner. To measure social learning, children completed Einav's (2018) consensus learning task. In this task, children learned about an unfamiliar country via conflicting testimony from two groups of informants: an independent consensus group who responded privately and a nonindependent consensus group who had access to each other's answers.

Children with greater cognitive reflection endorsed fewer gender stereotypes ($r = -.44$), made more fair distributions ($r = .21$), and more strongly favored independent consensus ($r = .23$). Cognitive reflection continued to predict stereotyping, fairness, and social learning in Bayesian regression models that adjusted for children's age, executive functions, and fluid intelligence (Figure 1).

Prior research suggests cognitive reflection is a useful predictor of many facets of adult social thinking. The present data suggests cognitive reflection is similarly useful when applied to children's social cognition. These data enhance our understanding of the cognitive foundations of children's social thinking across diverse domains. We further discuss implications of children's cognitive reflection for theoretical debates in our targeted domains (e.g., the intuitive cooperation debate) and the potential of cognitive reflection as a target for intervention to support positive social development.

P1-102 - Unpacking the challenges and predictors of students' use of the distributive property

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Details

The distributive property plays a pivotal role in advancing students' understanding of multiplication, enabling the decomposition of problems and the acquisition of new facts. It is recognized as a critical idea across both arithmetic and algebra in school mathematics (National Mathematics Advisory Panel, 2008). However, this property of multiplication is difficult for students to understand. The present studies explore factors influencing fourth through eighth graders' use of the distributive property, building a fluid connection between this property and multiplication skills to prepare students to face the mathematical demands of the 21st century (West, 2011). Developing a deep understanding of multiplication depends on understanding the distributive property (Kinzer & Stanford, 2013).

To explore these factors, we utilized two distinct datasets. Study 1 involved data from 1:1 structured interviews of students ($N = 24$) discussing worked examples and solving associated practice problems. We examined whether or not students used the distributive property to solve the problems and whether or not interviewers followed the recommended distributive property prompts or defaulted to more conventional methods. Study 1 revealed an important point regarding students' use of the distributive property: exposure alone does not consistently translate into its use, as students often gravitate toward previously learned intuitive approaches. Such findings underscore the need for increased exposure and persistent reinforcement of the distributive property during the late elementary and early middle school years. Notably, in Study 1, instructional interviewers often deviated from the intended script, sidestepping the distributive property. This deviation underscores the significance of metacognition in educational settings and emphasizes the need to incorporate cognitive reflection scaffolding into instructional design and teacher formation programs.

Study 2 used a data set with middle school students' ($N = 129$) item-level responses on Kirkland's (2022) brief assessment of mature number sense along with several related measures of domain-general and domain-specific skills. We extracted problems involving the distributive property for analysis. Surprisingly, there was no evidence that students' use of the distributive property improved from sixth to eighth grade. However, both grade-level mathematics achievement and cognitive reflection uniquely

predicted the correct use of the distributive property. Results suggest that middle school students who exhibit stronger reflective thinking tend to perform better on distributive property problems. Findings highlight cognitive reflection as a potentially important construct involved in the understanding and use of the distributive property. Such findings suggest the potential for interventions promoting reflective thinking to enhance conceptual understanding and application of the distributive property. These studies collectively provide valuable insights into students' problem-solving strategies and their familiarity with the distributive property. They highlight the potential role of cognitive reflection in students' performance on distributive property problems, aligning with prior research indicating that cognitive reflection is a predictor of students' conceptual understanding in mathematics and science (Young & Shtulman, 2020).

P1-103 - Prediction and error detection: the role of the intuitive number sense in symbolic mathematics

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Details

Learning about the complex world of mathematics requires not only problem-solving skills but also the capacity to notice mistakes. But deciding if we answered a symbolic math problem correctly is challenging since there are often an infinite number of answers and few cues to help identify mistakes. In three experiments, we test how well 5 – 9-year-old children detect mistakes in math, how this relates to their intuitive number sense, and explore pupillometric methods to better understand the stages through which error detection occurs.

In Experiment 1, 5 to 9 years-old children ($N = 42$; $M_{\text{age}} = 7.17$; $SD = 1.03$) watched as a puppet solved 22 age-appropriate math problems while getting only half of the answers correctly, and decided whether the puppet's answers were right or wrong. Children also solved the same problems themselves at a later phase. We found that even our youngest children could catch mistakes that the puppet made at above-chance levels, and that their ability to do so correlated with their intuitive number sense.

In Experiment 2 ($N = 63$; $M_{\text{age}} = 6.75$; $SD = 1.09$), we replicate the findings of Experiment 1, but also include a formal math assessment in which participants later solved the same problems that they previously saw the puppet complete. We found that the intuitive number sense correlated with formal math ability, and that this relationship was partly – but not fully – mediated by error detection performance.

In Experiment 3, presently in the data collection stage, we are examining children's error detection abilities implicitly through pupillometry. Children once again listen as a puppet solves symbolic math

problems, while their eyes are tracked by a remote eye-tracker. Replicating previous work, we expect to find that children's pupils show higher dilation for incorrect vs. correct answers, as the pupil is, in part, sensitive to surprise and violations of expectations. We will then examine if individual differences in the intuitive number sense predict the magnitude of the dilation. By deepening our knowledge in this domain, we anticipate revealing useful insights that might potentially reshape strategies and interventions in early mathematics education, ensuring they are anchored in a robust understanding of the intricate mechanisms of error detection and its relationship to predictive cognitive processes.

P1-104 - Children's reasoning about previous experiences based on subsequent belief-driven actions

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Details

In most theory-of-mind problems, participants are asked to reason "forward" from an agent's prior experiences to that agent's resulting mental state. For example, in the location-change task, the question is where Maxi, based on what he witnessed, thinks his chocolate is. This method of inquiring about other agents' perspectives has been criticized because it presupposes sophisticated mental state vocabulary and syntactical (complement clauses) understanding. The current study introduces a new method of "backward" reasoning, in which participants witness agents perform seemingly irrational acts (e.g., approaching an empty cupboard in search of chocolate) and have to infer what the agent must have seen or witnessed. Unlike forward-reasoning tasks, our backward-reasoning task requires neither the use of mental state vocabulary nor an understanding of embedded clauses. In two experiments, 3- and 5-year-olds (N = 120) were shown online stories modeled after the location-change and the unexpected-content tasks, respectively. Location-change stories began with an agent placing an object (e.g., a cupcake) in Location A, followed by the object's relocation to B. It was kept ambiguous whether the agent (who felt sleepy) witnessed the change or not. The children then observed the agent approaching either Location A (empty) or Location B (filled) and were asked whether the agent was asleep or awake when the object was relocated. In unexpected-content stories, it was kept ambiguous whether the agent observed or did not observe another's demonstration that a conventional box, e.g., a cookies box, contained, e.g., forks. The agent then expressed her appetite for, e.g., cookies and either happily glimpsed at the cookie box or disappointedly frowned at it. In both experiments, 5-year-olds outperformed 3-year-olds and children's performance on these novel backward-reasoning tasks was significantly predicted by their performance on traditional, forward-reasoning tasks.

Our study offers a new perspective on the development of mental state understanding. We removed task demands of classic false belief tasks (mental state language and complex syntax) by developing task variants in which children have to reason back in time and determine what an agent witnessed. The association between children's abilities to reason forward from experiences to beliefs and backward from beliefs to experiences supports the idea that children, between the ages of 3 and 5, develop a general understanding of how experiences, beliefs, and action, are interrelated.

P1-105 - Parent socialization and EFs as contributors to relational reasoning patterns

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Details

Background. Reasoning relationally is a powerful tool for solving problems and making leaps of insight, though younger children tend to draw inferences based on perceptual similarity, while adults and domain experts tend to reason more relationally (Gentner, 1988). This relational shift can be explained in part by domain knowledge (Rattermann & Gentner, 1998) or cognitive resources (Simms, Frausel & Richland, 2018; Morrison et al 2004), since with inadequate knowledge or executive functions reasoners tend to rely on object similarities for inference; but in this study we explored the role of socialization alongside executive function (EF), and also tested whether children's relational shift patterns were constant across tasks.

Methods. To examine socialization routines and their relationships to children's reasoning, parents and children 3-5 years old were given A, B, C matrices, and they were asked to discuss and select the best D object to complete the pattern (see Figure 1). The pattern could be completed relationally (e.g. in Figure 1, "turns into") or based on color patterns (yellow, yellow, green, green). The discussion was videotaped and coded to analyze children's and adults' contributions to generating relations or object matches, and decisions about the D selection. Children were also administered two EF measures, dimensional change card sort (DCCS) and Corsi blocks, and two additional analogy tasks that could be solved either through attention to relations or to matching object properties: Ambiguous Scene Analogy (see Simms & Richland, 2019) and a new task that measured proportional relational thinking versus object size matching, the Lemonade Analogy.

Key Results and Conclusions. Importantly, there was evidence of a stable pattern in children's relational attention, such that children's spontaneous relational matching on one task correlated with their relational attention on another task. Relational matches on the lemonade analogy task correlated with children's initial ambiguous matrix task matches ($r = .69, p = .010$) and with relational matches on the ambiguous scene analogy task ($r = .35, p = .038$). The latter were also correlated with children's DCCS scores ($r = .34, p = .036$), providing evidence for the contribution of EF to relational thinking, though this was not ubiquitous across tasks, suggesting EF isn't adequate to alone explain patterns of attention to relations versus objects. The socialization data from the ambiguous matrix task gives some insight into the latter, with the coding data revealing that parents were doing heavy socialization work to ensure that their children reasoned relationally despite the experimenter not indicating relations or color were preferred. We found that after discussion, most parents and children (76%) prioritized the relational answer choices (e.g., selecting the seeds in Figure 1). The socialization most often took the form of the parent specifying the A to B relation (38%), followed by prompting the child to state the relation between C:D (41%), which was correlated to a relational final answer choice ($r = .70, p < .001$). This suggests that parent socialization practices that prompt children to describe relationships can encourage children to reason more relationally, and this may extend across tasks.

P1-106 - Scaling playful fraction learning through design-based implementation research and randomized control trials in fragile and conflicted-affected states: The case of Kosova

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Details

Recently, developmental science is aiming to rectify an imbalance of drawing theory, evidence, and recommendations from studies with western educated industrialized rich democratic (WEIRD) communities (Henrich et al., 2010). This comes amidst efforts of many randomized control trial (RCT) grounded in developmental science that showed early victories failing to replicate at scale (Bryan et al., 2021). Perhaps due to overlooking local cultural and contextual factors commonly examined through design-based implementation research (DBIR; Fishman & Penuel, 2018). With 90% of the world's children living in low- and middle-income countries (LMICs), and in 2019, 69% living in fragile or conflict-affected states (FCAS; United Nations, 2021; n.d.), these awakenings have necessitated the field to reevaluate its aims and methods to align with the cognitive needs and experiences of children in LMICs and FCAS (Draper et al., 2022).

The current study combines DBIR and RCT methods to build upon two previous play-based RCTs called KOSOVAR PROJECT NAME (KPN)—a basketball game refashioned to teach fractions and decimals based on the science of learning. The first RCT with 6 teachers and 174, 4th- and 5th-graders randomized within classrooms successfully replicated positive impacts on children's rational number knowledge found through 6 games in US PROJECT NAME (Figure 1; Authors, 2022; March). Qualitative data after the first RCT reflected teachers' concerns around program feasibility because the intervention required two adults and additional instructional time (Authors et al., 2022, October).

The KPN program underwent further co-design to develop a 15-unit intervention with unique changes to game design, roles and rules (Figure 2). Importantly, it added complementary classroom activities, aligned with local standards in mathematics and physical education (PE). In a second pilot RCT with 224 students and 8 teachers randomized at the classroom level, the expanded KPN intervention replaced math and PE units and was delivered by a single teacher per classroom. KPN reflected positive impacts on rational number learning compared to "business as usual" (Authors, under review), suggesting promise for scale-up. However, some teachers previously participated in co-design activities which hindered generalizability.

In this study, we investigate whether a 15-unit KPN intervention can successfully scale to 3 new schools with 25 teachers and 679 4th and 5th graders who had no previous experience with the program. Classrooms were assigned to treatment or control through matched randomization based on children's pretests scores. Children completed identical pretests and posttests which included 13 subtests (Table 1), combined to create 3 composite scores: overall rational number knowledge, near, and far transfer.

Three model specifications were preregistered at WEBSITE and we report our final model with a compliant sample controlling for pretest score and grade level. Fourth and fifth graders improved on 12 out of 16 outcomes with moderate to large effects (Table 2), suggesting promise for a larger scale-up.

The iterative cycle of RCT and DBIR represents a promising approach for developing successful interventions that improve children's rational number knowledge by integrating principles from the science of learning with local expertise in FCAS and LMICs more broadly while also demonstrating potential for scalability.

P1-107 - The flexibility of structural reasoning about social inequality in childhood

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Details

Structural inequalities create and perpetuate discrepant outcomes between social groups. However, both adults and children more often attribute these discrepancies to internal factors of individuals, rather than to structural causes—a tendency which has been linked to increased prejudice toward disadvantaged group members across development (Gilbert & Malone, 1995; Rhodes & Mandalaywala, 2017). Therefore, promoting structural reasoning in childhood may serve to mitigate the development of social biases. Across three studies we investigated children's ability to make structural attributions for social inequality. Study 1 examined children's ability to accurately map structural and internalist attributions to appropriate scenarios. Study 2 investigated whether young children's fairness judgments impact their attributions for inequality. Study 3 explored children's capacity to flexibly update their attributions for inequality when provided new information about structural constraints.

Study 1 (3-to-8-years-old, N= 155) presented children with a novel game where two classrooms had either an equal or unequal chance of winning a desired prize similar to past work (Vasilyeva et al., 2018). By 5 years of age, children were able to endorse structural attributions while simultaneously rejecting both internalist and illogical attributions, $F(2, 291) = 6.38, p < .01$. Importantly, this pattern only emerged when a structural constraint was present, suggesting that 5-to-8-year-old children can intentionally and selectively apply structural reasoning. While younger children failed to selectively endorse individual attributions, when asked to select the *best* attribution, 3-to-4-year-olds were equally as successful as older children at attributing the structural inequality to structural factors as older children, $t(2) = 8.62, ps < .01$.

Given that 3-to-4-year-old children showed evidence of structural reasoning, Study 2 (N = 40) sought to examine if encouraging participants to evaluate the fairness of the structurally unequal game would scaffold their ability to make structural attributions. Overall, asking children to make a fairness judgement did not improve their ability to make structural attributions, $F(2, 49) = 0.30, p = .732$. However, analyses of open-ended fairness judgements revealed that children most often made appeals to the structure of the game, again reinforcing the presence of structural reasoning in younger children.

In Study 3, 5-to-8-years-olds (N = 81) viewed the same unfair novel game, but the structural constraint was not revealed until after they were asked to evaluate different attributions for the inequality. After the structural constraint was revealed, participants were asked whether they still agreed with their previous attributions. Data reveal that children were able to flexibly update their attributions when presented with new information about structural constraints, $F(2, 151) = 19.92, p < .001$, becoming less

likely to endorse the internalist attribution, $t(78) = 2.51, p = .014$, and more likely to endorse the structural attribution, $t(78) = -5.08, p < .0001$ on the second rating.

Together, these studies speak to the developmental trajectory of structural reasoning. By 5 years of age, children can selectively make structural attributions for social inequality and flexibly update their attributions when given new information about structural constraints.

P1-108 - Trusting young children causes them to cheat less

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Details

Trust and honesty are essential for human interactions. Philosophers since antiquity have long posited that they are causally linked. Evidence shows that honesty elicits trust from others but little is known about the reverse: Does trust lead to honesty? The present research aimed to answer this question. More specifically, we examined whether kindergarten children would act more honestly and cheat less after being trusted by an adult.

Across five preregistered studies, we recruited a total sample of 328 five- to 6-year-old children. Children took a challenging math test with five test items in a one-on-one session. They were asked to complete all items correctly in five minutes. Of the five items, the first four were easy but the final one was exceptionally difficult, which made it impossible for children of this age to answer correctly without peeking at the answer key. Before starting the test, the experimenter made an excuse to leave the room and left the answer key on a table near where children sat. Children were told not to peek at the answer key. Unknown to children, a hidden video camera recorded their behavior during the experimenter's absence. We assessed whether or not children cheated by peeking at the answers.

In Study 1, we randomly assigned children to either an experimental or a control condition. In the experimental condition, on their way to the test room before the test, the experimenter asked children to help hold the envelope that contained the answer key. After the help was rendered, the experimenter expressed her trust in them for help in the future and not to cheat on the upcoming test. In the control condition, children were not asked to help. Then, children in both conditions were given the math test in which they could cheat to answer all questions correctly. We found a trust effect: Children cheated significantly less in the experimental condition (34%) than in the control condition (61%).

In Study 2, children participated in either a new experimental or control condition. In both conditions, they helped the experimenter to hold her house keys. However, in the experimental condition, the experimenter expressed her trust in children to help in the future as well as not to cheat on the test. Children still cheated significantly less in the experimental condition (37%) than in the control one (63%), indicating that the mere act of children helping the experimenter alone did not cause the trust effect. Study 3 removed the message about trusting children not to cheat and found that as long as children received the trust-related messages about helping, the trust effect remained (39% in the experimental condition vs. 66% in the control condition). Study 4 further showed that the message about trusting

children not to cheat was ineffective in nudging children away from cheating (54%). Study 5 revealed that the trust effect was specific to the experimenter who trusted children (37%) and did not generalize to a non-trustor (49%).

Taken together, this research provides clear evidence for the causal effect of trust on honesty and contributes to understanding how social factors influence morality. This finding also points to the potential of using adult trust as an effective method to promote honesty in children.

P1-109 - Individual differences in children's acceptance of conflicting information

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Details

The testimonial learning literature has extensively focused on how children acquire knowledge from other sources, demonstrating that children have a sensitivity to informants who possess positive epistemic characteristics such as reliability, accuracy and knowledge (Koenig & Harris 2005; Koenig, Clement, & Harris 2004) as well as access to information (Brosseau-Liard & Birch, 2011). While children are sensitive to who they choose to trust or learn from, they often accept information that contradicts their own perceptions (Jaswal & Markman, 2007) and judgments (Li, Harris & Koenig, 2019). The present study investigates the impact of child maltreatment as well as differences in maternal adverse childhood experiences (ACEs) and depression on children's decisions to accept conflicting information.

The study sample consisted of 196 3-year-old children and their mothers (M = 45.6 months, SD = 2.2). All participants came from low SES households receiving Temporary Assistance for Needy Families and were recruited from Mt. Hope Family Center at the University of Rochester, NY. Participants' mothers completed the Maternal Interview on Child Maltreatment (Cicchetti et al., 2003), a 10-item questionnaire assessing ACEs and finally the Beck's Depression Inventory, a 21-item questionnaire measuring characteristic attitudes and symptoms of depression (Beck, et al., 1961). In addition, children participated in the tunnel task (Robinson & Whitcombe, 2003), a cardboard tunnel and toy game that examines children's ability to evaluate suggestions that contradict their own judgments. Children chose either to maintain their initial belief about an object's identity or to accept the speaker's contradicting suggestion.. Each child was presented with three-types of trials in the tunnel game: Better-informed trials (children had better perceptual access than the speaker), Equally-informed trials (both parties had poor perceptual access), and Worse-informed trials (children had worse perceptual access than the speaker). When asked to determine which toy was in the tunnel, the speaker's responses always contradicted the child's responses (e.g. if the child said "The red one", the speaker would say "The green one"), and the child was asked to make a final judgment in each trial by a moderator (e.g., "Which toy is in the tunnel, the red one or the green one?")

Children's responses in the tunnel game revealed a significant interaction between Maltreatment Status and Trial Type, OR = 2.3; 95% CI = [1.25, 4.27]; p = 0.007. Pairwise comparisons revealed a significant difference between the maltreated and non-maltreated group in the Better-informed trials, indicating that children who were at risk for maltreatment were more likely to revise their original judgment and defer to an adult, despite having better perceptual access than the speaker. Future analysis

will examine differences in high and low maternal ACEs and children's responsiveness to contradictory claims. In addition, the BDI has conventional cut-off scores between mild, moderate, and depression (Beck, Steer, & Garbin, 1988). We will seek to examine differences in children's deference to conflicting claims based on maternal mild, moderate, and severe depression.

P1-111 - The development of early phonological networks: An analysis of individual longitudinal vocabulary growth

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Details

Previous research has emphasized the role of a child's existing vocabulary in shaping their lexical development, alongside environmental factors. However, much of this research has relied on either restricted laboratory studies including only a few words or on cross-sectional data, assuming that the words known to children at one point can predict their vocabulary at later stages. To gain a more conclusive understanding of this phenomenon, it is imperative to explore individual differences in word acquisition over time, necessitating the use of longitudinal data.

Prior studies have investigated the impact of phonological similarity between words on early vocabulary development by utilizing network representations of children's vocabularies. These studies nevertheless have diverged in their methodologies and findings, with some relying on aggregated data from multiple children and others focusing on individual longitudinal data. Notably, these studies have also employed different phonological measures to assess word similarity, adding complexity to the comparison of their outcomes.

Given these discrepancies in previous research, our study addresses this research gap by investigating the influence of phonological connectivity on word learning. We utilize longitudinal vocabulary data from 215 Norwegian-speaking children, each observed at least six times, to capture the dynamic nature of vocabulary development over time. Employing logistic regression models, we investigate whether a word's phonological connectivity to known words or words in the child's linguistic environment predicts its likelihood of being acquired during development. By incorporating the three different phonological distance measures into the models, we examine whether they were a reason for the different results in the previous studies.

Our results reveal that early vocabulary growth predominantly adheres to a "rich-get-richer" pattern, where word learning is primarily driven by the phonological connectivity to words already known to the child (compare Figure 1). However, we also find that the connectivity of words in the child's linguistic environment exerts some influence, albeit to a lesser extent (compare Figure 2). Importantly, our study underscores the value of using longitudinal data to gain deeper insights into the factors shaping vocabulary development and emphasizes the insights to be gained from analyzing different measures of the same construct.

P1-112 - Comparing newborn animals and newborn machines: A newborn embodied Turing test for the development of object perception

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Details

Newborn brains exhibit remarkable abilities in rapid and generative learning, including the ability to parse objects from backgrounds and recognize those objects across substantial changes to their appearance (e.g., novel backgrounds and novel viewing angles). How can we equip machines with the same remarkable learning capabilities observed in newborns? A major obstacle to answering this question is that the field lacks benchmarks for providing the same training data to animals and machines from birth. To date, benchmarks of biological intelligence compare behavioral performance of humans and animals to machines, without attempting to match their data available for learning. However, an organism's behavior is a product of their learning algorithms and the training data those learning algorithms operate over (i.e., BEHAVIOR = LEARNING ALGORITHM X TRAINING DATA). To directly compare learning in biological and artificial brains, researchers need to provide animals and machines with the same training data from birth.

We introduce a new framework for comparing the learning abilities of animals and machines: a Newborn Embodied Turing Test (NETT). The NETT framework raises newborn animals and newborn machines in identical environments and tests them with the same tasks, permitting direct comparison of their learning abilities. Here, we present two NETT benchmarks: one focused on view-invariant recognition and the other focused on object parsing. In the view-invariant task, we raised newborn chicks in controlled environments with visual access to only a single object shown from a limited range of viewing angles and tested their ability to recognize their object across a variety of novel viewing angles. In the visual parsing task, we raised newborn chicks with visual access to only a single object on a single background and tested their ability to recognize their object across novel backgrounds. Next, we performed "digital twin" experiments in which we reared and tested artificial chicks in virtual environments that mimicked the rearing conditions of the biological chicks in each controlled-rearing experiment. We inserted a variety of machine learning "brains" -- deep reinforcement algorithms -- into the artificial chicks and measured whether those algorithms learned the same object perception behavior as biological chicks.

Our results revealed a striking distinction. All of the biological chicks solved the view-invariant recognition and object parsing tasks, successfully learning object representations that generalized across new viewpoints and backgrounds. In contrast, none of the artificial chicks solved these object perception tasks, instead learning view- and background-dependent representations that failed to generalize across new viewpoints and backgrounds. These results expose the limitations of current AI algorithms in achieving the learning abilities of newborn animals. Our NETTs are publicly available for comparing machine learning "brains" with newborn animals. Ultimately, we anticipate that this approach will

contribute to the development of AI systems that can learn with the same efficiency as newborn animals.

P1-113 - Understanding representation

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Details

Packer and Moreno-Dulcey (2022) critiqued the long history of Theory of Mind (ToM) research for its use of puppets and/or inanimate objects in the tasks meant to trace ToM's development. Arguing that the use of such objects requires children to understand or accept pretend play, as a primary condition to begin ToM task and to be familiar with the nature of puppets. While human actors have also been used in ToM research, Packer and Moreno-Dulcey note that a puppet and/or pretense is still a part of these conditions. Scholars have responded to this critique (see: Wellman & Yu, 2022; Lilliard, 2022) asserting that children do not need to accept the condition of pretend play because they understand the doll or puppet is a stand-in for a human. Rakoczy (2022) explains that pretend-play does not constitute a confounding variable. Considering the act of "standing-in," to encapsulate sociocultural representations, such as those found in children's learning tools (i.e., books and like media) case-study methodology (Yin, 2013) was used to explore how children describe, learn from and engage with pretend-play, fictional characters and/or narratives. Observations of a preschool and first grade after-school literacy programs, once/wk for 5-weeks 3-hrs. each, located in a metropolitan working-class historically BIPOC community, were layered with questionnaire-assisted semi-structured interviews and analyses of artistic work. Moments of play were both prompted and unprompted and are as such discussed as such. The onset of ToM is theorized to begin around age 4 and by age 6 progress to Interpretive-Theory of Mind, wherein children become skilled at making inferences. The ability to draw accurate or justifiable conclusions from partial information could arguably improve dexterity with pretend actions and stimulus and so it was decided to compare these two early learning spaces. Across age bands, observational findings include that, children demonstrated greater engagement in depicted or storied representations relevant or current to their entertainment interests, not per se their sociocultural background. This implies that pretend play and/or imagination may be more cued or supported by what is personally vs. culturally relevant. This was also reflected in artwork. A few exceptions occurred when artwork was intentionally for others. Older children were also seen deferring to classmates who they knew had a greater interest in an subject, such as a Dinosaur or Unicorn, to explain or predict its actions. Older children more readily explained to researchers a classmate's distress or disengagement with a book or activity, e.g., their classmate wanted a sticker too, or was "needing screentime." Younger children sometimes, but more often than older children, spontaneously offered emotional comfort. Children across age groups were observed expressing ToM elements with regards to teaching (Frye & Wang, 2008) as during a community day they assisted-to-proxied for younger preschoolers with playground games and activities. There was also an ease with unspoken activities, e.g., jump over the red floor tiles, which upon researcher inquiry were determined to be lava by multiple respondents, without prior collaboration.

P1-114 - Algorithm induction in the Amazon: Indigenous children find structure in novel patterns

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Details

In the first few years of life, children acquire a dazzling array of new cognitive abilities, but the mechanisms that support the breadth of human conceptual abilities remain unclear. While some theories posit domain-specific learning mechanisms (e.g. for language, objects, and numbers), others posit a domain-general process of program induction, in which people infer the computational processes that likely generated the data they observe out of a general space of logical possibilities. Here we studied this ability among US American and indigenous Tsimane' children (ages 3-13) in an unfamiliar pattern-learning task. Participants viewed short action sequences (Experiment 1) or symbol arrays (Experiment 2) and were asked to extend these novel patterns to new lengths and generalize them to new stimuli, without instruction or feedback. Accuracy was high even among children without formal schooling or basic counting abilities. An implemented, domain-general program-induction model showed that their response patterns were highly algorithmic, even when they deviated from canonical responses. These results suggest that human learners share a domain-general cognitive ability to induce algorithmic structure from limited experience.

P1-115 - Visual Attention as a Mechanism of Gesture's Influence on Math Learning

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Details

When learning to solve mathematical equivalence problems, students benefit from instruction with hand gesture. However, it is still unclear *how* hand gesture supports student's learning. Gesture is highly visual; therefore, it is possible that gesture supports learning mechanistically by changing visual attention.

To examine this possibility, we used eye-tracking to investigate how observing instruction that includes gesture influences visual attention during subsequent problem-solving. Children were taught how to solve mathematical equivalence problems (e.g. $4 + 6 + 3 = _ + 3$) using four instructional videos with or without gesture. Children solved one problem after each instructional video. Afterwards, children solved sixteen post-test equivalence problems and some true or false problems designed to capture understanding of mathematical equivalence. Children's eye gaze was measured for the entire experiment.

We found that instruction with gesture influenced children's visual attention when solving problems after instruction. Children had different patterns of visual attention to specific addends and to the answer blank due to instructional differences after controlling problem features, number size, and learning outcomes.

Children's patterns of visual attention were also differentially related to the likelihood of solving a problem correctly depending on instruction. Children instructed with gesture were more likely to solve a problem correctly when they had increased visual attention to the right addend and the blank (the right side of the problem). However, children instructed without gesture did not show this pattern.

This pattern of results is interesting because previous research has shown that children with incomplete or incorrect understanding of mathematical equivalence often fail to properly encode the right side of the equal sign (Knuth et al., 2006). The present findings suggest that gesture may support correct problem solving via attention to the right side of the equation. Children who solve the problem correctly after viewing instruction without gesture may be solving them in a different way. Therefore, these results suggest that one mechanism by which gesture influences learning is through influencing children's patterns of visual attention.

Indeed, if instruction impacts future visual attention, then we should be able to detect distinct characteristics in children's attentional patterns which differ by instruction. We used machine learning to predict whether children observed instruction with gesture or without gesture based on children's attentional patterns on the posttest. We found that a classifier model using *only* visual attention metrics can reliably predict whether a child observed instruction with gesture or without gesture. Thus, children's visual attention during problem-solving has discernable characteristics which are influenced by viewing gesture during instruction.

Altogether, we found three distinct patterns in children's visual attention as a result of viewing gesture in instruction. After instruction with gesture: 1) Children devote more attention to different parts of the problem, 2) Different patterns of visual attention are beneficial for children's success, and 3) Children's visual attention patterns have distinct characteristics. This evidence provides strong support that one mechanism by which gesture influences children's lasting learning is through manipulation of visual attention.

P3-3 - Actually, I am one to judge: children struggle with uncertainty in the moral domain

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Details

Much of the morality literature demonstrates that children use intent information to inform their moral judgments. In these studies, when assessing harm caused to a victim, the intent of the perpetrator is often made explicitly clear. However, in everyday life, we often know the outcome (i.e., that someone was hurt) but not the intent. When intent is ambiguous or unknown, it is prudent to withhold moral judgments until more information is acquired, since incorrectly attributing purposeful intent can lead to wrongful punishment or, conversely, lead to immoral actors not getting their just desserts. Though previous work shows that young children are more likely to incorrectly attribute harmful intentions to ambiguous acts (Verhoef, et al., 2019), children were not given the option to withhold their judgments or express uncertainty. Given this, the current study asks: Can children withhold their moral judgments when they lack information about intent?

To investigate whether children have the ability to express uncertainty and withhold their moral judgments when intent is unknown, we conducted 2 preregistered studies with 5-8-year-old children and adults. In Study 1, we manipulated information about intent to harm a third party. Children (N = 180) and adults (N = 181) were presented with one of three types of scenarios: a perpetrator who *intentionally* caused harm, *accidentally* caused harm, or *ambiguously* caused harm (i.e., the perpetrator's mental states and actions were completely obscured and thus unknown to participants). Participants then assessed the perpetrators' intent, moral character, and whether they should be punished. Notably, we provided participants the option to withhold their judgments for all test questions by adding the option, "*I'm not sure, I need more information.*"

When intent information is clear, children and adults recognize the difference between intentional and accidental harm, mapping their judgments of punishment and moral character accordingly, with performance becoming better with age. However, for ambiguous harms, adults, but not children, were able to express uncertainty and withhold judgments of intent, punishment, and moral character. Instead, 5-7-year-olds were significantly more likely to attribute accidental intent to ambiguous harm whereas 8-year-olds were equally likely to attribute purposeful or accidental intent. Once children made an intent attribution, this informed their subsequent judgments of punishment and moral character.

Study 2 replicates and extends Study 1 by making it explicitly clear to children that it was permissible to pick the uncertain option and clarifying the test question to ask what actually happened in the scenario rather than what children thought happened. Using only the ambiguous harm condition, we again find that adults (N = 60), but not children (N = 60), were able to withhold their moral judgments for ambiguous harm.

In sum, between 5- and 8-year-old children are increasingly able to use intent information to inform their moral judgments. However, when they are only given information about an outcome and no information about intent, children unlike adults do not withhold their moral judgments. Study 3 (ongoing) is investigating possible mechanisms for this age-related difference.

P3-7 - Quantifying attention to structure in children and adults: The role of speech and gesture on a patterning task

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Details

The ability to attend to structure in the environment, as opposed to superficial features, is considered essential for cognitive development in various domains and developmental periods (e.g., Chi et al., 1989; Christie & Gentner, 2014). However, what qualifies as *attention to structure* and how it gets communicated is not always clear, and how we operationalize this construct has important implications for the role of domain-specific knowledge in improving cognitive development. Here, we examined children's and adults' attention to structure on a repeating pattern abstraction task using both speech and gesture. We aimed to quantify metrics of *attention to structure* to investigate developmental trends and indicators of expertise.

Children ($N = 90$; $M = 5.4$ years) and adults ($N = 95$; $M = 19.5$ years) completed a series of six pattern abstraction items where they had to recreate the structure of a model pattern using novel materials (e.g., create blue-yellow-yellow-blue-yellow-yellow to represent circle-square-square-circle-square-square) and then explain how their pattern was similar to the model. Using video-recordings, we coded two metrics of attention to structure that could be present in speech, in gesture, or in both: and (1) *unit identification*, or explicit identification of the core pattern unit (e.g., both patterns go ABB, pointing exclusively to the unit), and (2) *mapping*, or making explicit, accurate links between features of target and model patterns (e.g., my blue stars are like your big squares, pointing from one element to its corresponding element).

Results indicated developmental trends in attention to structure. Most children were novices at the task, and infrequently attended to pattern structure (18% of trials in speech, 20% of trials in gesture). However, children's unit identification and mapping behaviors increased with age, as did their task accuracy. Adults were experts at the task and frequently attended to structure (86% of trials in speech, 65% of trials in gesture). Moreover, results confirmed attention to structure is a critical indicator of expert pattern knowledge: (1) unit identification and mapping were more frequent in adult and child experts relative to novice children ($ps < .05$), (2) within novice children, these structure-focused behaviors were used more frequently on correct versus incorrect trials ($ps < .01$), and (3) in the entire sample of children, these structure-focused behaviors positively related to task accuracy ($rs = .27-.40$). Finally, results demonstrated the importance of studying attention to structure across modalities, as mapping and unit identification sometimes occurred in both speech and gesture but often occurred in only one modality. For unit identification, children's task accuracy was higher when they identified the pattern unit in speech *and* gesture than if they only did so in one modality.

These findings corroborate evidence in other domains suggesting that the ability to detect deep structure among objects is a key indicator of cognitive capacities. By investigating child and adult experts' ability to convey knowledge about pattern structure in multiple modalities, we uncovered developmental trends in pattern knowledge and critical behaviors that increase with expertise and age. Findings highlight the need to look beyond mere performance to identify in-the-moment behaviors that reveal critical processes driving knowledge gains.

P3-36 - Learning to differentiate fake news from real news: A developmental investigation

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Details

Fake news abounds on the internet, spreading faster and farther than real news (Vosoughi et al., 2018). Its ubiquity presents internet users—including children (Girouard-Hallam et al., 2023)—the challenge of detecting it. This challenge requires coordinating factual knowledge of real-world events, conceptual knowledge of event-relevant principles, and social knowledge of informant reliability. How successful are we at undertaking this challenge?

We explored these questions by asking 135 elementary-school-aged children (age range = 4-12, mean age = 8.1) and 117 college undergraduates to decide whether 24 news stories culled from a fact-

checking website were true or false. The stories were presented as headlines, with an accompanying image, one-sentence summary, and news source. The stories were grouped into a pretest and a posttest separated by a training. Half the participants were trained to scrutinize the plausibility of news content, and the other half were trained to scrutinize the credibility of news sources.

Participants also completed a developmental version of the Cognitive Reflection Test, the CRT-D (Young & Shtulman, 2020). Cognitive reflection, or the disposition to override intuitive responses in favor of analytic ones, has been found to facilitate fake-news detection in adults (Pennycook and Rand, 2019). We expected that participants who score high on the CRT-D would exhibit a similar advantage, given that the CRT-D predicts rational thinking and normative thinking dispositions across the lifespan (Shtulman & Young, 2023).

Our primary finding, displayed in Figure 1, was that both children and adults differentiated fake news from real news, though adults' differentiation was much stronger. Training made participants more skeptical of fake news, but it also made them more skeptical of real news. Participants' ability to differentiate fake news from real news did not generally improve. The one exception was adults who received training about news sources; this group was not only more likely to judge fake news as false but also more likely to judge real news as true.

At the individual level, participants' scores on the CRT-D predicted their news differentiation prior to instruction (see Figure 2). Following instruction, CRT-D scores predicted children's news differentiation but not adults'. The change in predictive power for adults' CRT-D scores suggests that instruction shifted adults' focus to features of the news that only adults with high CRT-D scores had focused on earlier. The correlation between children's CRT-D scores and news differentiation remained significant when controlling for age but only at pretest. This pattern implies that cognitively reflective children were better at differentiating fake news from real news independent of age, but instruction nullified the added benefits of cognitive reflection.

In sum, instructing participants to focus on the plausibility of news content led to increased skepticism rather than increased accuracy at evaluating news. Source-based instruction improved adults' accuracy but not children's, possibly because children do not have sufficient knowledge of trustworthy and untrustworthy sources. These findings imply that early media literacy programs should focus on sources rather than content, as content does not provide sufficient leverage for differentiating real yet newsworthy events from fake events designed to be newsworthy.

P3-66 - Learning about emotions: How words affect early emotion understanding development

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Details

Interpreting how other people are feeling is a crucial social-cognitive skill, as it relates to a variety of social and academic skills (e.g., Denham et al., 2003; Voltmer & von Salisch, 2017). Thus, it is important to better understand what factors may help children to learn about emotions, as well as what cognitive mechanisms may underlie this development. Prior theoretical work has suggested that emotion words

may be particularly valuable for helping children to learn about emotions (e.g., Barrett, 2017; Hoemann et al., 2019), and recent empirical evidence supports this view (e.g., Ogren & Sandhofer, 2022). Yet, it remains unclear precisely *how* emotion words have helped young children in prior studies. Here, we directly address whether young children leverage any novel labels to learn about emotions, or whether the benefit applies specifically to familiar emotion labels.

The present study utilized a pre-test post-test emotion learning paradigm with 3-year-old children ($N=72$; $M_{age}=3.51$ years, $SD_{age}=0.26$ years). At pre-test, children listened to eight emotional vignettes and for each were tasked with identifying which face (among an array of four) best matched how the character would feel. Between pre- and post-test, children completed learning trials. For these trials all children heard eight vignettes, each paired with only one face which matched the stereotypical face associated with the emotion of the scenario. After hearing the vignettes for the learning trials, children were randomly assigned to hear either an Explicit Label (e.g., “she feels *annoyed*”), a Novel Label (e.g., “she feels *wuggy*”), or Irrelevant Information (e.g., “she sits down”). Following the learning trials, children completed eight post-test trials which mirrored the pre-test trials but with new vignettes. A difference score was calculated for each child as their post-test score minus pre-test.

Results revealed that children’s difference score significantly differed by experimental condition ($F(2,69)=4.51$, $p=.014$) with average difference scores as follows: Explicit Label=0.96 ($SD=1.57$); Novel Label=0.08 ($SD=1.69$); Irrelevant Information=-0.38 ($SD=1.41$). The difference score for the Explicit Label condition was significantly higher than for the Irrelevant Information condition ($t(46)=3.09$, $p=.003$), and the Explicit Label condition trended toward higher performance than the Novel Label condition ($t(46)=1.86$, $p=.070$). The Novel Label condition and Irrelevant Information condition did not significantly differ ($t(46)=1.02$, $p=.313$). Further, only the Explicit Label condition significantly differed from chance performance ($t(23)=2.98$, $p=.007$), but not the Novel Label ($t(23)=0.24$, $p=.811$) or Irrelevant Information ($t(23)=-1.30$, $p=.205$) conditions. This demonstrates that children improved at pairing faces to emotional scenarios only after hearing the explicit emotion label.

This pattern of results has two important implications. First, it aligns with prior research indicating that labels can facilitate children’s learning of emotion categories. Second, the use of explicit emotion labels—which children have likely heard in the past—facilitates learning over and above the use of completely novel labels. Ultimately, these results are beneficial for clarifying the potential role of prior real-world experience with emotion labels on emotion learning.

P3-70 - Confirmation or surprise? Rhyme, prediction, and a word’s likelihood support preschoolers’ fast-mapping

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Details

One rich support for children’s early vocabulary building is interacting with highly structured language. Evidence from several studies has tested a theory that common structural features of children’s books, such as rhyme, may be especially useful for fast-mapping new vocabulary through a two part process: (1) first, structured rhyme invites children to make lexical predictions of upcoming words as they listen

along; and (2) then predicting upcoming words draws extra attention to them making new words more memorable. In studies that employ rhyme, repetition, and pauses before target words, children reliably demonstrate spontaneous verbal and nonverbal signs of anticipation of a word they expect to complete a phrase (Read et al., 2014; 2019; 2020), and making such lexical predictions correlates with better memory for those words (Read et al., 2021). However, it is not clear from prior research whether efficient, accurate prediction of upcoming words in rhymes enhances children's later memory for word-referent mappings, or whether by contrast, inaccurate prediction and then feedback could lead to better memory of word-referent mappings through error-driven learning (e.g., Gambi et al., 2021).

In this recent study, we tested whether the accuracy of such lexical predictions impact preschoolers' word mapping ability. Three- to 5-year-olds ($n=60$) recruited at a local children's museum were presented with 12 new animal names in a digital story-like context designed to encourage lexical prediction with rhyme and pausing. By manipulating the likelihood of each target animal within subjects (e.g., "Laurelai is a...butterfly" vs. "Laurelai is a... dragonfly"), children's accuracy of predictions before hearing the animal name was encouraged or discouraged. Video recordings of participants were coded to measure whether children looked to the target animals before they were named as an indicator of whether they were showing evidence of predicting the more likely targets. And, children's subsequent retention of the 12 name-animal pairs was tested in a simple forced-choice animal picture identification task (e.g., "which one was Laurelai?"). Results from anticipatory looking data are unclear with respect to whether children's eye movements demonstrate that they predicted the likely animal targets more than unlikely or distractor targets. However, the more children looked to the likely target the higher their retention scores were for those name-animal pairs ($r = .39, p = .004$) and overall, children were significantly more successful at retaining the animal names for the likely animal targets that were more predictable ($p < .001; \eta^2 = .143$) even when age was controlled for. This demonstrates some advantage of predictable regularity over surprise or error-driven learning in this type of early childhood language learning task. These findings further strengthen an argument for encouraging children's engagement with structured language like rhyming children's books, and have wider implications for approaches for supporting language development.

P3-106 - Learning words from the company they keep

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Details

Learning words gives us the currency we use to express a limitless range of ideas, from science and philosophy to our own beliefs. However, much of what we know about word learning focuses on just on one aspect: how young children use language about the here-and-now to map individual words to their real-world counterparts, such as mapping "apple" to a physically present apple by following a speaker's gaze [REF]. Mapping indeed provides vital grounding for word knowledge. At the same time, children experience words not just as individual labels for individual things, but as part of broader language contexts, such as conversations and stories. Language contexts are likely vital for expanding word knowledge beyond what can be acquired from mapping. Yet, we know little about how pick up words from the surrounding language context.

To pursue this question, the present studies are motivated by extensive evidence that words similar in meaning occur in similar language contexts. For example, words for emotions such as “sad” and “happy” occur in the context of “feel” and “face”, and words for fruits occur in the context of “juicy” and “sweet”. In principle, this contextual similarity between words similar in meaning could play a powerful role in expanding word knowledge. For example, a child who knows some fruit words such as “apple” and “strawberry” could learn a similar meaning for “lychee” just from encountering it in the context of “juicy” or “sweet”. In practice, the reality of this route for word learning remains unexplored.

If contextual similarity contributes to word learning, two things must be true. First, it must be available in children’s everyday language input: the words that children learn must occur in similar everyday contexts to words similar in meaning that they already know. Second, its availability must predict word learning: words should tend to be learned earlier when they occur in contexts that are more similar to words similar in meaning that children already know.

We conducted two studies to test these possibilities. Study 1 used readily available corpora of language input to young (0 – 4 year-old) children to predict normative ages of acquisition for early-learned words. Study 2 introduced multiple methodological advances to extend this investigation to predicting later word learning from a key source of language input to older (~7-16 year-old) children: commonly read children’s books. For both studies, we developed a novel measure of contextual similarity between words that captures the degree to which they tend to be accompanied by similar sets of other words. Next, we took words with normative ages of acquisition for young (Study 1) or older (Study 2) children, and measured the degree to which they were more contextually similar to words similar in meaning versus words different in meaning. Finally, we used this measure to predict age of acquisition. Findings from both studies revealed that contextual similarity to words similar in meaning is available in children’s language input. Moreover, this variable is a robust predictor of word learning, even controlling for other important predictors, such as word frequency and concreteness. These findings thus shed new light on a vital source of word learning across childhood.

P3-113 - When you say it's okay, does it really mean it is okay? How do children and adults reason about evaluative testimony?

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Details

Imagine that you are inviting a friend for dinner. You tell them that you are considering making lasagna. They respond: “Lasagna’s ok”. Should you make lasagna for them? Their answer is ambiguous, so it’s hard to tell. Now, imagine that this friend is always enthusiastic about food. They like everything. In that case, you might infer that they don’t like lasagna that much. But what if your friend typically doesn’t like anything? Then, you might infer that they like lasagna quite a bit. In this study, we investigated children’s and adults’ ability to use informants’ past evaluative judgments to calibrate their inferences about those informants’ true preferences.

When deciding whether to trust what they are told, young children consider informants’ epistemic and social characteristics, e.g., their knowledge and character traits (Tong et al., 2020). Children’s trust is

also informed by the valence of informants' judgments (Marble & Boseovski, 2020). For example, 4- to 8-year-olds endorsed an informant who provided positive rather than negative evaluative information (Boseovski et al., 2017). We also know that children can engage in complex recursive and bi-directional inferences about the mental states of informants and the data those informants present (Gweon, 2022; Landrum et al., 2015; Ronfard & Lane, 2018; see also Wu et al., 2021; Wu & Shulz, 2018 for evaluative domain). However, most studies and models target learners' inferences about a "generic" individual and their claims. Yet, to make sense of uttered information in daily life, we sometimes need to use informants' past comments.

We examined 5-, 7-year-olds, and adults' ability to use a person's evaluative history to constrain their inferences about that person's liking and wanting. Participants ($N=163$) went through three conditions where different informants received boxes containing different foods, ate them, and made evaluative judgments about those foods. The *always-likes* informant said "It's good" for the six boxes she received and "It's okay" for the final target box. The *never-likes* informant said "It's bad" for the six boxes and "It's okay" for the target box. The *baseline* informant received only the target box and said "It's okay". Participants: (1) rated how much each informant liked the target box using a scale ranging from "not at all" to "very very much" (2) decided whether each informant would want another target box, and, (3) compared the three characters' liking of the target box. We found that 1) children took the literal meaning of the expression ("It's okay") for each informant, while adults stated that the *always-likes* informant liked the food less than the *never-likes* informant. 2) Seven-year-olds (but not 5-year-olds) and adults considered the informant's history and inferred that the *never-likes* informant would want this food more than the *always-likes* informant. 3) Only adults stated that the *never-likes* informant liked the food the most, *always-likes* the least, and *baseline* in between. Thus, children used the literal meaning of the expression while rating liking on a scale. Yet, they considered the informant's history by age 7 when inferring whether the informants would want more of the target food. This contributes to our understanding of selective social learning by highlighting an additional step, the calibration we make using an informant's history when interpreting evaluative information—an ability that develops with age.

P3-146 - Children's reasoning about changes in academic performance over time

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Details

Changes in performance over time can be informative. When reasoning about other's academic performance, we do not merely assess their current performance, we also take into account changes in performance over time, such as improvement, decline, or consistency. How do children consider changes in academic performance over time in their reasoning and evaluation of academic achievement? This study examines this question in children aged 4-10.

In Study 1, we presented 4- to 10-year-olds ($N = 102$) with two characters and their performance on two exams over one semester. One character received 3 stickers on the first exam and 4 stickers on the second, showing improvement over time. The other character received 4 stickers on both exams, indicating consistency over time. Participants were then asked questions about their inferences (i.e.,

"Who is smarter?", "Who is more hardworking?"), and comparative evaluations (i.e., "Who would you award a prize to?", "Who do you prefer?", "Who will be more successful in the future?") about the two characters. Across all age groups, children believed that the character with consistent performance was smarter ($t(100) = -7.578, p < .001$). However, developmental changes became evident in their perceptions of effort. With age, children were more likely to consider the character showing improvement as more hardworking ($B = 0.43, SE = 0.12, p < .001$) and favored this character over the consistent one ($B = 1.26, SE = 0.24, p < .001$) (see Figure 1).

Study 2 extended this research to examine whether children's inferences and evaluations depended on the direction of performance change (improving or decreasing) among 4- to 9-year-olds ($N = 103$). The methods were similar to the first study, with the addition of a within-subjects condition where participants compared a constant character to another character whose performance decreased over time. The results for the improving condition were consistent with those of the first study (see Figure 2(a)). However, in the decreasing condition, with age, children increasingly favored the constant character ($B = -1.76, SE = 0.48, p < .001$) in all measures (see Figure 2(b)).

The first two studies focused on scenarios where both characters performed equally well on the final exam. In Study 3, we investigated whether the evaluations of younger children (4-6-year-olds, $N = 49$) regarding the constant character and the improving character were influenced by whether the improving character outperformed the constant character on the last exam. The findings showed that 4- to 6-year-olds viewed the improving character more positively only when this character outperformed the constant character on the last exam ($M = .65, t(47) = 2.67, p = .011$). When the two characters had matched final exam performances, the children's evaluations did not significantly differ ($M = .41, t(48) = -1.64, p = .108$).

Taken together, our findings suggest that between ages 4- to 10, children gradually begin to consider changes in performance over time. With age, they tend to evaluate improvement in performance more favorably than consistency. Additionally, they demonstrate flexibility in considering factors such as the direction of change and the comparative final performance when forming their evaluations.

P3-147 - Preference matters: knowledge of preference influences children's evaluations of the act of leaving a choice for others

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Details

The act of leaving a choice for others when selecting an item for oneself has been termed "social mindfulness" (Van Doesum et al., 2013). Previous work shows that adults and 6-year-olds evaluate someone who leaves a choice (i.e., two different items) for others as nicer than someone who leaves no choice (i.e., two identical items) (Zhao et al., 2021). However, these works have only investigated cases when the preference is unknown. Across two studies, we investigate how the knowledge of either the protagonist's or the beneficiary's preferences may influence adults and 4-10 years old children evaluate the act of leaving a choice (or no choice) for others.

We exposed children (Study 1, $N=96$; Study 2, $N=91$) to a series of stories involving characters choosing a snack from three items: two identical and a unique item. These scenarios were designed to create situations where the characters either leaving a choice (two different items) or leaving no choice to the beneficiary. We systematically manipulated the preferences of either the protagonist (study 1) or the beneficiary (study 2) as unknown, preferring the unique item, or preferring the identical item. After each story, children were asked to use a 1-20 scale (Bass et al., 2017) to evaluate how nice the protagonist was. Participants were also asked to make inferences on the protagonists' intentions (e.g., why do you think she took an apple). We found that children's evaluations of the character leaving a choice (or not) varied by knowledge of preference and age (see figure below). When the preference was unknown, both studies showed that, by age 6, children evaluated the act of leaving a diverse choice as nicer than leaving no choice ($p < .001$). When knowing that the protagonist preferred the unique item, children as young as 4 understood it is nicer to sacrifice one's own preference in order to leave a choice for others, and this effect became more robust with age ($r = .23, p = .028$). When knowing that the beneficiary preferred the unique item, children as young as 4 years old understood that it is mean to take away the only thing others prefer, and this effect also became more robust with age ($r = -.54, p < .001$). When knowing that the protagonist preferred the identical item, with age, children increasingly inferred that the act of leaving a choice may not reflect a prosocial intention, thus evaluated the act as less favorably ($r = -.22, p = .030$). When knowing that the beneficiary clearly preferred the identical items, with age, children increasingly rated the act of leaving two identical but preferred items as nicer than leaving a diverse choice ($r = .22, p = .039$).

Our results reveal important developmental changes between ages 4 and 10 in how children increasingly incorporate knowledge of preference into their evaluations of the acts of leaving (or not leaving) a choice; their evaluation develops from a mere understanding of the value of preference to an appreciation for the value of choice, and then further, to a flexible appreciation of both preference and choice.

P3-150 - Exploring the influence of semantic content on children's attention in scene viewing

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Details

The ability to selectively attend to information-rich regions is a foundational element of visual exploration and learning. Studies have consistently shown that adults' eye gaze to natural scenes (e.g., photographs of kitchens, lakes, restaurants) is predicted by the distribution of semantic content, or 'local meaning,' within the scene (Henderson & Hayes, 2017, 2018). It is unknown whether young children's eye gaze is similarly influenced by meaning. Several studies have recently demonstrated that features such as physical salience and proximity to the center of the screen play a role in where infants look when viewing natural scenes (Tummeltshammer et al., 2014; van Renswoude et al., 2019). Much less attention has been directed at understanding eye gaze of toddlers and preschoolers as they view natural scenes. In one of the few studies conducted in this age range, Helo et al. (2017) observed that toddlers as young as 24 months old demonstrate an impressive ability to integrate both scene context and perceptual features when directing their visual attention. However, they also observed that

compared to adults, perceptual features exerted a notably stronger influence on toddlers' eye movement patterns, suggesting a shift in the contributing factors influencing visual attention during childhood versus adulthood. Here we explore this development from infancy through early childhood by examining the role of salience and local meaning in the eye gaze of children between 4 and 48 months. We have recorded the spontaneous eye gaze of three samples of children as they viewed digitized photographs of real-world scenes—a sample of 4- to 12-month-old infants ($N = 92$, 121-379 days, 52 girls and 40 boys), a sample of 12- to 48-month-old children ($N = 82$, 363-1475 days, 41 girls and 41 boys), and a sample of 12- to 36-month-old toddlers ($N = 47$, 353-1107 days, 24 girls and 23 boys). While the first two samples have been reported on previously; we present all three samples here to demonstrate the development across a wide age span. We implemented 'Meaning Maps' as introduced by Henderson and Hayes (2017). For each scene, we used generated maps based on adult assessments of the information richness of small patches (e.g., 3°) of the scene. For instance, patches containing recognizable elements, such as a fragment of a car tire, were rated as having higher semantic meaning compared to patches representing features like the blue sky. We compared children's patterns of fixation as they viewed the scenes with feature maps for meaning, physical saliency, and proximity to the center of the screen. Across all three samples, regions higher in meaning were more likely to be fixated than regions lower in meaning (p 's $< .001$). In addition, meaning had a larger impact than physical salience in determining where children fixated. Furthermore, our results revealed developmental shifts in the impact of semantic meaning on attention. Interestingly, the effect of meaning increased with age during the first year ($\beta = .12$, $z = 3.60$, $p < .001$), but appeared to be relatively stable between 12 and 48 months.

P3-158 - Cultivating social curiosity in young children: an experimental approach to fostering young children's curiosity about others

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Details

To successfully learn from others, children must be curious about how others think, behave, and feel (Wu & Gweon, 2021). Curiosity about people, or "social curiosity", is defined as the desire to learn about others (Renner, 2006) and is one of the core dimensions of early curiosity (Lee et al., 2023). Despite its importance, there have been few attempts to foster children's social curiosity. To fill this gap, we investigated the malleability of social curiosity in children by developing a novel paradigm, the "Social Uncertainty Paradigm (SUP)". The SUP elicits social curiosity in two key ways: (1) by creating gaps in children's knowledge about a new person, and (2) by drawing their attention to these gaps (Lowenstein, 1994).

Children ($N=89$, $M=78$ months) were randomly assigned to one of three conditions: Social Curiosity (SC), General Curiosity (curiosity about objects; GC), or No Curiosity (NC). Participants had chances to learn about a new person, Sam (target of SC) and a new object, the Apple House (target of GC). Children in the SC group gained only minimal information about Sam, but abundant information about the Apple House (vice versa for the GC group, who learned more about Sam than the Apple House). Children in the NC group obtained an equal amount of information about both (Fig 1A).

After the learning trials, children completed four curiosity measures. In a Choice Task, they chose to learn about either Sam or the Apple House and justified their choice, later classified into six categories (Fig 1B). In a Rating Task, children rated how much they wanted to learn about each topic on a 5-point scale. Next, children completed two Extension Tasks, in which they were asked to select to learn about and rate another new person (Erin) and a new object (Strawberry House). The extension tasks tested whether elicited social curiosity is target-specific or generalizes to any target within the social realm.

We found that the probability of choosing Sam was significantly higher in the SC group (odds ratio (OR)=3.67) than in the GC (OR =0.19, p =.001) and NC groups (OR =0.76, p =.001). 78% of children who chose Sam in the SC group explained that their choice was primarily driven by their desire to address knowledge gaps. Relatedly, the mean curiosity rating for Sam was significantly higher in the SC group (M =4.29, SD =1.21) than in the GC (M =1.90, SD =1.45, p =.001) and NC groups (M =3.23, SD =1.68, p =.001, Fig 1C). For the extension tasks, children were marginally more likely to choose Erin in the SC compared to the GC group (p = .056) and the mean curiosity rating for Erin was significantly higher in the SC (M =3.78, SD = 1.34) than in the GC group (M =2.74, SD =1.81, p =.005, Fig 1D). No other comparisons were significant across the two Extension Tasks (ps >.05).

These new findings show that social curiosity in childhood is malleable, and identify critical mechanisms of social curiosity – i.e. the creation and perception of social knowledge gaps. Further, we found the first evidence that social curiosity about a new person may extend to other individuals, within limits. In our talk, we will also present data exploring sources of individual differences in children’s responsivity to the SUP (e.g., whether trait-level social curiosity predicts children’s social curiosity elicited by the SUP) and a follow-up study testing whether increases in social curiosity boost children’s prosociality.

P4-30 - Can children learn compositional number words from the syntax of nouns?

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Details

When languages develop expressions for large, exact numbers, such as ‘twenty-six’, they compose small numbers together through a system of generative rules. For example, Mandarin “èr-shí-liù”, 26, is composed directly of words meaning 2, 10, and 6 (Comrie, 2013). These are added or multiplied based on their syntactic position within the expression. While young children quickly master the generative structure of their native language, the structure of its number system remains opaque to them years after they begin to use number words (e.g., Guerrero et al., 2020).

However, this protracted timeline may be an artifact of the languages studied. The most commonly studied languages in the acquisition literature exhibit base-10 systems, in which only numbers greater than 10 exhibit compositional rules, limiting children’s early exposure to composition. Further, with morphological irregularities in the 10s (e.g., ‘twelve’ in English but not ‘two-teen’), compositional rules may not become apparent before age 4 or 5, when children have learned number words in the 20s or 30s.

It therefore remains possible that children might learn the generative structure of smaller base systems faster, as those systems express the earliest-learned numbers compositionally; especially if they reuse earlier-acquired morphosyntax. Even 2- and 3-year-olds may have the conceptual tools to do so: they understand the logical operations of conjunctive constructions (Bloom et al., 1980) as well as small, exact, number word meanings like “one” and “two”. Together, these might support the composition of numerical meanings (Hurford, 1987; Spelke, 2017), analogous to conjunctive forms attested across languages (e.g., ‘vingt-et-un’ in French). Older children who have already learned to accurately count large sets (a.k.a. “Cardinal Principle” or “**CP** knowers”) can compose small numbers multiplicatively when taught a novel construction with familiar syntax (Cheung et al., 2016). However, it remains unclear whether younger children who have not yet mastered counting in their native, base-10, system (a.k.a. “**subset knowers**”) are also capable of acquiring such rules.

In a pre-registered experiment, we ask how CP and subset knowers interpret numerical constructions composed of small number words. In the **Conjunction** task, children are asked for small sets of 2-4 objects featuring **implicit** conjunction (e.g., “Can you get *two-two* apples?”) or **explicit** conjunction (*two-and-two* apples). CP knowers are additionally asked for large sets of 11-19 (e.g., ten-and-one). Critically, many subset knowers do not understand number words greater than 2, raising the question of whether they can extend the novel constructions to create sets that they do not already have words for. In the **Multiplier** task, children are asked for 1-2 pairs of objects, expressed via a familiar **nominal** label (e.g., “[*one lunch / two lunches*] of bananas”, where each ‘lunch’ contains 2 bananas) or a **numeral** label (“[*one two / two twos*] of bananas”).

Data collection is ongoing (and will be finished this fall). If trends hold, results suggest that CP knowers more reliably interpret conjunctive number constructions when they contain the word “and”, but subset knowers have difficulty regardless. Also, both groups may benefit from the numeral label to create sets of “one two”, while only CP knowers create sets of four when asked for ‘two twos’ or ‘two lunches’.

P4-32 - Toward understanding early gender disparities in STEM: persistence on a science-based task

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Details

Recent findings suggest gender differences in STEM persistence may have origins in early childhood. Girls as young as four years old have been found to persist less on science tasks than boys of the same age (Gilligan et al., 2022; Kumar et al., 2023; Rhodes et al., 2019; Shachnai et al., 2022; but see Rhodes et al., 2020). It has been suggested that gender differences in persistence on science tasks are driven by stereotype threat affecting girls (Shachnai et al., 2022); however, no study has explored relations between persistence and stereotype awareness or beliefs. Moreover, studies to date have used digital tasks, raising the possibility that boys engage with the tasks longer than girls because of the format, consistent with previous findings on screentime (e.g., Rideout & Robb, 2020). The current study thus aimed to confirm and clarify the nature of gender differences in persistence on a science task in early childhood by using a table-top “sink or float” task and assessing children’s beliefs and knowledge related to science and gender.

Five- to 7-year-old children ($n=65$) from middle-class, mid-Atlantic US families ($M\ age = 76.27$ mons; $SD = 10.34$; 33 females; 55% White) completed a table-top science persistence task, adapted from the digital task used by Rhodes et al., 2019 and others. The examiner introduced the task saying, “It’s time for our science activity! We’re going to observe objects with our eyes and make a prediction, or a thoughtful guess, about whether it sinks or floats in water!” Children were shown everyday objects (e.g., pencil, egg) one at a time and asked to predict whether it would sink or float when dropped in an opaque tub of water. The examiner then tested the child’s prediction and provided feedback (“Your prediction was right [wrong]! It floated [sank]!”). The child was then asked if they wanted to continue playing the science game or do something else. Persistence was operationalized as the number of trials (up to 30) the child completed before ending the task. Science–gender stereotype awareness and beliefs were assessed, as were children’s science experience and knowledge (Table 1).

A mixed-effects survival model was used to estimate the risk of quitting the science task on a given trial. Gender, accuracy, and age were modeled as fixed effects, and subject-level random intercepts were included. In contrast to our preregistered hypothesis, we did not find a main effect of gender on persistence, $\beta=.27$, $SE=.42$, $z=.65$, $p=.51$. In exploratory models, lower overall accuracy and accuracy on the trial prior to quitting were both independently related to an increased risk of quitting, $\beta=-4.02$, $SE=.87$, $z=-4.63$, $p<.001$, and $\beta=.66$, $SE=.35$, $z=1.88$, $p=.05$. Children tended to persist less with age, $\beta=.03$, $SE=.01$, $z=1.97$, $p<.05$, and greater science knowledge was marginally related to a lower risk of quitting, $\beta=-.12$, $SE=0.06$, $z=-1.96$, $p=.05$. Gender did not interact with these variables to predict quitting. Stereotype awareness, beliefs, and science experience were not significant predictors, despite evidence that children in this age group were aware of and held gender-science stereotypes.

Together, these findings raise questions about the meaning of previous results finding gender differences in science tasks in early childhood and suggest further exploration of science knowledge and accuracy in children’s science interest and engagement.

P4-115 - All talk, no digital play: examining the effects of digital media use and social interaction on low SES children’s vocabulary knowledge

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Details

Background: During the first few years of life, young children’s vocabulary expands rapidly, from around 50 words at 18-months to over 500 by 30-months (Fenson et al., 1994). This rapid growth is fueled, in part, by relevant language experiences and input from the world around them. These relevant sources of input include high quality language from caregivers and other individuals through social interaction, as well as from the increasing presence of digital media in children’s lives. By the time children are just two-years-old, they experience upwards of an hour of screen time per day (Rideout & Robb, 2020). This amount of screen time is substantially higher for children from low-income households or whom identify as part of a marginalized group (Rideout & Robb, 2020). A growing number of studies have suggested both positive and negative effects of digital media exposure on children’s language development (e.g. Madigan et al., 2022; Jing et al., 2023); however, the mechanisms or pathways by which media use alters language development remain unknown. In the current study, we examine whether increased

social interactions with other individuals may buffer the potentially detrimental language effects of social media use among a socioeconomically diverse sample.

Methods: 273 caregivers of children between 17-30-months completed questionnaires about their family demographics (parent education, income), and their child's technology use (MAQ; Barr et al., 2020), vocabulary (MCDI, Fenson et al., 1994), and daily routines and social interactions ("On average, how many people does your child interact with on a daily basis?").

Results: A series of Pearson's Correlations revealed that greater video use was associated with less vocabulary knowledge, $r(271) = -0.12, p = 0.04$, less human interaction, $r(260) = -0.20, p = .001$, and coming from a lower SES household, $r(271) = -0.21, p < 0.001$. A multiple regression model examined the interaction between SES, age, amount of human interaction, and amount of video interaction on vocabulary knowledge. A three-way interaction between age, amount of human interaction, and amount of video interaction emerged ($b = 52.57, t = 2.65, p = 0.009$), as did a three-way interaction between SES, age, and amount of human interaction ($b = 26.12, t = 1.98, p = 0.05$).

Discussion: Children who experience less human interaction and greater technology use have smaller vocabularies, and this disparity becomes greater as children get older. Although children from low SES households are likely to experience less human interaction and greater technology use, putting them at risk for poorer vocabulary outcomes, our findings suggest that increasing the amount of human interaction older low SES children engage in can serve as a protective factor for their vocabulary outcome.

P4-147 - Evaluation of 'Good Trouble' in children of two cultures (US and India)

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Details

Do children always see rules as enforceable or appreciate challenging them under certain circumstances? By 3-years of age, children internalize and enforce social norms on others. They also understand that social norms are context-sensitive and conventional, depending on shared intentionality and agreement. One consequence of conventionality is that, over development, children construe norms as arbitrary, and therefore *changeable*. Thus, the current research asks if children value 'Good Trouble', i.e., the challenging of arbitrarily inequitable rules. Furthermore, because protest often comes at a cost for the protester, we asked whether children's evaluation of protest vary with consequences. Finally, we also asked whether children's culture influence protest evaluation. We tested groups of 5-to 9-year-old children from urban India and the US (N=178). Children saw a fictional town that follows an arbitrary rule of food distribution i.e., one group(unprivileged) gets less food than another group(privileged). Thereafter, a person from either the privileged group or the unprivileged group engages in 'Good Trouble'. This protestor challenges and breaks the extant rule by distributing resources equally. As the dependent measure, children were asked if this character should continue to protest even if faced with various consequences for breaking the rule. We manipulated the severity of 4 graded consequences ('no play', 'no food', 'locked with no food and play', 'no one in the protestor's group gets food'). Based on previous studies showing a developmental lag in the expression

of a disadvantageous inequity aversion in Indian children compared to US children, we hypothesized that US children would show faster growth toward positively valuing good trouble. We also hypothesized that children in India would show some indifference to the severity of consequences associated with protest due to studies indicating that in non-WEIRD societies, advantageous inequity aversion is not prevalent before 12 years of age.

Overall, and as predicted, results from a generalized linear mixed model show that as a function of age (in years), US children compared to Indian children are increasingly inclined (OR=1.38, 95% CI:1.08–1.77, $p < .01$) to support good trouble protesters. Additionally, among the US children, the main and interactive effects of age groups (5-6 years, 6-7 years, 7-8 years, 8-9 years) and four consequences revealed that from 7-8 years of age, children factor severity of consequences in their protest evaluation. More specifically, they think 'no play' for the protestor is less severe compared to when 'everyone in the group gets no food' (Figure 1). However, within India, children are less sensitive to the severity of consequences i.e., the interactions between age groups and consequences were not significant. Finally, we also ran separate analyses for the protestor type (privileged or unprivileged) and the four consequences as predictors for each country. Results show that in both cultures, children are more inclined to support the protest of privileged characters compared to unprivileged characters when the consequence is 'no play'. Children may think that privileged characters should have more responsibility in engaging in good trouble if associated costs are low. These results are interpreted in the context of developing conventional and moral normativity in children, a development that reflects significant cultural differences.

P1-1 - Investigating individual differences in parents' science explanations

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Details

Adults vary in how they explain science to children and to other adults (Vlach & Noll 2016). They also find some questions more difficult to answer than others, but little is known about the factors driving their intuitions (Nguyen & Rosengren, 2004). This project examines factors such as parents' comfort discussing topics, their perceptions of how much knowledge they have related to a topic, and perceptions of their child's ability to comprehend and emotionally handle topics. Parents of 5-10-year-old children responded to *why* science questions using the Prompted Explanation Task (Mills et al., 2022) and answered questions regarding their perceptions of each question, including question difficulty. Data collection will be complete by late January (planned sample based on power analysis = 90) and analyzed using a multilevel modeling approach to understand how parents' difficulty ratings of items relate to factors like parents' comfort, knowledge, and perceptions of their children's abilities. These research findings will have implications for understanding and potentially improving parent-child conversation about science.

P1-2 - I want it that way: preschoolers' choice and interest in mathematics activities

Nicole Scalise ¹, Morgan Conway ¹, Amya Dahl ¹

¹ Washington State University

Details

Many children and adults dislike math. As early as preschool, children show variability in their math interest - some children like math more, others less. This difference matters: Children with higher math interest tend to have higher math achievement in later elementary school compared to children with lower math interest. The present study examines whether allowing children a choice of early math activities increases their situational (i.e., immediate, context-specific) interest in math. Three- to five-year-old children ($n = 42$, $M = 50.1$ months, $SD = 7.2$ months) were asked to play with three math activities (e.g., a numbered puzzle, a counting activity, a balance scale), then asked how much they liked each activity. Half of the children were randomly assigned to choose the order in which they played with the math activities, and half of the children were given the activities in a predetermined counterbalanced order. Data collection is ongoing, however, under our Sequential Bayes Factor design the intermittent analyses suggest anecdotal evidence that children in the choice condition reported higher interest in the math activities than children in the no-choice condition, $BF_{10}=2.98$, $t(35.55)=2.42$, $p=.021$. These results suggest that incorporating choice into young children's mathematical experiences may lead to increased math interest, which may ultimately lead to improved mathematical development.

P1-3 - Young children talk differently about their own mental states as compared to those of other people

Paul Harris¹

¹ Harvard University

Details

It is often assumed that children conceptualize their own mental states and those of other people similarly (Bartsch & Wellman, 1995; Gopnik, 1994). However, a recent analysis of the production of *know* showed that young children talk differently about their own knowledge states as compared to those of other people (Harris et al., 2017). In a follow-up study of the mental state language of 5 Mandarin-speaking children (aged 25-40 months), we find that references to the self are much more frequent than references to other people for three key mental terms: *want* (*yao4*); *know* (*zhi1dao4*); and *think* (*xiang3*). Moreover, the relative frequency with which children produce those terms in the context of assertions, denials and questions varies markedly depending on whether children are talking about themselves or another person. We discuss how far these findings undermine the assumption that children's theory of mind is person-neutral.

P1-4 - Parents' perception of video chat ease-of-use predicts their and their child's enjoyment of family video chats with a grandparent

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Jade Stone¹, **Kendall Shaw**², **Jessica Langlois**², **Hayley Katz**², **Lauren Daniels**², **Narindra**
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Details

Families use video chat to maintain relationships across distance (Strouse et al, 2021) but frequently report that children disengage during video chat (Myers & McKenney, 2021). We hypothesized that prescribing structured activities during family video chats could increase enjoyment, but only if they did not technologically overwhelm families.

We randomly assigned grandparent-parent-child (18-71mo) triads (N = 71) to engage in structured activities (play, reading) or video chat without any specific instructions (control). Structured activities had 3 types: led by the grandparent, matching participation from the grandparent and child, and an on-screen activity. We used repeated-measures ANOVAs to examine interactions between condition, activity type, child age, and participants' ratings of ease-of-use of video chat in predicting enjoyment of the chats.

Grandparent enjoyment was highest. Parent and grandchild enjoyment were lower, with the greatest gap in the unstructured control condition. Parent ease-of-use predicted greater parent ($p = .03$) and child ($p = .01$) enjoyment. Within structured activities, parent ease-of-use predicted child enjoyment

especially during activity types that required greater parent involvement (matching $p = .008$, and on-screen $p = .04$).

Structured activities support engagement, but parents who find video chat harder to use may wish to choose activities led by the grandparent to avoid frustration and child disengagement.

P1-5 - Autistic experiences and perceptions of stimming: The role of repetitive behaviors in emotional expression and social communication

Isabelle Morris ¹

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Details

Repetitive behaviors, also called “stimming” in the autistic community, are a hallmark trait of autism. Although it is known that autistic children and adults frequently engage in stimming, much less is known about the function(s) of stimming for autistic individuals. Autistic adults ($N = 131$) completed a novel survey about their general perception of stimming (e.g., as a positive/negative experience); relation between stimming and emotion (e.g., “I stim when I feel...”, “When I feel ____, I stim by ____.”); and the role of stimming in social relationships/communication (e.g., “Stimming helps me connect with other autistic people”, “When I see other autistic people stimming, I can usually tell what they are feeling”). The results revealed that while there are idiosyncratic stim/emotion pairings there are also common expressions of emotion through stimming, for example hand flapping when excited. Furthermore, nearly three-quarters of participants indicated they were able to understand what others were feeling when they saw them stimming. The results of this study suggest that studying stimming may provide a new avenue for understanding how social cognition, especially emotion recognition, and social-communication develop in the autistic population.

P1-6 - How can parents encourage infants’ attention to books when reading together? A head-mounted eye tracking study on parent-infant shared book reading

Isabelle Pai ¹, Erim Kizildere ¹, Lisa Oakes ¹, Katharine Graf Estes ¹

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Details

Parent-child shared book reading supports early language, socio-emotional and cognitive development. When reading with their children, parents provide verbal and physical cues to encourage children’s attention to the book and stimulate their interest. This study investigated how infants ($n = 30$, 8 - 11 months) pay visual attention to the books during parent-child joint reading tasks, with the use of head-mounted eye trackers.

Our results show that infants’ visual attention to the book was strongly correlated with the number of words parents produced ($r(28) = 0.75$, $P < 0.001$). Infants’ attention to the book was also significantly

associated with parents' pointing to the book ($r = 0.58$), number of questions ($r = 0.45$), and labeling of objects ($r = 0.70$), but not with parents reading the content of the books word for word ($r = 0.28$). This result highlights the importance of active parental participation, over passive text reading, in encouraging infants' attention to book reading.

P1-7 - Calling all caregivers: examining 'technoference' in children's museum exhibits

Samuel Vasich¹, Megan Lorenz¹

¹ Augustana College

Details

Children's museums provide a space for meaningful caregiver-child interactions, which have been shown to promote the development of cognitive skills-including language and self-regulation. Despite their importance, previous research has demonstrated that caregiver-child interactions are negatively impacted by "technoference" - when personal digital devices disrupt communication. The present study examined if the frequency of "technoference" differs in exhibits designed to elicit different types of caregiver-child interaction and how the frequency compared to other caregiver behaviors. We observed 77 caregiver-child dyads in an exploratory exhibit ($n=43$) and a roleplaying exhibit ($n=34$) and recorded what each member of the dyad did every 20 seconds. Caregiver behaviors were collapsed into four categories: phone usage, observing, teaching, or other. A mixed-effects ANOVA revealed no significant main effect of exhibit type on "technoference", but highlighted that observing occurred more frequently than teaching and phone usage, and teaching occurred more often than phone usage (Figure 1). The results suggest that "technoference" was a noticeable but minor interruption to the caregiver-child interactions and emphasize the importance of having well-designed museum exhibits that further engage families in play to continue to minimize these distractions.

P1-8 - Mechanisms underlying children's generalizations about social groups

Allie Chodes¹, Sona Kumar², Kathleen Corriveau¹

¹ Boston University, ² Purdue University

Details

Understanding how children make inferences about social groups is crucial to understanding why stereotypes develop. The current study investigated eighty 4- to 8-year-old children's propensity to make generalizations about social group members and their justifications for these inferences. Participants were exposed to either group-level or individual-level trait information about novel social group members. Then, children were invited to generalize the trait to another group member and to justify their decision. Results indicate children were less prone to generalizations ($p < .001$) and less likely to give essentialist justifications when introduced to individual-level traits first. Findings suggest that discussing traits of individual group members does not necessarily lead to essentialist beliefs or broad generalizations. This insight holds significance in real-world scenarios where children frequently

encounter individual group members and contributes to our nuanced understanding of stereotype development and its potential application in educational or social settings.

P1-9 - Are children influenced by brand characters similarly to entertainment characters when evaluating products featured in advertisements?

Lauren Cunningham¹, Isabelle Harden¹, Allison Williams¹, Kathleen Corriveau¹

¹ Boston University

Details

Understanding which brand characters children find most appealing and trustworthy in advertisements is essential for companies in influencing their marketing strategies. This study aims to see if young children respond to the presence of brand characters similarly to entertainment characters in their evaluation of products. The current study investigated children's preferences for objects featuring images of entertainment or brand characters, children's parasocial relationship towards these characters, and the monetary value they placed on these objects. Results showed that children preferred and valued objects featuring brand characters at similar rates to objects featuring entertainment characters, $F_s < 2.44$, $p_s > 0.101$. Additionally, there was a significant correlation between children's preference and monetary value of the objects ($r = 0.63$, $p < 0.001$). The study's findings contribute to understanding children's ability to evaluate products featuring a range of characters, demonstrating children are influenced by brand characters similarly to entertainment characters when evaluating products featured in advertisements.

P1-10 - Early threads of connection: probing infants' early understandings of caregiving relationships

Christina Steele¹, Megan Richardson¹, Azwayla Taylor¹, Denisse Lopez¹, Denis Tatone², Ashley Thomas¹

¹ Harvard University, ² Central European University

Details

Caregiving relationships, characterized by strong attachment and asymmetry in obligation and skills, are central in the lives of infants and children. The current studies investigate whether 8-to-10-month-old infants ($n = 40$) recognize this type of relationship. They test the hypothesis that infants do this by attending to two cues, affiliative touch and physical size, to predict who will respond to distress. In study 1 ($n = 15$ pilot; $n = 55$ ongoing), infants expected larger characters to respond to the emotional and physical needs of smaller characters, only when they saw affiliative touch (proportion looking time at large character: $BF_{10} = 15.41$; first looks towards large character: $BF_{10} = 9.12$). In study 2 ($n = 25$), they did not expect smaller characters to respond to larger characters (proportion looking time at large character: $BF_{10} = 0.78$; first looks towards large character: $BF_{10} = 1.65$), suggesting they expect asymmetrical roles in caregiving relationships. Collectively, these findings suggest that from an early age humans have an early-emerging ability to represent key members of their social world.

P1-11 - Early-emerging nuance in children's reasoning about social mobility

Rachel King¹, Isobel Heck², Reut Shachnai³, Molly Gibian⁴, Katherine Kinzler¹

¹ University of Chicago, ² University of Rochester, ³ Yale University, ⁴ Stanford University

Details

Meritocratic narratives pervade American society despite myriad structural obstacles that hinder upward mobility (Chetty et al., 2017). We investigated the early roots of social mobility beliefs, focusing on when in life mobility beliefs emerge and from where they stem. In three studies, 5- to 12-year-old children ($N = 485$) viewed a ladder representing American society and answered questions about (1) people at the top vs. bottom of the ladder and (2) the possibility of upward vs. downward mobility. Results reveal early-emerging nuance in children's reasoning about social mobility. With age, children increasingly rated upward (vs. downward) mobility as harder to achieve, $B = .40$, $p < .01$. Yet, children also possessed a rosy view of their own mobility, expecting to achieve higher status than their parents, $t(19) = 3.96$, $p < .001$. Further, the more children's parents believed in the possibility of social mobility, the less children viewed upward mobility as hard to achieve, $B = -.23$, $p = .017$. The results suggest that children believe upward mobility is difficult to achieve, yet also endorse meritocratic narratives and possess a rosy view of their own mobility prospects. These mobility beliefs reflect patterns evident in American society but are also influenced by children's parents. The findings provide crucial insight into the developmental roots of social mobility beliefs — beliefs with widespread impacts on both individual and societal scales.

P1-12 - Temporal dynamics of children's self-regulated eating decisions for food and food brand logos

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Details

Individuals can make healthier food choices by engaging in greater self-regulation during their decision-making process. This involves consciously selecting less tasty but nutritious options or refusing tasty yet unhealthy options, which prioritizes long-term health benefits over immediate satisfaction from palatable food. In adults, speedy (less delayed) integration of health attributes over taste attributes promotes healthier food choices. However, the temporal dynamics of self-regulatory dietary decisions, especially concerning both food and food brand logos, remain unknown. In this study, we examined how children's self-regulated eating decisions are related to the temporal dynamics of integrating health and taste attributes in the food and food brand logo decision-making process. Eighty-five children between 8 and 12 years ($M_{age}=10.4$, $M_{BMI\ percentile}=64.1$, 49.4% girl, 57.6% POC) rated each of 60 foods and 60 brand logos based on perceived health and taste attributes and completed binary choices using a mouse tracking method (Fig. 1). As the difference of the significant time of integration onset between health and taste decreased, the self-regulated decisions increased for both food ($r = -.244$, $p = .025$) and brand logos ($r = -.279$, $p = .012$) (Fig. 2). Our findings suggest that children's self-regulated eating decisions are associated with the temporal dynamics of health and taste attributes in the decision-making process, extending to both food and food brand logos.

P1-13 - Navigating generics: children and adults diverge in communicating about restricted sociocultural patterns

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Details

Communicating about societal disparities is a thorny issue. Can patterns of oppression be acknowledged with generic claims like “women have trouble getting tenure in STEM” without implying inherent group flaws and fostering bias, as generics have been shown to do (Hammond & Cimpian, 2017; Rhodes et al., 2012)? We examined how 4-7-year-olds ($N=45$) and adults ($N=159$) respond to context cues signaling that speaker uses a generic to convey either a broad context-universal regularity, or a regularity restricted to a “sociocultural bubble”. Adults endorsed generics flexibly, tracking context cues ($p<.001$). Older children showed a similar but weaker trend ($p<.001$). Younger children struggled, over-attributing socially contingent properties to the group beyond the “bubble”, on par with context-general regularities ($p=.421$; see Figure 1). This reveals a troubling discrepancy between children and adults’ interpretations of generics, opening doors for miscommunication. When parents or teachers highlight problematic patterns with the hope of promoting social change, children may perceive their assertions as claims about group’s broad, unalterable attributes. We discuss strategies to mitigate this in educational and family communication settings.

P1-14 - The role of social engagement in infants' preference for infant-directed speech

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Details

A substantial body of work has shown that infants prefer infant-directed speech (IDS), characterized by exaggerated pitch and slower enunciation, starting from the first months of life (e.g., Cooper & Aslin, 1990; ManyBabies Consortium, 2020). Usage of IDS also influences social preference —infants look longer at an individual’s face after hearing them speak in IDS, when compared to the face of someone who used adult-directed speech (ADS) (Shachner & Hannon, 2011). Given that IDS in infants’ natural environments are largely accompanied by active social interaction (often from a caregiver), how much are infants’ IDS preferences driven by a preference for *social engagement*? In our experiment, 5-6-month-old infants watch two characters who speak using equal amounts of IDS and ADS. One character directs IDS towards the participant infant, while the other uses IDS with an infant character on the screen. The character that directs IDS towards the participant uses ADS with the on-screen infant character, and vice versa. During test trials, infants’ looking time towards both characters is measured. If infants look more at the character that directed IDS towards the participant, that would indicate social engagement as a factor influencing IDS preference. Data collection is ongoing, but we anticipate having a full data set by March 2024.

P1-15 - "But I want it!" Children's talk about desires and their negotiation of desire conflicts

Michal Miaskiewicz¹, Paul Harris¹

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Details

With notable exceptions (Bartsch & Wellman, 1995; Karniol, 2010), children's desires have received little attention. This project aims to portray the "ecology" of children's desires, especially when they conflict with those of others. Using the CHILDES database, we coded 2- to 6-year-old children's *want* utterances for affirmations, denials, or questions, and for whose desire was referenced. We coded *want* conflicts for: 1) whether the child was prevented from doing what they wanted or denied something they wanted the interlocutor to do; 2) whether the interlocutor referenced their own welfare to justify what they wanted; 3) how each side tried to get their way; and 4) who finally got their way. Ongoing analyses indicate that children mostly affirm or deny their own desires but ask questions about their interlocutors' desires, repeating the pattern for *know* (Harris, Yang & Cui, 2017). We are currently investigating if children yield more often when their interlocutor references their own welfare than when the interlocutor invokes an impersonal norm.

P1-116 - Deaf children who use American Sign Language at home learn mathematical equivalence when instruction includes gesture

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Details

Deaf students underachieve in mathematics but the causes of it remain understudied. Proficiency in sign language correlates with mathematic development but more than 90 % of deaf children are born to hearing parents. Not all hearing parents learn sign language. Few studies investigated how children learn from non-native language models.

In this study, we used video instruction of mathematical equivalence that includes gesture to 43 deaf students (N = 43, mean age of ASL acquisition age was 2.07 years). Children solved 9 pre-test problems (e.g., $3+4+5=_+5$), then watched video instruction and solved 9 post-test problems.

Signing at home significantly predicted children's learning for both deaf and hearing families; especially when comparing non-signing and signing hearing families. Additionally, children who sign at home produced more ASL-gesture mismatches (implicit index of emerging mastery) after instruction. This result underscores the importance of the language environment for acquisition of mathematics and encourages accessible communication.

P1-117 - Children learn novel causal events from realistic and fantastical storybooks

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Details

Previous research demonstrates that young children are susceptible to the “reader's dilemma” (i.e., the struggle to learn novel information from fictional stories); however, evidence on the impact of multiple fantasy types on children’s learning is mixed. Work in this area has focused on children’s analogical transfer to real-world solutions, or on children's generalizations from non-real causal chains. Here, we investigated preschool-aged children’s ($n = 86$) ability to generalize novel concepts from stories using a causal event that exists in the real world (flicking one’s wrist causing a stone to skip across the water). We randomly assigned children to read one of four picture books with increasing levels of fantastical elements: baseline (real world), basic (fantastical setting), intermediate (talking animals), or deep (flying characters). Children were asked, “If I were at a river by my house and I flicked a flat smooth stone towards the water, what do you think happened?” We found that children comprehended and generalized information from picture books better with age ($p < .001$). Importantly, they did so equally well in the baseline and fantasy conditions, and there were no differences in children’s learning based on the level of fantastical elements in the story. We suggest that young children can overcome the “readers' dilemma” when the novel causal event being taught exists in the real world, even if the story itself contains multiple elements of fantasy.

P1-118 - children's story world absorption

Mg Prezioso¹

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Details

Story world absorption is a mental state in which a reader’s attention is captured by immersion in a story. Although there is extensive research on story world absorption in adults, there is very little research on story world absorption in children. This mixed-methods study investigated the mental state of story world absorption in 66 children ages 9-11 years old, asking how they experience that state. Motivated by the hypothesis that, despite differences in their reading frequency, most children can become absorbed by stories, we asked a diverse sample of readers to report on their reading experience. Although 9-year-old frequent readers reported greater overall absorption than 9-year-old occasional readers, 10- and 11-year-old readers reported similar levels of absorption, regardless of their reading frequency. Additionally, frequent and occasional readers across age groups were similar in the extent to which they differentially endorsed the four dimensions of the absorption experience: attention, transportation, emotional engagement, and mental imagery. Semistructured interviews conducted with a subset of the sample (18 children) provided additional information regarding the text types and features that are most likely to absorb child readers. Overall, the findings underline the possibility that both frequent and occasional child readers can become absorbed in a fictional world.

P1-119 - "I wanted to challenge myself!": Children's developing metacognitive understanding of effort in a building task

Sarah Kiefer ¹, David Sobel ¹

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Details

Few studies have explored the metacognitive mechanisms behind effort-based decision making in dynamic paradigms designed intentionally for young children. Rather than scaling down existing adult methods, we introduced children to a novel paradigm that allowed us to explore a series of their decisions to take on tasks that required high versus low amounts of effort to complete. Five- to- 7-year olds ($N = 100$, N determined by *a priori* power analysis assuming medium-to-large effect sizes) chose from easy and hard building instruction cards to construct a gear machine. After each card choice, children received 90 seconds to complete the instruction and were given explicit feedback on their build accuracy before making their next choice. We compared a series of models to investigate the role of children's accuracy and previous card decisions in predicting their choice of a hard as opposed to an easy set of instructions. Results revealed that children's hard choices were related to higher accuracy scores on previous hard choices, $B = 1.34$, $SE = 0.35$, Wald $\chi^2(1) = 14.95$, $p < .001$, but were not related to scores on previous easy choices. These results suggest that across the procedure, children monitored their performance on their intentional choice of hard challenges and used this information to adaptively control their decision making about future effort. These findings reveal new insights into children's metacognitive reasoning about effort allocation.

P1-120 - Preschoolers' mathematical language learning during book reading with an AI smart speaker

Jisun Kim ¹, Daniel Vargas-Diaz ¹, Shannon Mury ¹, Caroline Hornburg ¹, Koeun Choi ¹

¹ Virginia Tech

Details

An emerging body of literature suggests that young children can interact with and learn from AI voice assistants (Xu et al., 2022). However, there remains a gap in understanding how these interactions with AI voice assistants can be used to support preschoolers' engagement in and learning of mathematics through repeated exposure. This study aims to systematically evaluate the impact of AI voice assistant technology on preschoolers' mathematical language learning using a randomized pretest-posttest experimental design. Each child completed 5 sessions, including 2 testing and 3 reading sessions. Children were randomly assigned to one of three reading conditions: math book with questions, math book without questions, or non-math book with questions to read a storybook with an AI voice assistant. Before and after the reading sessions, children were assessed on their mathematical language, numeracy skills, and receptive vocabulary. Preliminary analysis, based on 12 children ($M = 59.33$ mos, $SD = 7.58$, 3 girls), showed that on average, children had higher scores on mathematical language post-tests ($M = 17.75$, $SD = 3.11$) compared to pre-tests ($M = 16.67$, $SD = 2.46$), which was marginally significant ($p = .071$). On numeracy tests, children's scores were not significantly different between the pre-and post-tests. No significant condition differences were found with the current sample size. To ensure robust testing, ongoing efforts will focus on increasing the sample size.

P1-121 - Exploring the numerical processing of probabilistic inferences in children by hierarchical drift-diffusion model

Siyi Liu¹, Yanjie Su¹, Dachuan Suo², Jiaxuan Zhao³

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Details

Probabilistic inferences have been explained by two hypotheses. *Logic hypothesis* proposed that infants enumerated all the possible events or consequences to get conclusions, whereas *probabilistic hypothesis* proposed that infants were sensitive to the numerical relationships between populations and samples. We proposed that the two numerical core knowledge system, object file system (OFS, for small number processing) and approximate numerical system (ANS, for large number processing), underlay probabilistic inferences, corresponding to the two hypotheses.

To examine children's probabilistic inferences in small- and large-magnitude condition (within-subject design), we recruited 97 seven- to 10-year-old children and conducted two-alternative forced-choice (2AFC) behavioral experiment, then utilized hierarchical drift-diffusion model (HDDM) to distinguish children's decision making in different conditions.

The results suggested that children made precise and strict decisions in small-magnitude condition with higher speed of evidence accumulation, whereas they made approximate and loose decisions in large-magnitude condition with lower speed of evidence accumulation.

P1-122 - Combining forces for causal reasoning: children's predictions and explanations

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¹ University of California, San Diego, ² Koc University

Details

Predicting and explaining causal events are intuitive processes, essential for early cognitive and language development. We asked whether children showed similar patterns when making nonverbal predictions and generating verbal explanations for physical causal events. We investigated 4- to 6-year-olds' (N=36) intuitive physics with two tasks about interactions of multiple forces. Animations depicted physical configurations of hair dryers pushing a ball, differing in the number of forces or dimensions involved. Children predicted the endpoint of the ball in one task, and explained the outcome in the other task. Results showed that predictions and explanations shared some similar patterns, but children's performances in two tasks were not directly associated. Moreover, while predictions were less accurate with more complex trials, explanations were better with trials of intermediate complexity. These findings suggest that although 4- to 6-year-olds can predict and explain complex physical interactions, accuracy in prediction might not go parallel with better explanations.

P1-123 - Learning the demographics of pain: adults believe age and gender affect physical pain sensitivity, but 4-6 year-olds do not

Nicole Steiner¹, Katharine Tillman¹

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Details

In the US, the physical pain of women, children, and Black individuals is undertreated compared to that of men, adults, and white individuals (Cohen et al., 2014; Franck et al., 2010; Dore et al., 2018). Past research has examined gender, age, and race related pain-sensitivity biases individually, but the present research examines them together. In the present studies, adults (n=307) and children (n=120, age 4-6 years) read vignettes about diverse characters suffering specific injuries (e.g., papercut; broken arm), and rated each character's pain on a 1-7 scale. Mixed effect linear regression models were used for analysis. In Study 1, injury type was significant (Wald $\chi^2(7) = 4267.77$, $p < 0.01$), and adults showed the expected age bias ($\beta = 0.535$, $p < 0.01$) and a marginal gender bias ($\beta = 0.129$, $p = 0.058$). In Study 2 with 4-6 year-old children, injury type was significant (Wald $\chi^2(7) = 322.67$, $p < 0.01$). However, the 4-6 year-olds ratings did not show effects of character age ($\beta = -0.02$, $p = 0.92$), race ($\beta = 0.026$, $p = 0.92$), or gender ($\beta = 0.126$, $p = 0.61$), nor did these factors improve the fit of the model. Two explanations are possible. One, these biases emerge after the age of 6, with substantial cultural exposure required to form them. Two, the rating scale, specific injury recognition, and/or perspective taking may have task demands too high for 4 to 6-year-olds, thus obscuring their biases. Future research should sample older children, or substitute in a simpler rating scale.

P1-124 - Children's developing concepts of the praiseworthiness of actions

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Details

Do children praise judiciously? Most work on praise has focused on how *receiving* praise influences children's learning and motivation, but few studies have investigated when and why children praise others. The present work seeks to understand the conditions that prompt children to endorse or withhold praise, and their underlying motivations for doing so. In Study 1, five- to 8-year-olds were introduced to two characters who had an equal number of stickers. A third character then divided more stickers between those two characters equally or unequally (within-subject). Children were asked whether that distributor should be praised ('You gave all your stickers away, that was so nice!' or should just receive neutral feedback ('You gave all your stickers away'). Children endorsed praising the equal distributor 83% of the time, significantly greater than the unequal distributor (52%), controlling for age, $B = 1.56$, $SE = 0.70$, Wald Chi-Squared(1) = 4.94, $p = .03$. In Study 2, five-to 8-year-olds were shown the same stories, except that the two characters started with an unequal number of stickers, and the third character's unequal distribution resulted in the characters having the same number of stickers in the end. Children did not endorse praising the equal (84%) and unequal (79%) distributors differently. Children did not praise all distributors. Rather, they selectively praised distributors who did not cause inequities.

P1-125 - Understanding parental factors associated with toddlers' video viewing: a chained mediation model investigating the roles of parental emotion regulation, media use, stress, and media use motive

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Details

The American Academy of Pediatrics advises against video viewing for children under two years due to potential negative effects on cognitive development (AAP, 2016). However, toddlers' daily media consumption often exceeds these guidelines (Rideout, 2020). Prior research has shown parental factors influencing toddlers' media use, including emotional regulation, media use, stress, and media use motives (Cingel & Krcmar, 2013; Holmgren et al., 2022; Shin et al., 2021). This study examined the interconnections of these factors in shaping toddlers' screen use. Mothers of toddlers (18-36 months; N = 296) completed an online survey, reporting their emotional regulation (expressive suppression, cognitive reappraisal), parenting stress, media use motives, as well as viewing for both mothers and children. Using Structural Equation Modeling, we fitted a chained mediation model (Figure 1; RMSEA=0.04). We found that cognitive reappraisal ($B=-0.25, p<.001$) and expressive suppression ($B=0.47, p<.001$) predicted parenting stress, which, in turn, was associated with parental regulatory media use motive ($B=0.22, p<.001$) and children's video viewing ($B=0.24, p<.001$). Moreover, parental expressive suppression ($B=0.20, p<.01$), not cognitive reappraisal, was associated with parental video viewing, subsequently linked to children's video viewing. The findings suggest the key role of parental emotion regulation in digital parenting and young children's media use.

P1-126 - Math instruction that includes gesture improves learning for deaf and hearing children but only if gesture is simultaneously presented with language

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Details

Deaf students often demonstrate poor math skills but this is poorly understood. To improve math learning, this research determined whether **gesture** in math instruction: (1) improves learning for deaf and hearing individuals and (2) enhances learning when it is *temporally synchronized* with accompanying language (English for hearing and ASL for Deaf children). Deaf (49) and hearing children (134; 7-10 years old), individually watched a randomly assigned instruction video using 2 correct strategies (across language and gesture) for solving equivalence problems (e.g., $3+4+5= _ +5$): 1) language *simultaneously* occurred with gesture (2) gesture occurred *before* language, 3) gesture occurred *after* language and (4) language occurred *without* gesture. Children participated in a pretest-instruction-posttest design. Instruction significantly improved learning; increasing on average 3 correct solutions (out of 9) after instruction. *Language instruction occurring with simultaneous gesture* conferred the greatest learning advantage across all children. Features of gesture may improve learning across diverse groups of children.

P1-127 - Feeling guilty around child's screen use: the associations among parental awareness, agreeableness, and adherence related to media guidelines, child screen use, and maternal media guilt

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¹ Virginia Tech

Details

Given the American Academy of Pediatrics (AAP) guidelines concerning media use for young children and their cognitive development (AAP, 2016), a notable gap exists between these recommendations and their actual parenting practices (Rideout & Robb, 2020). A few qualitative studies have explored parental guilt in this context (Mauk, 2021), but limited research has quantitatively assessed maternal guilt regarding children's screen media use. Our study aimed to measure maternal media guilt and identify associated factors. In our online survey of 95 mothers with children aged 0-5 years, maternal media guilt, child's actual screen media use, and maternal awareness of, agreeableness with, and adherence to the AAP media guidelines were measured. A linear regression model examined the relations between the key variables, controlling for maternal age, child age, child gender, and child ethnicity. The results revealed that maternal media guilt was positively related to their agreeableness with the guidelines ($B = 0.47, p < .001$) and negatively related to their adherence to the guidelines ($B = -0.51, p < .001$). Maternal media guilt was not related to their awareness of the guidelines ($p = .578$) or the actual frequency of their children's screen media use ($p = .459$). The findings suggest that parental feelings of guilt are not directly linked to their knowledge of the media guidelines; rather, it is more about the degrees to which they agree with and adhere to these guidelines.

P1-128 - Social pressure promotes accuracy, not positivity, in preschool and school-aged children's attributions of others

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Details

Children tend to assign positive attributes to others, even in the face of negative information – the positivity bias (Boseovski, 2010). Children were assigned to a face-to-face or anonymous group to determine whether social pressure to be “nice” plays a role in the positivity bias. Forty-one 5- and 10-year-olds watched videos of actors behaving in either a trustworthy, untrustworthy, competent, or incompetent way and answered questions about the actors' traits and behaviors. Chi-square tests showed that children in the face-to-face group were more positive about competent actors' traits ($p = 0.05$) and behaviors ($p = 0.04, r = 0.32$) than those in the anonymous group (Figure 1). Further, older children were more positive about competent actors' behaviors than younger children ($p = 0.05, r = 0.03$) (Figure 2). Therefore, being older and in a face-to-face interaction led to more accurate attributions about competence. Interestingly, instead of demonstrating a positivity bias, some children inaccurately assigned actors negative attributes, particularly those in the anonymous, rather than the face-to-face, group (Table 1). This suggests that children may be more likely to ignore evidence to test the boundaries of “politeness” if no one is watching them. Ongoing work explores how children may or may not use evidence to assign attributes to others.

P1-129 - Examining baseline relations between parent-child interactions, STEM learning and engagement

Skyler Gin¹, C. Malik Boykin¹, David Sobel¹

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Details

The interplay between parental involvement and child engagement in STEM tasks has emerged as a focal point in understanding educational dynamics within informal learning environments. Prior research has shown that parental goal setting during free play reduces children's engagement in a STEM-related activity (Sobel et al., 2021). The present study extends this procedure to consider baseline levels of engagement. Our sample of 4-7-year-olds (N=68) was presented with the same challenges used by Sobel et al. without any prior free play with parents. Children in this baseline condition demonstrated higher engagement levels (participating in 5.53 challenges on average) than those in parent-directed dyads reported by Sobel et al. (M=5.05), but not those who set goals with parents collaboratively (M=6.71) or child-directed dyads (M=6.49). When prompted to explain how the circuit worked, children in the baseline condition generated causal explanations 66% of the time, less than those observed in the groups that had parent-child free play beforehand (87%). The generation of unobservable mechanic explanations by children was related to the proportion of causal language utilized by parents. These data suggest a nuanced dynamic where less directiveness by parents potentially reduces children's engagement in STEM tasks. However, parents who actively engage in causal language during free play may foster the development of their children's causal understanding.

P1-130 - Does performance guide children's choices of similar activities?

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Details

Although young children choose to continue or abandon activities based on their rate of improvement in performance, it is less clear if the experience of progress influences their choices of subsequent activities. To test their preferences, 4- to 6-year-old children ($n = 104$) played a computer game in which their goal was to find out which shapes a character liked to eat. Half of the children experienced gradual improvement over the course of the game, while half experienced static performance. Participants rated their enjoyment ("How much did you like the game?"), learning ("How much did you learn?") and performance ("How many stars did you get throughout the game?"). Children were then given options to play follow-up games with either the same character and a new procedure as in the first game; a new character and the same procedure; or a new character and a new procedure. We found no differences between the conditions in children's game choices ($p = .781$), though they exhibited preferences between the featured similarities (character > none > procedure; $p < .001$). Further, children did not report greater liking ($p = .769$) nor greater learning ($p = .751$) in either condition even though they were aware of their rates of performance ($p < .001$). These results contextualize previous findings and suggest that children's perseverance when performance is improving is better understood as goal-directed behavior rather than as shaping enduring learning trajectories.

P1-131 - Syntactic bootstrapping of mental state verbs in Mandarin-speaking children

Yuanyuan Chang¹, Yuexin Li¹, Sining Gao¹, Tianyi Liu¹, Haiwei Liu¹, Peter Gordon¹

¹ Columbia University

Details

Children may use syntactic bootstrapping to acquire mental state verbs like *think* and *want*, for which physical cues are limited. The current study examines whether Mandarin-speaking children can infer meanings of novel verbs based on their syntactic structures. Mandarin grammar provides fewer morphosyntactic cues than English that would indicate semantic distinctions in mental state verbs, but does distinguish them nonetheless. Twenty-eight Mandarin-speaking children (M= 51m) were exposed to a novel verb 10 times within either a belief-type syntax, a desire-type syntax, or a mixture of the two. Then, children were asked to choose which syntactic structure sounded better with the novel verb, and which of two videos corresponded with its meaning. Children showed a preference for the structure or video that was consistent with the syntactic cues in training, which supported the use of syntactic bootstrapping. However, in the mixture condition, there was a bias toward the belief interpretation.

P1-132 - Less (and more) are not always more: individual differences in children’s information-seeking strategies on epistemic trust tasks

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Details

Preschoolers value many cues when choosing who to trust (Harris et. al. 2018). Here we explored children’s information-seeking strategies in epistemic trust tasks. Forty-eight 4- and 5- year-olds participated in a selective trust task (4 trials). First they were asked to choose up to three pieces of information to learn about two sources: an appearance, epistemic, or social cue (Figure 1). After selecting and viewing their chosen cues, children then asked one of the two sources about a novel object, the sources provided labels, and then children endorsed one of those labels. Children completed measures of metacognition (Dutemple et. al. 2023), theory of mind (Wellman & Liu 2004), and need for cognition (Keller et. al. 2016). Children asked and endorsed the “better” source more than chance (χ^2 's > 7.03, p 's < 0.01). Children did not select one cue more frequently than the others (χ^2 's < 2.32, p 's > 0.31), but they did have strategies for how they selected cues. Nine children always chose one cue, 21 always chose all 3 cues, and 16 switched their strategy across trials. Although these strategies did not predict who children chose to ask or endorse, individual differences in age and need for cognition predicted which children adopted different strategies (Tables 1-4). Surprisingly, children did not prefer epistemic cues when making epistemic decisions, but differences across children predicted how they engaged in information-seeking.

P1-133 - Gamifying a mental rotation task for children between the ages of 6 and 9 years old

Samantha Zakrzewski ¹, Edward Merrill ², Yingying Yang ³

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Details

Mental rotation (MR) is the ability to mentally manipulate an object. Previous studies involving children have found that MR predicts STEM success, boys typically outperform girls and these abilities are first exhibited around the age of 5 years old. However, MR is a cognitively demanding task that is often redundant and boring for children. This study incorporates gamification, adding game-like elements into a traditional, non-game-like MR task, to determine if gamification could increase children's performance. Children between the ages of 6 and 9 years old received both the gamification and baseline conditions, the order of which were counterbalanced between participants. The gamification condition included a cover story, feedback, point-tracking system, and catching game whereas the baseline condition did not. Children benefited from the gamification manipulations as gamification performance was better than baseline performance. Furthermore, children who received the baseline condition first improved on the gamification condition later on. However, children who received the baseline condition second were able to maintain their good performance after receiving the gamification condition first. Future cognitive developmental research studies would benefit from incorporating gamification elements to increase motivation and learning, which would improve overall task performance.

P1-134 - Sources of variation in children's math achievement: the role of gesture use and parents' attitudes towards mathematics

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Details

Children vary in their mathematics performance. This variation is explained through internal factors (e.g., children's own cognitive resources such as hand gestures) or external factors (e.g., parents' attitudes toward math). This study investigated the effects of children's gesture use, parents' math anxiety, and parents' belief in math importance on preschoolers' math achievement. We assessed the mathematical skills and hand gestures of 63 children (33 girls, *Age*=49.9 months, *SD*=3.68) through object-counting and arithmetic tasks, while parents self-reported their math anxiety and beliefs about the importance of math.

Results showed that gesturing was related to lower performance on object-counting and higher performance on verbal arithmetic tasks. Furthermore, parents' anxiety was negatively associated with object-counting performances and parents' math belief was positively related to children's arithmetic scores. Summarizing, children might benefit from gestures differently in mathematics depending on the task and parents' attitudes towards mathematics.

P1-135 - Verb learning using mutual exclusivity in English-learning preschoolers

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Details

Young children hearing a new word prefer to map it to a novel object rather than a familiar object, a phenomenon known as mutual exclusivity. Few studies have examined mutual exclusivity in verbs (Golinkoff et al., 1996; Merriman et al., 1993, 1996). Because verbs are difficult to acquire (e.g., Gentner, 2006), it is important to understand what learning mechanisms support verb acquisition.

In this online pre-registered study, preschoolers (ages 3;7-4;4, $N = 37$) participated in noun and verb trials, each depicting one familiar referent and one novel referent, and were asked to point to the referent of an accompanying novel noun or verb. Children preferred the novel referent over the familiar referent on both noun and verb trials, but significantly more so with nouns than verbs.

The results suggest that mutual exclusivity is available for verbs but may not be as important of a learning mechanism as for nouns.

P1-136 - The improvement of spatial abilities assessed in Down Syndrome youth

**Karima Elgamal¹, Stephanie Grinshpun¹, Komal Khera¹, Melinda Mo¹, Samantha Zakrzewski¹,
Matthew Baker¹, Yingying Yang¹, Edward Merrill²**

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Details

Spatial ability is the basis for many skills required for independent living (Park, et al., 2000). These capabilities are not formally taught (National Academy of Sciences, 2006), but generally acquired through experience. Experience with spatial tasks promotes spatial ability improvement in typically developing children (Levine, et al., 2012), yet the effects of spatial experience for Down Syndrome (DS) youth has not been explored. We examined one domain of spatial ability: visual perspective taking, the ability to see the world from another's point of view. Participants with DS aged 13 to 28 ($N=22$), were initially assessed on a perspective-taking task, the Three Mountains Task (Piaget & Inhelder, 1956), then exposed to virtual spatial play activities twice a week over eight weeks, tested again, followed by eight additional weeks of experience and a final assessment. Experience consisted of (1) visual search using Google Streetview and (2) locating a hidden character after seeing their point of view. A repeated measures ANOVA reported a significant effect of participants' scores across testing sessions ($p=0.028$) (Fig. 1). Post hoc test, Tukey, revealed significant differences in scores between initial and second test scores ($p=0.046$), as well as between initial and final scores ($p=0.48$). Findings highlight the malleable nature of perspective-taking abilities, indicating virtual spatial play exposure may promote improvements in spatial skills for those with DS.

P1-137 - Young children's understanding of others' actions on mutually exclusive possibilities.

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Details

Three-year-olds struggle to take actions that anticipate multiple, mutually exclusive future possibilities, instead behaving as if only one outcome is possible (e.g., Redshaw & Suddendorf, 2016). However, 3-year-olds can recognize when an agent's actions cover multiple possibilities: 3-year-olds who saw two agents catching marbles from a tube with two exits chose the agent who placed her hands under both exits over the agent who placed her hands under only one exit when asked who would catch the marble for sure in a future game (Turan-Küçük & Kibbe, under review). We asked whether children's ability to understand others' actions on mutually-exclusive future possibilities is dependent on whether the child is able to observe the outcomes of the agents' actions. Children (n=48 US 3-4-year-olds) were told that they would watch "how" two actors "play a marble game". They then watched the actors taking different approaches to the two-exit tube (one covering one exit, one covering both exits), but did not observe marbles being dropped or caught, so they were not able to observe the outcomes of the actors' different approaches. When asked "who will catch the marble for sure?" in a future game, children chose the actor who covered both exits at rates significantly above chance (both $p < .01$) and there was no difference between 3- and 4-year-olds ($p = .42$). Children can recognize others' optimal actions on future possibilities without observing outcomes of those actions.

P1-138 - The development of working memory capacity for objects and features

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Details

Working memory capacity, the small amount of information held in mind and used in cognitive tasks, increases with development in childhood. It could be that the key capacity in working memory that increases with development is the number of objects, or it could be that the key capacity is the amount of information to be remembered. Our study examines the role of these two factors in an experiment with children aged 8-9 years, children aged 10-12 years, and young adults (total N = 101) to unravel the intricate interplay between these factors. On each trial, the participant had to remember two arrows that each had four distinct features (orientation, color, shape of the arrow's stalk, and a pattern within the arrowhead). After two objects were presented concurrently, memory for one object was probed. After applying statistical models to adjust for guessing, the results indicated not only an increase in the number of objects represented in working memory, but also a marked increase in the number of features correct per represented object. The implications of these findings extend beyond this study, paving the way for further inquiries into the characteristics and repercussions of the developmental increases in working memory capacity.

P1-139 - American children's categorization of, and attitudes towards, immigrants

Shreya Sodhi¹, Zoe Liberman¹

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Details

Children's attitudes towards immigrants depend on similarity: they like immigrants who assimilate to their culture and emigrants who avoid assimilating into other cultures (Verkuyten et al., 2014). Interestingly, immigrants themselves often choose to integrate, identifying with both their heritage and host cultures (Verkuyten et al., 2019). We tested American children's (ages 4-11, $N = 110$) categorization of immigrants (as (dis)similar to their heritage and host country) and their attitudes towards immigrants with different acculturation strategies to ask about the relationship between categorization and attitudes. In a categorization task, children expected nonimmigrants to be like (only) people from their heritage country, $t(219) = 56.42$, $p < .001$, but expected immigrants to either integrate (be similar to people from both countries, $t(219) = 7.81$, $p < .001$), or assimilate (be similar to (only) people from their host country, $t(219) = 4.66$, $p < .001$). Expectations for integration increased with age, $B = .012$, $p = .037$. In terms of attitudes, children preferred integrators over both assimilators ($p = .002$) and separators ($p < .001$), though, as expected, these preferences were based on similarity to the self (with children liking people who identified with American culture). Given that children expect immigrants to integrate or assimilate, and like immigrants who assimilate or integrate, categorization and attitudes may be highly related constructs.

P1-140 - Distinct inhibitory control processes underlie children's judgments of fairness

David Kamper¹, Joo-Hyun Song², David Sobel²

¹ University of California, Los Angeles & Brown University, ² Brown University

Details

We examined how 5- to 8-year-olds ($N=51$, $M_{age} = 83$ months, 27 girls, 24 boys, 69% White, 12% Black/African American, 8% Asian/Asian American, 6% Hispanic, 6% Not Reported) and adults ($N=18$, $M_{age} = 20.13$ years, 11 Female, 7 Male) accepted or rejected distributions of resources between themselves and others. We used a reach tracking method to track participants' finger movements in 3D space over time. This allowed us to dissociate two inhibitory processes. The first involved pausing motor responses to detect conflict between observed information and how participants thought resources should be divided. The second involved resolving the conflict between the responses. The first system was more involved when children reasoned about disadvantageous distributions than fair ones, $B = -0.78$, $SE = 0.33$, 95% CI [-1.43, -0.13], Wald $\chi^2(1) = 5.50$, $p = .02$, Odds Ratio: 0.46. This was similar for adults, $B = -0.02$, $SE = 0.01$, 95% CI [-0.03, -0.01] Wald $\chi^2(1) = 8.81$, $p = .003$, Odds Ratio: 0.98, suggesting continuity in development for evaluating unfair distributions. Rejecting advantageous inequities involved more of the second system, particular for the youngest children, $B = -0.007$, $SE = 0.003$, 95% CI [-0.01, -0.001], Wald $\chi^2(1) = 6.16$, $p = .01$, Odds Ratio = 0.99. What is developing are the inhibitory processes necessary to reject gaining resources in favor of acting fairly. More generally, reach tracking offers an online measure of inhibitory control when studying cognition.

P1-141 - Neural correlates of emotion perception relates to prosociality and theory of mind in preschool children

Zoe Pestana¹, Ruohan Xia¹, Megan Heise¹, Aditi Hosangadi¹, Serena Mon², Lindsay Bowman¹

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Details

How we perceive emotional facial expressions is important for social behavior. Facial expressions communicate information for decision-making in prosocial behaviors (e.g., when deciding to help, comfort, etc., Paulus, 2014) and when making mental-state inferences (e.g., in theory of mind; ToM) (Ribeiro & Fearon, 2010). The brain specializes to respond to faces over development. Thus, children's neural responses to emotional faces may directly predict their ToM and prosocial skills, in particular in preschool when these skills undergo critical development. We directly test this possibility in typically developing 3- to 5-year-old children (N = 83). We examined children's neural responses (via ERP components) associated with emotional face perception--the P1 (automatic attention allocation), N170 (decoding facial features), and LPP (sustained attention). We related ERP amplitude to children's ToM (Wellman & Liu, 2004) and prosocial tendencies (Parent Report on Prosocial Behavior, Gross et al., 2015). Linear mixed effects analysis shows that enhanced P1 amplitude (indicating greater attention allocation) and reduced N170 amplitude (indicating greater neural efficiency in decoding facial features), but not LPP amplitude, predicted increased ToM (N170: $B = 0.34$, $p = 0.01$; P1: $B = 1.19$, $p = 0.008$) and prosocial behavior (N170: $B = 0.05$, $p = 0.02$; P1: $B = 0.21$, $p = 0.001$). These results suggest critical early attentional and perceptual processes in viewing emotional faces that support children's ToM and prosocial skills.

P1-142 - Preschoolers recognize novel and semantically inconsistent objects in familiar classroom scenes

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Details

Natural scenes have structure, referred to as scene grammar (Draschkow & Vo, 2017). Adults' viewing of such scenes is influenced by this scene grammar (Cohn et al., 2014; Draschkow & Vo, 2017), suggesting their attention is guided by the structure. In this project, we are investigating preschool-aged children's sensitivity to scene grammar using an eye-tracking task in which children viewed scenes of their familiar classroom. Scenes contained a semantically consistent (e.g., scissors in the art area), a semantically inconsistent (e.g., doll in the block area), or a novel (e.g., clothes iron) object. Control scenes had no added object. We have collected data from 22 children (15 boys and 7 girls; *Mage 50 ms, SD 7.4*) to date. Preliminary findings from this sample show that although children looked equally long at all types of images, they looked longer to scene quadrants containing added objects than to similar quadrants in control scenes, $F(3,63) = 17.61$, $p < .001$. $\eta_p^2 = .46$. Moreover, they looked longer to quadrants with novel

and inconsistent objects than to quadrants with semantically consistent added objects, all t 's $<.05$. Thus, not only did children recognize the presence of additional objects, they recognized when those objects were inconsistent with the scene grammar. By spring 2024, our sample is anticipated to include over 40 children.

P1-143 - Reach tracking reveals dissociable roles of inhibitory control in children's "trust in testimony"

David Sobel ¹, David Kamper ², Joo-Hyun Song ¹

¹ Brown University, ² University of California, Los Angeles & Brown University

Details

Preschoolers selectively reason about others' information. Inhibitory control might be a necessary component for this capacity. But how? We presented 4-6-year-olds ($N=48$, $M_{age}=68$ months, 26 girls; 37% BIPoC) with a hiding game. On each trial, a confederate hid a sticker in one of two boxes on a screen. She indicated where by pointing at a location with her finger or an arrow, always accurately or inaccurately. Children then touched a box. Reaches were tracked in 3D space over time. This allowed us to describe distinct inhibitory mechanisms: (1) A monitoring component that detects conflict between the stimulus and response, operationalized by the latency between the appearance of the stimulus and the finger taking flight. (2) A conflict resolution component that allows children to respond, operationalized by the maximum deviance in the curvature of their reach compared to an idealized line. Regardless of the cue's accuracy, children needed more resources to monitor human pointing for conflict than arrows, $B = 3.37$, Wald chi-squared(1) = 10.36, $p = .001$. The curvature trajectory for early trials with arrow cues, in contrast, were more deviant than human cues, particularly for the younger children, $B = -0.001$, Wald chi-squared(1) = 3.84, $p = .05$. These data suggest there are distinct inhibitory mechanisms involved in the development of selective learning.

P1-144 - Children's expectations for outgroup food choice and the influence of pro-American biases

Bailey Immel ¹, Shreya Sodhi ¹, Zoe Liberman ¹

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Details

Culture guides humans' food choice. Even children expect people from their culture to eat familiar foods (DeJesus et al., 2019). If children truly understand that food is cultural, they may expect people from other cultures to eat unfamiliar foods. Across 2 studies we ask whether 1) children expect outgroup members to eat unfamiliar foods, and 2) their pro-American biases relate to expectations about food choice. 4- to 9-year-olds ($N= 107$) sorted familiar foods (e.g., ravioli), unfamiliar foods (e.g., mbeju) and disgust elicitors (e.g., hair), based on who ate each item: people from a familiar country (USA), people from an unfamiliar country (Vanuatu), both, or no one. Children understood that food is cultural: they reported that people from a familiar country would eat familiar foods ($B = -2.359$, $p <.001$), people from an unfamiliar country would eat unfamiliar foods ($B = 2.506$, $p <.001$), and nobody would eat disgust elicitors ($B = -2.43$, $p <.001$). Children also rated how much they liked each food and each group of

people. These variables related to expectations about food choice: children who preferred familiar foods ($B = 0.666, p < .001$) and children who were higher in pro-American biases ($B = 0.283, p = .033$) were less likely to think Vanuatians would eat familiar foods. Understanding the mechanisms underlying children's expectations about food choice may therefore help guide research on decreasing nationality-based biases.

P1-145 - The role of causal reasoning in children's inferences about leaders

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Details

Attributional processes influence children's status-based attitudes. We investigated the influence of different causal attributions (internal vs. external) on 6-7-years-old and 9-10-years olds' ($N = 64$) attitudes toward leaders by comparing two leaders who attained equally high statuses due to different causes. Parental education of the children was also examined to understand its role in children's attributional processes and status-based judgments. Children were asked about their level of support for the presidents, to infer the presidents' intelligence, success in their roles, and expected status stability. All children considered leaders who attained their position due to internal factors as more successful and intelligent, and supported them more. Older, but not younger children attributed more stability to leaders' status when they were given internal explanations. As the parental education increased, children supported leaders less and attributed less stability to status of the leaders with external explanations. Findings revealed that children's evaluations of leaders interact with attributional processes. These interactions vary with contextual factors throughout development.

P1-146 - Children see correcting in private as a cue to friendship

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Details

Children can use many cues to infer friendship. Here, we test a novel friendship cue: correcting someone in private. We were interested in this cue as people may correct others in private in order to salvage their reputation. In Study 1, 253 children (4-12 years) were asked whether an agent was better friends with a person they corrected in public or one they corrected in private. Children were above chance at selecting the character corrected in private as the closer friend ($p < .001$), and the effect became stronger with age. A second study sought to compare private correction to other cues known to indicate friendship: similarity, propinquity, and loyalty (Liberman & Shaw, 2019). In Study 2, 272 children (4-12 years) were asked whether an agent was better friends with someone they corrected in private or someone they engaged in a different friendship cue (similarity, propinquity, or loyalty). Results suggest that children saw propinquity ($p = .025$) and loyalty ($p = .003$) as stronger friendship cues, but rated private correction as a similarly good friendship cue as similarity ($p = .28$). As in Study 1, with age

children were more likely to endorse private correction as a good friendship cue. Overall, these findings suggest that concerns for others' reputations may play an important role in friendships, and protecting another person's reputation may be an important social interaction indicative of friendship.

P1-147 - The effect of event boundaries on 3-year-olds' novel category learning

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Details

The Event Segmentation Theory (EST) posits that people naturally segment everyday experiences into distinct units, aiding memory and learning. Although not extensively researched, exploring event boundaries in children's learning is vital. These boundaries are ubiquitous in children's daily experiences and could play a significant role in shaping how children encode new information. This study investigated how event boundaries affect novel category learning. We hypothesized that presenting objects across an event boundary (i.e., across distinct background contexts) would enhance encoding and generalization. The study involved 23 English-speaking three-year-olds learning novel object categories under two conditions. In the event boundary condition, objects were moved across two different background contexts, while in the control condition, they remained within the same backgrounds. Contrary to our hypothesis, the results showed no significant difference in children's generalization performance between the two conditions. An interesting order effect was observed, where children performed better on categories introduced first in each trial, suggesting the influence of task structure on learning and children's different interpretation of event boundaries. Notably, the order effect is more pronounced in females. This study paves the way for new research into how event boundaries affect early category learning, presenting several promising directions for future exploration.

P1-148 - "Split the cookie in half!": Exploring informal parent-child fraction talk and its relation to symbolic fraction knowledge

Karina Kling ¹, Yihan Chen ¹, Susan Levine ¹

¹ University of Chicago

Details

Fractions are foundational to early mathematical development, but little is known about early informal fraction learning opportunities, particularly in the home environment. In an online study, 84 parent-child dyads (child age 6 to 7 years) were asked to talk about and generate real-world examples of fractions. Coding of the video-recorded conversations revealed that parents contributed, on average, more fraction content to the conversation than their children (81% of mentioned fraction topics and symbolic labels like "one half"). Most fraction examples referred to concrete objects (77%), many of which were food-related (55%) and/or discretized (56%), representing parts of a single object rather than discrete sets or continuous quantities. Of all coded content, only parental mention of fractions having a part-whole structure significantly related to child performance on a symbolic-to-nonsymbolic

fraction mapping task (Miura et al., 1999; $\beta=0.21$, $t(58)=2.69$, $p<.01$). These findings suggest that communicating about fractions' part-whole structure may be an effective way to support young children's fraction understanding.

P1-149 - Working memory and cultural influences on children's ritual inflexibility

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Details

Group rituals require significant cognitive effort and are defined as socially-prescribed sets of action in which causal opacity is a central element (Rybanska et al., 2018; Kipitany and Nielson, 2015). The current study examined the influence of working memory (WM) and parental beliefs on children's prayer inflexibility (PI). 203 parent-child dyads from diverse religious backgrounds (Protestant, Muslim, Catholic, Non-affiliated, Other) participated. Children (59.6 % female), aged 3.31 to 6.98 years ($M = 4.772$, $SD = .799$) were asked about performing unconventional actions during prayer. Additionally, they participated in a digit span task, and parents shared their certainty about God's existence. A regression model predicting children's PI demonstrated that parental belief ($\beta = .167$, $p < .01$), children's WM ($\beta = .150$, $p < .05$), and age ($\beta = .349$, $p = < .001$) were significant predictors. Further, the overall model was significant, $R^2 = 0.262$, R^2 (adjusted) = .251, $F(3, 199) = 23.57$, $p < .05$. Together, these findings lend support for the view that executive function skills and parents' beliefs shape children's thinking about rituals.

P1-150 - Creativity across domains: examining the role of imagination and self-regulation in early childhood creativity

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¹ Hampden-Sydney College, ² University of Alabama

Details

Experiences with creativity in early childhood can set the foundation for creativity throughout the lifespan (Russ, 2014). Despite this, research is limited examining creativity for this age group. Research suggests that developmental skills, such as imagination and self-regulation predict creativity in preschoolers (Bauer & Gilpin, 2023). However, it is unknown if these skills translate across multiple domains. The aim of the current study was to examine how imagination and self-regulation predict creativity across different domains. Preschoolers completed the divergent thinking task and The Triple Creativity Task, a new multiple domain (e.g., drawing, stories, and play) creativity measure. In addition, children and teachers completed measures of self-regulation and imagination. Data analysis is forthcoming to determine how these skills predict creativity in different domains. This study adds to the literature by examining the role of these skills in creativity and may motivate future studies examining ways to foster creativity in early childhood.

P1-151 - Social group exposure and children's ritual inflexibility: examining the effects of school type, out-group exposure, and religious engagement

Alison Garcia¹, Jamison Cortez¹, Ashley Marin¹, Rebekah Richert¹

¹ University of California, Riverside

Details

Young children are sensitive about rituals being performed the “right way” (Shaman et al., 2016). The present study investigated whether children’s social experiences could explain why. Religiously and ethnically diverse children ($N = 218$; 60.6% Female) between the ages of 3.318- to 6.98-years-old ($M = 4.66$, $SD = .803$) were interviewed about their certainty that unconventional actions were permissible during prayer, and parents answered questions about their child’s school, religious engagement, and religious outgroup exposure. After controlling for age, prayer inflexibility (PI) was significantly positively related with religious engagement ($r = .150$, $p = .027$). Further, children who attended a religiously-affiliated school were more inflexible about prayer ($Md = 1.33$, $n = 64$) compared to those in non-religious schools ($Md = .67$, $n = 154$), $U = 3707$, $z = -2.910$, $p = .004$. Yet, no distinctions in PI emerged between children exposed to religious out-group members ($Md = .67$, $n = 84$) and those without such exposure ($Md = 1.00$, $n = 134$), $U = 5248.50$, $z = -.846$, $p = .397$. In sum, children’s environment and interactions likely influence their views on social conventions.

P1-152 - Children's social versus material priorities when copying others

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Details

This study examined children’s social versus material priorities in their imitative behavior. Over two experiments we investigated young children’s pull to act socially by allowing them to reproduce an experimenter’s demonstrated action sequence or instead use the modeled actions as a clue for how to retrieve a desirable material reward (a sticker). Of interest was whether children would imitate redundant actions when this resulted in the loss of a material reward. We also evaluated whether levels of social attention would impact their behavior. Across these experiments, 125 3–6-year-olds ($M_{age} = 4$ years, 11 months, female = 50.4%; majority identified as Australian) were presented with three apparatuses, consisting of an opaque section containing a low-interest object (e.g., a bell in E1; a wooden block in E2) and a transparent section containing a desirable sticker. An adult modeled opening the opaque section. Imitation rates were the same whether the adult observed the children’s responses or turned away (E1), but children retrieved more stickers when allowed to explore the apparatuses than when shown a demonstration (E1 and E2), largely due to children focusing on copying the demonstration instead of retrieving the reward. This study shows that children’s inclination to copy others is so strong that it can override the opportunity to obtain an immediately available, attractive material reward.

P1-153 - Children expect atheists to be more likely to violate moral and conventional norms

Oya Serbest¹, Zoe Liberman¹, Gaye Soley²

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Details

Previous work suggests that children expect linguistic outgroup members to be more likely than ingroup members to violate norms (Liberman et al., 2018). Here, we ask whether similar findings are seen for religious groups, or whether children (regardless of their own group membership) expect atheists to be more likely than theists to violate norms. To do so, we introduced American children ($N = 337$; 3 to 12 years) to pairs of characters with one theist and one atheist. For each pair, we asked children who was more likely to have violated a norm. Children were randomly assigned to hear about moral or conventional violations. A LMM analysis with Age, Condition (moral vs. conventional), and Background Religiosity (calculated from parental survey) as predictors revealed significant main effects of Age ($b = .08$, $SE = .02$, $p < .001$) and Background Religiosity ($b = .26$, $SE = .06$, $p < .001$), with *older* children and children from *more religious* families being more likely to report that the atheist had violated the norm. The effect of Condition was not significant ($p = .53$). Despite these effects, even the youngest children and children from the least religious backgrounds were above chance at selecting the atheist as the norm violator. Thus, children have robust and early emerging expectations that theists will follow social norms

P1-154 - Does God scare you? How children's personal connection with God relates to their prayer inflexibility

Elena Guerrero Galaz¹, Jamison Cortez¹, Ashley Marin¹, Rebekah Richert¹

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Details

Young children see prayer as a way to connect with God and adhere to rituals to maintain a relationship with their in-group (Richert et al., 2016; Watson-Jones & Legare, 2016). This study examined the relationship between prayer inflexibility (PI) and God concepts. Children ($N = 254$; 59.4% Female) between the ages of 3.32- to 6.98-years-old ($M = 4.701$, $SD = .812$) were interviewed and belonged to one of the following religious affiliations: Protestant ($n = 29.1\%$), Catholic ($n = 20.1\%$), Muslim ($n = 29.1\%$), non-Religious ($n = 18.1\%$), or Other ($n = 3.5\%$). Children were asked how certain they were that unconventional actions are not allowed during prayer and that God demonstrates distinctive attributes (e.g., scares them). Children's certainty that God scares ($r = -.142$, $p = .024$) and frequently punishes them ($r = -.174$, $p = .005$) remained significantly negatively associated with PI after adjusting for age effects. In other words, the stronger they believed that God demonstrated these attributes, the more open children were to unconventional actions during prayer, indicating that PI is linked to children's emerging concepts of God as an active agent in their everyday lives.

P1-155 - Parental play and language contributions to infant spatial development

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Details

Individual differences in spatial cognition present early in childhood. Play is an important aspect of childhood, and past work suggests that spatial play is related to spatial development. Spatial ability is a known predictor for STEM achievement, so it is important to support the early development of spatial skills. This study explores individual differences in parent engagement, play style, and spatial language input during play with a shape-sorter toy (N=99, M infant age=11m) and whether parent play type and spatial language use varies by child sex. Preliminary analyses of 33 dyads found variability in how parents and infants chose to engage with the toy. Block building and motor play (e.g., throwing blocks) were the most common types of play. Parents who focused more on spatial affordances (e.g., block building and shape sorting) had infants who also focused more on spatial affordances, suggesting that parents direct their infant's attention towards spatial features through modeling play. Both parent and infant play type and parent spatial language input did not differ by child sex. Future analyses will study how differences in infants' motor development and parental perceptions towards play influence spatial language input and play types, including the additional 66 dyads. This will clarify how parental engagement with spatial features varies across dyads and relates to spatial skill development and could inform interventions to improve spatial skills.

P1-156 - "Saving face" when faced with feedback - In-person feedback reduces children's persistence and negative affect during mathematics practice

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Details

Research indicates that corrective feedback can be a powerful learning tool, but with variable effects. Feedback Intervention Theory posits that feedback may hinder performance by directing attention toward the self instead of the task. This study tests how two features of feedback - personalization and source - influence persistence and affect during math practice. We hypothesize that personalized feedback and in person feedback will direct greater attention to the self, worsening motivational and emotional outcomes. Elementary school children completed a learning activity focused on math equivalence (N=150), and were assigned to different feedback conditions which varied by personalization (with "you" vs. without "you") and source (in person vs. computer & person vs. computer alone). Outcomes differed by feedback source. In terms of persistence, children who received feedback in person (EM = 11.4 out of 20, SE = 1.03) opted to complete fewer items than children who received feedback in virtual contexts (EM = 14.5, SE = 0.67). In terms of affect, children who received feedback in person (EM = 1.04 out of 5, SE = 0.65) expressed lower levels of negative affect compared to children who received feedback in virtual contexts (EM = 1.36, SE = 0.56). Results suggest that feedback presented by a live person may encourage children to "save face" and stop the activity before it gets too hard, resulting in lower persistence and negative emotions.

P1-157 - Relations between spatial skills and science achievement: a meta-analysis

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Details

Much research has reported a positive link between spatial skills and science achievement. However, the size and nature of the relation between these two constructs is unknown. Questions persist regarding if the relation varies by gender, grade, and across different spatial tasks and science domains. Additionally, the extent to which the space-science relation is due to other skills, such as math and verbal reasoning, has yet to be ascertained. Thus, we conducted a meta-analysis to: a) identify the overall correlation between spatial skills and science achievement, b) examine if the spatial-science relation is moderated by gender, grade, type of spatial skill assessed, and domain of science, and c) measure the impact of math and verbal reasoning on the space-science relation. Our analysis focused on kindergarten to undergraduate samples and included 84 manuscripts (total averaged $N = 13,215.29$). Results revealed a positive moderate association between spatial skills and science achievement ($r = 0.27$, robust standard error = 0.02, $\tau^2 = 0.02$) and no significant effect of gender or grade-level on the association. Additionally, math skills and verbal skills mediated the relation, but a unique link between spatial skills and science achievement remained. Implications of these findings include enhancing our understanding for how to leverage spatial skills as a method for improving science outcomes across multiple educational levels.

P1-158 - How confident are you? Adults, but not children, are less confident when making temporal judgements compared to numerical ones

Evan Sumner¹, Lucy Panyard¹, Karina Hamamouche¹

¹ Butler University

Details

Research has shown that non-symbolic timing is worse than non-symbolic numerical abilities through the lifespan (Odic et al., 2016) and that we are more confident when we perform tasks accurately (Baer et al., 2018). This study explores if we are more accurate *and* confident on non-symbolic number tasks throughout development. We predict superior performance and confidence on the numerical task compared to the temporal one in both children and adults. Children ($n = 57$, $M_{age} = 7.95$ years) and adults ($n = 85$, $M_{age} = 19.51$ years) completed numerical and temporal discrimination tasks where they rated their confidence on each trial. Paired samples t-tests found that adults were more accurate ($t(77) = 5.02$, $p < 0.001$, $d = 0.57$; Number: $M = 0.88$, $SD = 0.05$, Time: $M = 0.83$, $SD = 0.08$) and confident ($t(75) = 4.22$, $p < 0.001$, $d = 0.48$, Number: $M = 2.92$, $SD = 0.36$, Time: $M = 2.77$, $SD = 0.39$) on the numerical task. Children were equally accurate and confident regardless of task (Accuracy: $t(52) = 1.93$, $p = 0.06$, $d = 0.27$; Number: $M = 0.73$, $SD = 0.08$, Time: $M = 0.76$, $SD = 0.11$; Confidence: $t(54) = -2.01$, $p = 0.05$, Number: $M = 4.13$, $SD = 0.51$, Time: $M = 4.03$, $SD = 0.51$). Our results suggest that better accuracy and higher confidence on numerical tasks may develop with time as children become more exposed to quantity.

P1-159 - Comparison of route and landmark knowledge in individuals with Fragile X syndrome and typically developing children

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Details

Spatial navigation, or finding one's way through an environment, is an important adaptive skill that has meaningful implications for safety. Some existing research suggests that individuals with Fragile X syndrome (FXS) may have increased difficulty with certain types of spatial abilities (e.g., visuospatial construction, memory, mental rotation) (Cornish et al., 1999; Huddleston et al., 2014). Notably, however, the existing literature is very inconsistent and limited. The current study compares route knowledge (RK) and landmark recall (LR) accuracy in 13 individuals (12 - 25 years old) with FXS and 13 mental age-matched (based on performance on Raven's 2 Progressive Matrices) typically developing (TD) children (4 - 9 years old). Participants learned a route through a virtual reality environment and were asked to complete a task assessing route knowledge and landmark recall. Our findings indicate that there were no significant differences in performance accuracy between the FXS and TD groups on either task. This research contributes to a better understanding of the cognitive profile of individuals with FXS and indicates that perhaps route knowledge and landmark recall accuracy are relatively intact aspects of spatial abilities in individuals with FXS. However, our results were based on a small sample and did not assess survey knowledge of the environment. Thus, additional research is needed to evaluate spatial navigation abilities in individuals with FXS.

P1-160 - Making a broad impact: children's valuation for a world-oriented mindset

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Details

Throughout history, many influential figures have dedicated themselves to making a profound impact on humanity at large. While young children naturally care about family and friends, do they also develop an appreciation for impacting the world? Across three studies ($N=447$), we examined how 4-9-year-olds evaluated this world-oriented mindset in comparison to family and self-oriented mindsets. Study 1 found that children across ages evaluated world-oriented individuals ($M=5.36$) more positively than self- ($M=3.38$; $B=-1.979$, $p<.0001$) and family-oriented individuals ($M=4.72$; $B=-0.64$, $p<.0001$). In Study 2, children expressed their motivation to grow up like the individuals and adopt their jobs. Children were more motivated to emulate the world-oriented ($M=4.45$) than the self-oriented individuals ($M=2.61$; $B=-1.84$, $p<.0001$), with a similar level of motivation as for family-oriented individuals ($M=4.19$; $B=0.26$, $p=0.1$). In Study 3, when presented with world-oriented individuals making a greater impact at greater costs to themselves or a smaller impact at smaller costs, children evaluated the former more positively ($M=5.46$ vs. 4.88 ; $B=0.59$, $p<.0001$). However, they were equally motivated to emulate both ($M=3.57$ vs. 3.55 ; $B=0.02$, $p=0.9$). Our findings collectively reveal an early valuation for the mindset of making an impact on the world.

P1-161 - Mind over matter: conflict monitoring and science learning

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Details

Constructing and deploying scientific knowledge is hard. While there are certainly many different reasons why the process of theory construction is difficult, one plausible reason is the requirement to employ complex metacognitive and conflict monitoring processes while acquiring scientific theories. The hypothesis tested here is that children with higher conflict monitoring abilities would make more progress in revising their naïve theory. Our participants were 83 early elementary school students ($M_{age} = 7;3$ years). Children received a battery of questions that assessed their understanding of the material world (outcome variable), as well as their executive function skills (working memory, inhibitory control, and set shifting), their reflective reasoning (CRT-D task (Young et al., 2018)), and a conflict monitoring task named Inconsistent Stories (IS) adapted from (Markman, 1977). The results showed that controlling for Age and EFs, CRT-D and IS remained significant predictors, each being associated with unique variance in Matter understanding. These findings suggest that conflict monitoring is a separate ability – independent from inhibitory control, set shifting, and reflective reasoning – that has a unique role in constructing and deploying new scientific understanding.

P1-162 - Evaluating observational contexts for learning hard nouns: how word learning is measured is key

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Details

Children learn a wide range of words, and it is believed that the degree to which children draw on different sources of information (e.g., observational, linguistic) for learning varies by word type. According to one dominant view, whereas the observational contexts words occur in are sufficient to learn words that denote concrete objects (e.g., “ball”), other sources of information, such as the linguistic contexts words occur in, are necessary to learn words that denote more abstract concepts (i.e., “hard words” like “story”; Gleitman et al., 2005). The current study asks whether the tasks used to assess the informativity of observational contexts in prior studies that informed this view may have underestimated their role for learning hard words. In this study, a new paradigm was developed to assess the informativity of observational contexts for learning one type of hard word: nouns that denote non-basic level object categories (or “hard nouns”; see Kako, 2005). These data reveal that although observational contexts may not be sufficient to yield learning of precise hard noun meanings, they allow learners to extract systematic partial knowledge that may lay a critical foundation for full meaning acquisition. This finding highlights the importance of carefully considering the tasks used to assess, and thus our definition of, word learning.

P1-163 - Using numbers to encode space reduces item recognition in adults but not children

Yujia Zhang¹, John Opfer¹

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Details

Whether using maps to navigate cities or using Cartesian coordinates to describe shapes, relational reasoning allows abstract generalization, which is notoriously difficult for children. Here, we examined children's use of numbers to encode spatial locations. Using a relational match-to-sample paradigm, we presented 3- to 10-year-olds (Exp1, n=79; Exp2, n=74) and adults (Exp1, n=64; Exp2, n=64) with sample and matching arrays of objects. Given the "winner" in the sample array, participants were asked to find the "winner" in the matching array. In all trials, the "winner" in the sample and matching arrays had the same ordinal position. Then, object recognition was tested to assess memory for irrelevant information. As predicted, accuracy was higher when winners were described using numbers ("The second is the winner") vs nouns ("The duck is the winner"; Exp1; $p < 0.05$). Accuracy was higher when numbers increased vs decreased from left-to-right ($p < 0.05$). Last, providing adults with numbers (Exp1) or increasing between-object similarity (Exp2) improved relational matching and reduced object recognition, suggesting that adults attended to ordinal over object information. In contrast, numbers improved children's relational matching, but had no impact on their object recognition (Exp1). Results suggest that adults optimize performance by ignoring object identity, whereas children succeed while distributing their attention between relevant and irrelevant information.

P1-164 - Language produced during shared book reading in homes

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Details

While reading to children is positively associated with language outcomes, the causal pathways are less well understood. To understand the potential contribution of shared book reading to language environments, we need to better understand the language produced during book reading. We built a corpus of caregiver-toddler (12 dyads; 24-36 mo) shared book reading interactions recorded in homes. Books varied on familiarity (novel vs familiar) and linguistic complexity (simple vs complex). The language generated during reading was compared with other sources of child-directed speech. Book reading generated overall more words, more lexically diverse talk, and longer utterances relative to other contexts. However, these tendencies strongly depended on characteristics of the book: Short, simple, and familiar books generated less complex caregiver speech but more conversational turns. The pathway to positive language outcomes from shared book reading may be a varied range of experiences rather than one specific profile of language input.

P1-165 - Expectations of forgiveness and perceptions of perpetrator intent differ in interpersonal and intergroup contexts

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Details

While prior work has found that forgiveness is associated with interpersonal conflict resolution, less work has examined whether children, adolescents, and adults expect forgiveness to facilitate intergroup conflict resolution. This study addresses this gap by exploring whether forgiveness expectations and intent perceptions differ in interpersonal and intergroup contexts. Participants ($N = 479$) were 97 children aged 5-10, 180 adolescents aged 12-15, and 202 adults aged 18 and older. Participants saw third person ambiguously intentional transgression vignettes in four within-subjects conditions (interpersonal, intergroup, group perpetrator/individual victim, individual perpetrator/group victim) and reported forgiveness expectations (Figure 1) and attributed perpetrator intent (Figure 2). Linear mixed effects models found effects of perpetrator type such that participants expected less forgiveness ($b=0.27, p<.001$) for and attributed more intent ($b=-0.39, p<.001$) to group relative to individual perpetrators. No effect of victim type was found for forgiveness ($p=.172$) or intent ($p=.224$). Participants expected less forgiveness and attributed more intent in intergroup relative to interpersonal contexts (all $p<.001$). Adults and adolescents also expected less forgiveness and perceived more intent than children (all $p<.001$). Across developmental and adult samples, this study highlights important differences between interpersonal and intergroup forgiveness.

P2-1 - Parents' spatial talk to boys and girls in museum settings: variations by topic and exhibit size and scale

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Details

Children's exposure to STEM-related ideas in everyday contexts with parents may support interest and engagement in STEM, possibly contributing to gender differences. The present study investigated variations in frequency and type of parental spatial talk in museum settings varying in topic (physical vs life science) and exhibit scale (single seated exhibit vs larger multi-component exhibit). Families with children 3-6 years old ($N = 194$; 96 boys) visited two life science museum exhibits: one large-scale (44 families), one small-scale (50 families), and two physical science exhibits, one large-scale (50 families), one small-scale (50 families). Parents' spatial language was coded (Cannon et al., 2007). Controlling for time spent at exhibits, parents used significantly more "where" spatial language (describing location and direction) than "what" spatial language (describing how something looks) across exhibit contexts. Moreover, boys heard more "where" spatial language than girls heard. Additionally, parents used more "where" spatial language in the large-scale exhibits than in the small-scale exhibits. These findings provide evidence that the kinds of spatial language that parents use with their children can vary according to the spatial scale of an exhibit and the gender of their child. Future theories should consider how these variations might differentially support children's STEM engagement.

P2-2 - The effects of drawing on memory in children

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Details

The goal of the present experiments was to determine whether drawing would provide more of a benefit than writing to memory performance in children. In experiment 1, experimenters read children a story with novel objects paired with novel names. While the participants listened to the story, they were asked to copy the depiction of the novel object or write the name of the novel object. A subsequent old/new recognition task consisting of the novel object names was administered. We found a significant benefit for writing the words compared to drawing the pictures, likely due to a study-test congruency effect. In experiment 2, a similar procedure was conducted in classrooms. Two subsequent old/new recognition tasks consisting of the novel object names as well as pictures of the novel objects were administered. Lastly, a matching task was administered. We found a significant benefit for writing the words compared to drawing the objects.

P2-3 - Novel noun learning during naturalistic picture book reading in 14-, 18-, and 22-month-olds

Kristen Gilyard¹, Erika Bergelson¹

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Details

Current word learning accounts generally do not quantify what kind of exposure to new words and referents infants need to add words to their lexicons, or the role of age in this process. We measured how caregivers read to 14-, 18-, and 22-m.o.'s, and whether differences in caregiver input linked to differences in children's novel word production. Over 2wks, caregiver-child dyads read a book with novel words "shang," "blick," and "dax" 2x/day, and audiotaped the sessions. While caregivers typically spent ~2 minutes/session reading the 100-word book, reading time did increase significantly across age groups ($M_{14}(SD)=1.2(.16)\text{min.}$, $M_{18}(SD)=1.8(.71)\text{min.}$, $M_{22}(SD)=2.5(.81)\text{min.}$; Pearson's $R=.59$, $p<.05$). Caregivers of older infants provided significantly more extratextual extensions by e.g. asking questions or prompting children to count objects ($M_{14}(SD)=0(0)$, $M_{18}(SD)=1.5(1.8)$, $M_{22}(SD)=5(1.9)$, Pearson's $R=.70$, $p<.05$). Unsurprisingly, younger infants rarely produced the new words; all 22-m.o.'s said a target word. This provides some evidence that at least for 22-m.o.'s, roughly 1hr of exposure spread over 2wks is sufficient to bring a word into the productive lexicon. More extratextual extensions by caregivers predicted a higher probability of the child saying a target word in a logistic regression model ($B=0.68$, $p<.05$). Ongoing eyetracking data collection will augment the book-reading data to more fully reveal how age may influence the earliest stages of word learning.

P2-4 - ASR performance in Spanish-English bilingual children: the role of bilingual proficiency

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Details

Automated Speech Recognition (ASR) systems are increasingly incorporated into children's education, yet potential biases against diverse languages pose risks of exacerbating educational inequalities. The present study examines the effect of language proficiency, assessed through the Bilingual English Spanish Oral Screener, of Spanish-English bilingual children from Southern California ($N = 200$; ages 3-7 years) on the transcription accuracy of their English speech (word level samples from picture-naming task) by four widely used Application Programming Interface (API) systems (Amazon, Google, IBM, Whisper). Preliminary analyses of 137 children reveal differences in transcription accuracy between ASR systems. Additionally, older or more English-proficient children exhibit higher transcription accuracy across all APIs. Ongoing analyses will explore the impact of speech quality and cross-language influence on transcription accuracy using Voice Onset Times (VOT). Preliminary findings indicate a three-way interaction, suggesting improved IBM accuracy with age and more English-like VOTs. This study is the first to rigorously examine ASR performance in Latino bilingual children and highlights the need for greater language diversity in ASR model development.

P2-5 - Exploring caregiver-child mental state talk during scientific storybook reading

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Details

We explored how a scientific storybook about success and failure may elicit caregiver-child dyadic mental state talk. Caregiver-child dyads ($N = 202$, 100 female, 35% non-White, aged 4-5, $\mathcal{A}' = 0.15$) were assigned to one of three storybook conditions about Marie Curie or Katherine Johnson: *Achievement* (highlights success without any mention of failure), *Effort* (emphasizes challenges on the path to achieving success) or *Baseline* (does not highlight success or failure). In line with previous work (*Bartsch & Wellman, 1995; McLoughlin et al., 2020*), we coded caregiver-child language for evidence of four types of mental state talk: cognition, emotion, desire, and intention. Analyses indicate that caregiver-child dyads in the *Effort Condition* engaged in more mental state talk related to emotion ($B = 0.02$, $p < .001$) and intention ($B = 0.01$, $p = .005$) compared to families in *Achievement* and *Baseline* Conditions. This work highlights how STEM storybooks may serve as a collaborative tool for enhancing social-emotional skills, literacy, and STEM engagement during the early and elementary school years.

P2-6 - Who did it? Children consider others' emotional reactions when inferring agent responsibility

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Details

Children have a powerful ability to use people's emotional cues to reason about the world. In two experiments, we examined older ($N=117$ 5-7-year-old; Experiment 1) and younger ($N=165$ 3-5-year-old; Experiment 2) children's ability to use people's emotional reactions to infer agent responsibility. Children heard two negative and two positive stories. For example, in a negative story, two girls baked a cake that dropped. One expressed guilt and the other expressed anger. Children judged who dropped the cake or who did not. Positive stories were similar except that the event was positive (e.g., a paper bird was made), and one expressed pride and the other expressed pleasant surprise. See Fig 1A.

In Experiment 1, all children correctly inferred that the person who exhibited guilt or pride caused the event and the person who exhibited anger or pleasant surprise did not (5-year-olds: $p<.001$, Cohen's $d(d)=0.64$; 6-year-olds: $p<.001$, $d=0.73$; 7-year-olds: $p<.001$, $d=1.97$). Experiment 2 demonstrated a developmental change. Those aged 5 correctly inferred agent responsibility as in Experiment 1 ($p<.001$, $d=0.48$), but younger children did not (3-year-olds: $p=.268$, $d=0.15$; 4-year-olds: $p=.583$, $d=0.07$). See Fig 1B.

Together, this work shows from age 5, children consider others' emotional reactions when determining agent responsibility. Such findings indicate that emotional cues provide rich, powerful sources of information for children's reasoning about the world.

P2-7 - How prompting feelings of relatedness during a STEM storybook reading impacts children's persistence

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Details

Prior work has shown that reading a storybook centering effort rather than ability increased 4- to 5-year-old children's task persistence ([removed for review]). This study examines whether increasing children's feelings of relatedness can ameliorate the negative impact of reading about scientists' achievements on task persistence. An experimenter read 5-year-old children ($N = 114$, $Mage = 66$ months, $SD = 4$, 58 female) a storybook about a scientist who either achieved success effortlessly (Ability) or who faced challenges (Effort). Half of children ($n = 56$) were prompted to make personal connections to the scientist (Relatedness; e.g., "Tell me about a time you were really smart, just like Katherine Johnson"); the other half received neutral prompts about the story (No Relatedness; e.g., "Tell me what you are noticing about Katherine Johnson in this picture"). Children were then invited to do an impossible task (find the differences between two identical images). Results indicated no main effects or interactions between Prompt Type (Relatedness or No Relatedness) and Success (Ability or Effort; $F(1, 109) = 0.77$, $p > 0.05$) on persistence. We are coding children's responses to the prompts to evaluate the types of

connections children made to the storybook (e.g., related to extracurricular activities or school). We plan to conduct a follow-up baseline condition to determine the specific impact of storybook reading on persistence.

P2-8 - Spatial skills and STEM learning during the early elementary years

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Details

Improving science, technology, engineering, and mathematics (STEM) learning is critical for meeting growing workplace demands. Early STEM exposure is important (Maltese & Tai, 2010). Spatial skills are malleable and correlated with STEM success (Alexander, 2017; Frick, 2019; Uttal et al., 2013). Mental transformation involves mentally combining or rotating stimuli. Relational reasoning involves noticing patterns. Children's spatial language is positively associated with performance on spatial tasks (Turan & De Smedt, 2022). The goal of this project was to determine which spatial factors predict engineering learning among 6- to 7-year-old children. To date, 51 children completed computerized relational reasoning and mental transformation tasks along with a simple engineering task (deciding which piece would make a cube the strongest). Parents completed surveys measuring family demographics, STEM interest, and spatial language. Mental transformation was significantly positively correlated with relational reasoning, $r(40) = .48, p < .05$, and with engineering learning, $r(40) = .35, p < .05$, even after controlling for age. These findings suggest that mental transformation skills are relevant for STEM learning during childhood.

P2-9 - Children's essentialist and stigmatizing beliefs about mental illness

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Details

Adults hold stigmatizing beliefs about mental illness (MI), but less is known about the development of these beliefs. We investigated children's (ages 5-10) concepts of MI and if language (i.e., labels used to reference an individual with MI) is a potential mechanism underlying negative beliefs. Children ($n = 129$) learned about characters with a novel MI ("agrexia") using person-first ("a person with agrexia") or generic noun ("an agrexic") labels [X]. We evaluated children's stigmatizing beliefs (e.g., desire for social distance) and three dimensions of essentialism: stability (e.g., will this [X] always be nervous), causality (e.g., why does this [X] have trouble sleeping), and homogeneity (e.g., do you think only this [X], a few [X], or a lot of [label] are scared to try new foods?). Based on their endorsement of essentialist explanations and stigmatizing statements, children viewed the novel MI as a stable, causally informative, homogeneous category, but did not frequently endorse stigmatizing beliefs. The specific labels used ("agrexia" or "person with agrexia") did not predict essentialist or stigmatizing beliefs. While the frequency of essentialist explanations increased with age, stigmatizing beliefs related to dangerousness

and a desire for social distance decreased. Thus, children increasingly view MI as inductively informative, reflecting people's stable personal character, and expect similarities to arise from inherent causal properties.

P2-10 - How children reason about intellectual humility and intellectual arrogance

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¹ Vanderbilt University, ² Emory University

Details

When in development do children come to appreciate intellectual humility in others? Existing research suggests that children—especially young children—appreciate confidence and certainty, so children may not value intellectual humility until later in development because it may signal low confidence and uncertainty. Here we examined how children ages 4-11 years reason about individuals who express either intellectual humility or intellectual arrogance when discussing real-world (Study 1; N = 111) or ambiguous (Study 2; N = 118) scenarios. We found that children across ages evaluated intellectual humility positively—they found an intellectually humble individual to be more likeable and knowledgeable than an intellectually arrogant one. That said, younger children were more likely than older children to appreciate intellectual arrogance, regardless of whether individuals discussed real-world or ambiguous scenarios. In addition, effects were stronger for real-world compared to ambiguous scenarios. Altogether, these findings indicate that intellectual humility is appreciated by the time children enter formal schooling, and they also point to promising future directions surrounding how perceptions of humility become appreciated over development and may vary across contexts.

P2-11 - Child vocabulary and toddler classroom language environments

Ryan Colburn¹, Alexa Ellis¹

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Details

Early life child-adult interactions have been linked to future language abilities (Gilkerson et al., 2017), and concurrent child vocabulary performance (Duncan et al., 2020). However, it is unknown whether language environments relate to survey-reported vocabulary measures. This study examines whether neurodiverse toddler's conversational turns, adult words, and child vocalizations are differentially related to parent- or teacher-reported child vocabulary. Across three participating childcare programs, 52 children ages 1 - 4 years old from 11 classrooms wore LENA audiorecording devices for two full days. Both teachers and caregivers completed the same vocabulary checklist (Silver et al., 2023). Parent- and teacher-reported vocabulary measures were strongly related to child vocalizations. However, only teacher-reported child vocabulary was related to the conversational turn count ($r = .358^{**}$). These results suggest teachers may be better reporters of child vocabulary.

P2-12 - The Spanish and English web-CCT: dual language trends in bilingual Spanish-English speaking children

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Details

Early vocabulary is fundamental to children's language and cognitive development. During the first five years, children establish word-to-world mappings that support literacy and future outcomes.

Following the original Computerized Comprehension Task (CCT; Friend & Keplinger, 2003, 2008) and its expansions (Bleses et al., 2021 in Denmark, Gillen et al., 2021 in the UK, Lo et al., 2021, in Norway, and Rosemberg & Alam, 2021 in Argentina), we have extended this assessment to create the English and Spanish Web-CCTs. These are automated two-alternative forced-choice procedures with target-distractor pairs matched on difficulty, semantic category, word class, and salience. The assessment estimates vocabulary from 18 to 60 months of age.

We present psychometric properties for the English and Spanish Web-CCTs: convergent validity with the Receptive One-Word Picture Vocabulary Test ($r_{11}=.877$, $p<.001$, $r_{29}=.745$, $p<.001$, respectively), test-retest reliability ($r_{10}=.759$, $p=.007$, $r_{24}=.522$, $p=.007$) and internal consistency ($\alpha = .973$, $\alpha = .985$). In this poster, we explore relations between age and vocabulary acquisition on each measure and, because previous findings suggest that Spanish skills become weaker as children's English skills develop with age, we explore trends in relative language exposure and proficiency over time.

P2-13 - "They're nice because they're rich": 5- and 6-year-old children's absolute evaluations for groups of wealth and poverty

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Details

Research on young children's perceptions of rich and poor individuals has typically focused on relative evaluations: children are presented with a rich and a poor character and asked questions such as who they prefer or who is more likely to share (Ahl & Dunham, 2017; Horwitz et al., 2014). Such studies suggest a pro-rich bias (e.g., they prefer to befriend the rich; Li et al., 2014). However, it is possible that young children positively evaluate both rich and poor individuals and this is masked by a need to make a forced choice between the two. Studies on absolute evaluations — how children feel about the rich and poor independently from each other — have focused on older children (Mistry et al., 2015), making it difficult to evaluate this possibility. To address this issue, a sample of 5- to 7-year-old children evaluated rich and poor individuals independently on a series of positive (e.g., nice, smart) and negative (e.g., mean, selfish) traits. For each trait, children were asked to indicate how many members of a given social-class group exhibited the trait on a 5-point scale ranging from "none of them" to "a really big amount." Preliminary results suggest that, for both groups, children provided significantly higher ratings for positive traits than for negative traits (see Table 1), and ratings for the two groups did not differ from

one another. These findings suggests that young children view both rich and poor individuals positively when evaluated independently.

P2-14 - Learning about viruses at home: The effect of anthropomorphic representations on children's thinking about viruses

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Details

Children sometimes incorrectly attribute features of animals (such as being able to move independently) to viruses (Labotka & Gelman, 2023), and this might be supported by the anthropomorphic images and language in children's books (Ünlütarbet al., 2023) and adults' speech (Labotka & Gelman, 2022). We recruited 155 5- to 8-year-old children (79 girls, 76 boys; 110 white, 8 Black, 16 Asian, 3 Latinx, 1 Arab, 15 bi- or multi-racial, 2 did not report) to complete a two-session online study about how they think about viruses. At the end of the first session, children were randomly assigned to be read one of three children's books about illness: (a) depicting viruses in a realistic way, (b) depicting viruses in an anthropomorphic way, or (c) not depicting viruses (control). Bayesian analyses show that children who were read the control book attributed animal features to viruses more in the second session than children who were read either the anthropomorphic, $b = 0.32$, $95\%HDI = -0.07, 0.72$, $pd = 94.47\%$, or the realistic book, $b = -0.31$, $95\%HDI = -0.56, -0.05$, $pd = 99.09\%$. Additionally, 7- to 8-year-olds were less likely to attribute animal features to viruses than 5- to 6-year-olds, $b = 0.32$, $95\%HDI = -0.07, 0.72$, $pd = 94.47\%$. Overall, these results suggest that teaching children about viruses can reduce their tendency to ascribe agency to viruses, and that using anthropomorphic representations do not necessarily make children more likely to think of viruses as animals.

P2-15 - School-aged children differentially trust textbooks, humans, and ChatGPT

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Details

The development of AI (artificial intelligence) like ChatGPT poses opportunities to explore what children think about AI in comparison to human and text-based sources. Here, 10-year-olds ($N = 30$) evaluated information provided by a human, a textbook, and ChatGPT. In the endorse trials, children reported their endorsement, correctness rating, and recall of each source's answer to a novel question. Next, in the ask trials, children ranked the sources in order of who they preferred to ask for stable, transient, and personal questions. Last, children answered biological, artifactual, and psychological attribution questions for each source (Girouard-Hallam & Danovitch, 2022). Endorsements, correctness ratings, and recall did not differ across sources. On ask trials, children showed significant preferences for sources based on question type (Table 1). Children's attributions were more mixed. Sometimes they viewed ChatGPT as more of an artifact than the human (Figure 1). However, they also occasionally attributed

psychological traits to ChatGPT – particularly more so when compared to the textbook (Figure 2). Individual differences also predicted children’s choices (Table 2). Thus, while children are able to recognize the limitations and strengths of ChatGPT for different domains of knowledge, their conflicting attributions suggest that they may inappropriately apply human-like expectations toward ChatGPT.

P2-16 - Exploring how young children’s “literal” and “reality” biases collide in their metaphor comprehension

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Details

Children’s early conceptual development appears marked by robust preferences for literal interpretations and realistic outcomes (Weisberg et al., 2013; Winner, 1993). Traditionally studied separately, these preferences clash in metaphor comprehension as literal interpretations can often be unrealistic (as in “The frog with the umbrella”). We investigated the interplay of these preferences during children’s metaphor comprehension.

In Study1, 50 children (4-8) and 30 adults rated which image, from 20 literal vs. metaphorical pairs, they considered “pretend.” Both groups consistently rated more literal items as pretend ($p < .001$), and their ratings correlated ($r(78) = .81$).

In Study2, children hear a story set in their city and choose pictures to match different scenarios (each referencing a metaphorical statement). Picture options include a metaphorical image and either a distractor or literal image, with the literal being those consistently rated as pretend in Study1. We record picture selections, reaction times, and looks pre/post-the metaphorical statement (e.g., after “frog”/“umbrella”).

Results will be presented at the conference. We expect children’s interpretations will be more influenced by the literal meaning of the words than by how well they match the real-world scenarios. Consequently, children may look less at literal images before the metaphorical statement (e.g., at “frog”) but still opt for literal interpretations once the utterance unfolds.

P2-17 - It’s alive! Are children’s and adults’ vitalistic attributions to nature related to environmental moral concern?

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Details

Humans employ diverse frameworks to understand nature (Inagaki, 1997). They may attribute mentalistic agency, perceiving natural entities as having intentions, thoughts, and desires, or vitalist agency, representing them with survival needs and non-intentional goals. While mentalistic agency (mind) is associated with recognizing nature’s moral standing (Waytz et al., 2010), we know little about

how more basic attributions of vitalist agency (life) relate to environmental moral reasoning across development.

To explore this, six to seven-year-olds (N=48) and adults (N=63) evaluated four environmental damage scenarios (e.g. logging). After rating moral concern participants justified their judgements. We coded whether they spontaneously attributed vitalist or mentalistic agency to nature in their moral justifications.

Children attributed vitalist agency to nature more than adults ($p < .01$) (Fig. 1). Despite this developmental difference, tendencies to justify moral judgements in vitalist terms were associated with greater environmental moral concern at both ages ($ps < .01$) (Fig. 2). These relationships did not occur for mentalistic agency with mental attributions low at each age (Fig. 1).

These results illuminate the unique relationship of different framework theories to moral reasoning. Recognizing that natural entities are alive seems to play a greater role in environmental moral concern than attributions of human-like mentality. Such findings can inform environmental education.

P2-18 - All tied up: developing the knot reasoning task, a novel measure of non-rigid spatial thinking

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Details

Spatial skills are important for STEM learning (Tian et al., 2022). Despite substantial research on rigid spatial skills like mental rotation, we know little about *non-rigid* spatial skills, especially those that involve continuous change (e.g., bending). Yet non-rigid spatial skills are used in many STEM fields (e.g., surgical knot-tying, oceanography) and may be influenced by different experiences (e.g., fiber arts) than rigid spatial skills (Bennett-Pierre & Gunderson, 2022). We asked how adults' non-rigid spatial skills relate to gender, other spatial skills, and childhood spatial activities, as a first step to understanding their development. We created a novel measure of non-rigid spatial reasoning for adults using pictures of knots. In Study 1 (n=278), we used Item Response Theory to ensure items had a wide range of difficulty and eliminate items with low discrimination. In Study 2 (n=95), we assessed knot reasoning, mental rotation, folding, bending, and vocabulary. We did not find gender differences in performance on the knot reasoning measure in either study. In a simultaneous regression, only folding (but not mental rotation, bending, or verbal skill) predicted the knot reasoning task ($b = .37, SE = .11, p = .001$). Childhood spatial activities were not correlated with the knot reasoning ($r(93) = .03, p = .752$). Future work could adapt the knot reasoning task for use with younger children, and develop fiber-arts-based interventions to support STEM learning.

P2-19 - Infants expect others to explore objects that violate their expectations

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Details

Infants prefer to play with objects that violate their expectations (Stahl & Feigenson, 2015), but do they expect others to exhibit this preference as well? In this study, we asked whether infants expect other people to engage with surprising objects over novel ones.

In Experiment 1, 28 17- to 24-month old infants watched videos depicting an adult who saw and expressed surprise at objects that violated either gravity or continuity. On key test trials, the adult chose to engage either with the object that had just behaved surprisingly (Expected Outcome), or else ignore the surprising object and instead engage with a novel distractor (Unexpected Outcome). Infants looked significantly longer at Unexpected Outcomes, suggesting that they expected others to engage with surprising objects. In Experiment 2, we are asking whether affective cues are required for infants to form this expectation. 17- to 24-month old infants see stimuli like those in Experiment 1, except that the adult's face is hidden by a visor (although it is clear that they have visual access to the surprising event). Preliminary results suggest that infants still look longer when an adult engages with a novel object over a surprising one, despite the lack of an observable affective response. These findings suggest that infants have expectations about what other people will be surprised by, and how this surprise will guide others' explorations of the world.

P2-20 - Children's willingness to pay for self-promotion: cooperation vs. competence

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Details

Four- and 6-year-old children (N=105) participated in a single experiment which explored their 'willingness-to-pay' to appear either cooperative or competent to others. Children participated in an animal sorting task and (between subjects) were praised for being either "helpful" (cooperation), "smart" (competence), or simply for having finished (control). Children were then introduced to a 'boring' black and white sticker and were told that the sticker would signal to other individuals that the child was either 'helpful' or 'smart', or would communicate nothing at all. To receive the self-promotional sticker, children had to pay the cost of relinquishing two attractive puppy stickers that they had previously received. Four-year-olds were, surprisingly, quite willing to trade their puppy stickers under any condition. Six-year-olds on the other hand, showed greater sensitivity to our design and were reluctant to trade in the control condition (< 1%), much more willing to trade in the 'helpful' condition (58.33%), and most willing to trade in the 'smart' condition' (70.84%). For Exp. 2, we aim to increase the value of the initial stickers and to pit competence and prosociality against one another to see which quality children will be more interested in displaying. We conclude that young children are willing to pay a cost to publicly display either their cooperation or their competence.

P2-21 - Exploring the relations between helping, sharing, and comforting in childhood prosocial development

Seleste Beaulieu¹, Radu Urian¹, Kristen Dunfield¹

¹ Concordia University

Details

Prosocial behavior – i.e., acting on behalf of others – is an important part of children’s positive development. While children respond to a diversity of needs (e.g., instrumental, material, emotional) early in development, different varieties of prosocial behavior (e.g., helping, sharing, comforting) frequently do not correlate. As the ability to recognize and respond to diverse needs relies on the development of distinct social-cognitive processes (Dunfield, 2014), the distinctiveness of responses should decrease as social-cognitive abilities mature. Yet, it remains unclear how the associations between varieties of prosocial behavior change throughout childhood. This study aimed to further examine the interrelatedness of the three subtypes by exploring age-related differences in the associations across prosocial responses. To examine children’s prosociality, 189 3.5- to 7.5-year-olds completed six behavioral tasks while parents completed a questionnaire. Correlations and a principal component analysis provided evidence for partial convergence across subtypes. Three components were identified: 1) Parent-Reported, 2) Instrumental-Comforting, and 3) Costly. Results suggest that the social-cognitive constraint account alone cannot fully explain the lack of associations across subtypes.

P2-22 - Placement of prized possessions: childrens’ reasoning about how social factors shape where others put possessions

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Details

The physical world can convey social information. For example, a person’s possessions can signal their preferences and social identity. Here we examine children’s reasoning about how social factors shape where others store their possessions, and how this joint physical-social reasoning develops. In a pre-registered study, we tested 4- to 7-year-old children (N=72) and adults (N=72), asking if they made systematic predictions about where an owner will keep their object based on (a) whether the owner likes the object, and (b) whether competitors covet it. Participants chose between two possible locations: a hard-to-reach high shelf, and an easily-accessible low shelf. As predicted, we found a significant interaction ($ps < .001$): Children and adults expected owners to keep *liked* objects on a high shelf when there was competition (i.e., when others wanted it), but on a low shelf when there was no competition. By contrast, *disliked* objects were *not* expected to be kept on a high shelf when there was competition, nor on a low shelf when there was no competition, suggesting that children’s and adults’ interpretations of competition depend on objects’ value to their owners (Fig. 1). These findings provide evidence that from preschool age, children can use social factors to reason about people’s interactions with physical objects and can integrate information about object value and potential competition to form expectations for where others’ will place their property.

P2-23 - What do children learn from statements about opportunities for novel social groups?

Erin Kim¹, Hilary Barth¹, Jessica Pordy¹, Molly Fung¹, Suchita Sridhara¹, Ellie Pan¹, Addie Defeo¹, Jinjia Hu¹, Shanthi Soans¹, Sarah Hammond¹, Abby Wolk¹, Courtney Litts¹, Selena Delgado¹, Rachel Hsu¹, Leah Vaidya¹, Emily Hauser¹

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Details

Previous research shows that the way we talk about groups can support existing stereotypes or create novel ones. In some situations, people may draw conclusions about groups that are explicitly mentioned in verbal statements, and about groups that are not. We ask if statements about opportunities that are targeted to particular (novel) groups lead to inferences about both mentioned and unmentioned groups. Children were introduced to a pair of novel social groups and heard a statement about a special “activity day” targeted to one group. They then rated new members of both the mentioned and unmentioned groups for their ability at the designated activity. Children rated the mentioned group’s ability for the activity positively and rated the unmentioned group’s ability negatively, providing evidence for another case in which statements that may seem neutral or even positive might lead listeners to draw inferences that the speaker did not intend.

P2-24 - All the cool kids are doing it: children's naïve theories of popularity and social influence

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Details

Popular kids are junior influencers: their peers copy what they do (e.g., Lease et al., 2020). While externally valid, research documenting children’s grasp on this dynamic in their schools cannot disentangle confounds popular kids share that could also drive others to copy them (e.g., wealth, attractiveness; Closson, 2009). In three preregistered studies ($N_{total}=300$), we strip away these confounds by contrasting two novel characters, one popular and the other having a different desirable trait. Study 1 found that children believed a popular child was more influential than a control (fast) one. This belief was specific— they did not report either was smarter or nicer. However, aligned with past work (e.g., Yee et al., 2022), children associated popularity with being rich. So, Studies 2 (forced choice) and 3 (non-forced choice) pit popularity and wealth against each other. In both studies, children reported the popular child was more influential than the other (rich) child. Importantly, children were evenly split when asked which of these forms of status they desire. We also explored if participants themselves copied the popular kids but did not find evidence for this. This work provides a detailed picture of children’s conceptual reasoning about popularity, demonstrating that children believe social influence is a central and specific trait of popularity, which provides important insights about their emerging intuitions about social status, reputation, and social influence.

P2-25 - The development of prejudice and discrimination: black men and children as large, strong, and threatening?

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¹ Tufts University

Details

White adults perceive Black men as physically larger, stronger and more threatening than White men of the same size (Wilson et al., 2017; Johnson & Wilson, 2019). The present research investigated the development of this bias. One hundred and one 6- to 11-year-old children and 48 adults saw cartoon faces of Black and White children paired with vignettes depicting them as the actors of negative social interactions (e.g., social exclusion, physical contact). Participants rated each actor's meanness, strength, weight, and height. We found that adults rated Black actors as stronger than White actors, and that these ratings interacted with the kind of social interaction; in contrast, children's strength ratings varied across the social interactions, but did not interact with race. We also found that both children and adults overall rated all actors as mean; meanness ratings varied by interaction but not by actor race. Finally, both children and adults' ratings of height and weight did not consistently vary based on race or kind of interaction. Taken together, these findings suggest that the bias to rate Black actors as stronger than White actors may have a later developmental onset than the age range tested in the current study. They also suggest that strength may be the variable informing any emerging association between race and physical size across development. Future research should continue to study the emergence of these biases between early childhood and adulthood.

P2-26 - Twenty-month-olds recognize the impact of phone usage on others' performance

Qiong Cao ¹, Anna Mears ¹, Lisa Feigenson ¹

¹ Johns Hopkins University

Details

Seeing adults use smart phones is a common daily experience for many infants. Although research finds that parents' phone usage can negatively impact their interactions with infants, less is known about how infants themselves think about the others' cell phones usage. Do infants recognize that phone usage can affect the user's behavior? Here we asked whether infants expect a person's task performance to be impaired by phone use. Twenty-month-old infants watched two adults, matched in age and gender, engage in building block towers. One of the adults did this while also using a phone—either looking at the screen and scrolling (Experiment 1; N=20) or talking while looking at what they were building (Experiment 2; N=20). Infants then saw the outcomes of the adults' efforts. Across both experiments, infants looked significantly longer when the person who had been using the phone built a taller tower than the person who had not been using the phone, compared to the reverse, suggesting that infants expected phone usage to negatively impact performance. These findings are consistent with the view that from early in development, children are aware that cell phones cause distraction.

P2-27 - Children's imitation of costly rituals: insights into early cultural learning

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Details

Rituals are deeply ingrained in human lives, serving adaptive roles. Children demonstrate a remarkable ability to faithfully copy rituals they observe. However, it remains unclear whether this extends to situations where ritual learning involves a material cost. This research examined children's imitative responses to costly rituals versus ordinary costly actions. 130 children aged 4 to 7 were shown two methods to acquire stickers: one involving ritualistic actions and the other matched instrumental actions, both incurring a cost of forgoing stickers. Remarkably, children who witnessed the ritual imitated more faithfully, despite gaining fewer stickers; whereas those shown the instrumental actions largely ignored them and obtained more stickers. This highlights how children are motivated to acquire and perpetuate even costly rituals, pointing to their predisposition to engage with social conventional information. This study also reveals the flexible nature of children's imitation, influenced by both situational understanding and features of the observed method.

P2-28 - The role of situational context in 4- to 9-year olds' moral evaluations of prosocial and transgressive actions

Sophie Charles¹, Ilana Cohen^{1,2}, Larisa Solomon¹

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Details

Across development, moral judgments become more attuned to intent, such that older children respond less harshly to accidental versus intentional transgressions than do younger children (Cushman et al., 2013). The proposed work asked whether older children may also consider the situation in which a behavior occurred. For instance, children may think differently about a peer who shares when they have access to many resources (an easy context) versus few resources (a hard context). If older children are broadly interested in "why things happen," we would expect them to evaluate transgressors more favorably in the "hard" context than in the "easy" context. However, as the outcome is the same, younger children should not distinguish between these conditions. Because intent-based moral judgment shifts in early elementary school, we recruited 4- to 9-year-olds. Children evaluated targets who engaged in a prosocial behavior or transgression with a) no additional context, b) easy alternatives, or c) hard alternatives. Children evaluated transgressors as less moral in the neutral ($p < .001$) and easy ($p = .002$) contexts versus the hard context but did not distinguish between neutral and easy contexts. They did not distinguish among any contexts when evaluating prosocial actors. Although younger children focus less on intent than do older children (Cushman et al., 2013), they may make sense of others' behaviors beyond simply focusing on outcomes by integrating information about context.

P2-29 - A longitudinal investigation of imaginary companions, fantasy orientation, and theory of mind

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Details

Having an imaginary companion (IC) in early childhood is often considered evidence of an orientation toward engaging in fantasy (fantasy orientation; FO) (Brown et al., 2017). Studies have rarely examined how ICs and FO are differentially related to developmental outcomes. This study investigates changing relations between ICs, FO and theory of mind (ToM) across three time points in early childhood. Two hundred sixty-three children (154 female) ($M_{age} = 56.24$ months, $SD = 9.74$) participated at Time 1, and 138 participants (~52%) indicated having an IC. At Time 2 ($n = 146$; $M_{age} = 63.76$ months, $SD = 10.32$), 61 children (~42%) indicated having an IC. At Time 3 ($n = 135$; $M_{age} = 74.41$ months, $SD = 11.01$), 54 children (~40%) indicated having an IC. Having an IC and FO are related, but longitudinal changes in having an IC are not mirrored in changes in FO. Differences in IC status across time points emerged (Figure 1); while FO scores remained relatively stable (Figure 2). Both IC status and FO are increasingly negatively correlated with ToM over early childhood (Tables 1 & 2). What is unclear from these findings is if gains in ToM subsequently influence maintaining a relationship with an IC or if ICs and FO are not having the hypothesized influences on ToM development. These findings suggest research examining the influence of fantastical play in early childhood should differentiate between general engagement of fantasy and the specific kinds of engagements that occur with ICs.

P2-30 - Exploring how proximal factors may relate to differences in maternal speech with bilingual families

Alexus Ramirez ¹, So Yeon Shin ¹, Brenda Jones Harden, Tiffany Martoccio ¹, Lisa Berlin ², Rachel Romeo

²

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Details

Caregiver input is associated with children's language and cognitive development. Children's socioeconomic status (SES) is often found to relate to their language experience, with families of higher SES producing more complex and responsive speech. Here, we examined the associations of four risk factors (education, mental health, parenting stress, and financial strain) on language input in low-income, bilingual, Latinx mothers and their infants ($N = 103$, $M_{age} = 16.44$ mo., $SD = 4.20$, $Range = 9.43-24.67$, 47 males). Notably, maternal education spanned levels much lower than that of typical Western studies. Mothers completed standardized questionnaires, and dyads engaged in a 15-minute semi-naturalistic interaction with the three-bags task. Results revealed that education was a stronger predictor of maternal speech than all psychosocial stressors, suggesting that these stressors have less of an effect in more diverse samples. Future research should continue exploring how proximal factors may relate to caregiver speech in families across the entire SES spectrum, as results may not be generalizable to those of different backgrounds.

P2-31 - Advancing the reporting of developmental EEG data: tools for estimating reliability, effect size, and data quality metrics

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Details

EEG research is critical for understanding the development of cognitive processes, individual differences, and the impacts of interventions across development. However, current developmental EEG studies often lack consistency in reporting reliability, effect sizes, and data quality metrics, which are crucial for assessing the data's inherent quality beyond the paradigms used. To address this gap, we developed a novel tool to estimate reliability, effect size, and data quality (e.g., standardized measurement error) in EEG data. The tool features user-friendly software along with bootstrapped estimates to guide decisions on trial numbers for the inclusion of participants and task optimization for future study designs.

Our poster will demonstrate this tool's utility for enhancing metric reporting in popular EEG pipelines. We will apply the tool to large, longitudinal datasets of infants and children, generating reliability, effect size, and data quality estimates in three commonly used paradigms: visual perception, face perception, and resting state. As an initial example, Figure 1 illustrates the reliability estimates for Visual Evoked Potentials (VEPs) in a subset of infants.

Overall, we aim to improve the quantification and reporting of reliability, effect size, and data quality estimates to inform robust understanding of cognitive processes in EEG studies, fostering higher standards of reliability and reproducibility in developmental neuroimaging research.

P2-32 - Eye can help: infant prosocial behavior in a gaze-contingent eye-tracking paradigm

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¹ University of Michigan

Details

Infants begin to help others early in their second year, yet the building blocks of prosocial behavior emerge earlier in development. Studying helping behavior in young infants is a challenge due to their limited motor abilities. In the current set of studies, we employ a novel gaze-contingent eye-tracking paradigm to equip infants with a means of helping that does not rely on their motor skills. Across two studies, infants aged 9-12 months had the opportunity to remove a barrier to an animated agent's goal by looking at a button on the screen to trigger a gaze-contingent action. In Study 1, infants could look at a button to remove the target wall blocking the agent's goal, or a distractor wall blocking a non-goal object. Results showed that infants were more likely to trigger the target wall ($M = 2.25$) than the distractor wall ($M = 1.08$), ($N = 24$, $t = 2.67$, $p = .01$). In Study 2, we adapted this procedure to a go-no go paradigm to rule out a possible side bias. Infants saw the agent move towards a goal object and a single wall either blocked the goal object (Experimental condition) or did not (Control). Data collection for Study 2 is currently underway and expected to be completed prior to the meeting. Our initial evidence

suggests even before infants have acquired the motor capacities to engage in real-life helping, they understand how to help others and are motivated to do so when given the means.

P2-33 - Developmental changes in children's predicted learning curves.

Xiuyuan Zhang¹, Brandon Carrillo¹, Ac Christakis¹, Saif Behairy¹, Julia Leonard¹

¹ Yale University

Details

How do children – who are undeniably productive learners – think about their learning? Do children understand, as adults do, that learning is a process of continuous improvement over time? To explore children's emerging representations of the learning process, we created a motor learning paradigm where 4- to 8-year-olds predicted their own learning curve without prior experience. In Experiment 1 ($n = 125$, preregistered), we found that 7- and 8-year-olds, but not 4- to 6-year-olds, predicted improved performance across five trials. Younger children instead were overly optimistic about how well they would do at the game and often predicted near perfect performance across trials. However, when we added more scaffolding and lowered task demands (preregistered Exp. 2; $n = 75$), we found that even 5- and 6-year-old children, but not 4-year-olds, predicted improved performance across trials. This work suggests that children's predictions of their future learning curve become more refined with age, which may have implications for how best to scaffold young children's learning decisions.

P2-34 - Learn or perform? Children's inferences about adult's child-directed achievement goals and actions

Brandon Carrillo¹, Mika Asaba¹, Lizbeth Lozano¹, Julia Leonard¹

¹ Yale University

Details

Adults hold different goals for children's achievement: Sometimes adults want children to learn as much as possible (learning goal), while other times adults discount learning in favor of high performance (performance goal). How do children reason about the achievement goals adults have for them? Here, we examine how 5- and 6-year-old children reason about the causal relationship between adults' achievement goals for children and their task choices for them (all preregistered). In Exp. 1, we establish that adults are more likely to give harder tasks to children when they hold learning versus performance goals, and when they perceive the child to be more versus less competent. In Exp. 2, we found that children correctly predict this behavior given adults' achievement goals and a child's competence. Finally, in Exp. 3, children also inferred that adults who want them to learn will give them harder tasks. Children themselves also pick harder tasks when they want to learn versus perform. Thus, young children can infer the relationship between adults' child-directed achievement goals and actions and may use this information to learn about what adults prioritize for children across contexts.

P2-35 - Mathematics undraped: an inspection of content explicit and implicit through parent-child interaction

Stephanie Gomez¹, Keting Chen¹

¹ California State University, San Bernardino

Details

Early numeracy environments benefit young children's numeracy skills development, especially from the home context. Studies examining parent-child interactions during math explicit and implicit activities, however, are scarce. Understanding the differences in parent-child interaction during the two activities will help design effective interventions. This exploratory study examined the differences in parents' number talks during explicit and implicit math activities. Participants were 119 parent-child dyads with children ages 3-to-5 years old. Dyad interactions were recorded for two 10-minute activities: math-explicit numeracy activity and math-implicit textless book reading. The percentage of parents' number talk for both activities was significantly different ($t [118] = 14.13, p = .000, \text{Cohen's } d = 0.243$), indicating that parents produced more math-related utterances during the explicit numeracy activity than in the textless book reading. The results indicate that in implicit math content, parents might not be sensitive to such content, thus, the likelihood of talking about numeracy-related content to their child may be low.

P2-36 - Pandemic disruptions and socioeconomic status: examining their effects on early vocabulary development

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¹ San Diego State University

Details

We examined relations between Pandemic-Related Chaos (PRC), Socioeconomic Status (SES), and Conceptual Vocabulary in 44 English and/or Spanish speaking children (20F, $\text{Mage}=26.98\text{mos}$, 19 to 38). PRC was measured via a Covid-19 Family Stressor Scale with income, anxiety, family, and childcare subscales. Our SES composite was comprised of income, education, and family size. Vocabulary was assessed via the Web-CCT and ROWPVT/MCDI:WS. SES and PRC were significantly and independently related to Vocabulary in a hierarchical regression. Adding SES (Model 2) and PRC (Model 3) to age and sex significantly improved model fit (Model 2: $\Delta R^2=.107, F_{1,40}=6.84, p=.012$; Model 3: $\Delta R^2=.113, F_{1,39}=8.61, p=.006$). SES was positively related to Vocabulary, whereas PRC was negatively related. Partial correlations revealed negative associations between Vocabulary and family and childcare subscales ($r_{41}=-0.394, p=0.009$; $r_{41}=-0.31, p=0.043$, respectively), but not income or anxiety subscales. Relative weights analysis revealed that relationship conflict between caregivers, children's screen time, and feelings of overcrowdedness explained 25%, 22%, and 15% of the effect of family changes on vocabulary, respectively. Relying on a patchwork of childcare arrangements, being unable to access childcare, and not being able to afford childcare explained 30%, 19%, and 14% of the effect of childcare changes on vocabulary, respectively.

P2-37 - Acceptable noise level development for 3-12 year olds

Zewei Li ¹, Yanjie Su ¹, Yanwei Wang ¹

¹ Peking University

Details

Acceptable noise level (ANL) represents an individual's tolerance for background noise. ANL equals to the most comfortable level (MCL) minus the maximum background noise level (BNL). Previous studies mostly focused on adults, but has not systematically examined the development of ANL across childhood. We proposed that the ANL of children decreased with age, and that children with higher ANL performed better in verbal repetition.

In order to investigate the development of children's ANL and its relationship with verbal repetition, we recruited 110 children from 3 to 12 years old, and conducted behavioral experiments to measure children's ANL by psycho-physics methods.

The results revealed that ANL decreased with age, and children's speech repetition performance was positively correlated with ANL when controlling age and gender. Besides, MCL was also positively correlated with age across childhood.

Current study suggested the developmental trajectory of ANL and the relationship between ANL and verbal repetition.

P2-38 - Characterizing infant object experience through repeated video sampling across the day

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Details

Infant object experiences provide rich opportunities for perceptual and cognitive development. Prior work using ~2-hour home observations and laboratory play sessions found that infants interact with objects around 50-60% of the time and do so more frequently while sitting. However, single "snapshot" observations cannot capture the varying motor (e.g., sitting versus other body positions) and environmental (e.g., physical locations) contexts behind infant behavior as full-day observations do. Therefore, our present study characterizes infant object experience across the day using repeated daily video samplings and examines if we replicate prior findings on object experience.

We collected data from 46 infants through two 14-day sessions (11 and 13 months). Caregivers received daily smartphone notifications (10 times a day) to record 10-second videos of their children for us to code infants' object activities and sitting frequencies. We found that infants spent a significant amount of time holding objects in daily life ($M = 44.8\%$ of the time), although this rate was more modest compared with "snapshot" estimates. Regarding the motor context behind object interaction, we replicated prior findings by showing that infants were more likely to hold objects while sitting. Overall,

our study using repeated daily sampling replicated and strengthened prior findings about the importance of object experience in infants' daily activities and the facilitative role of sitting.

P2-39 - How does inheritance influence children's resource valuation and sharing?

Sophie Riddick¹, Richard Ahl¹, Mahsa Ershadi¹, Katherine McAuliffe¹

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Details

Most resources at children's disposal come from parental resource transfers (i.e., "inherited" wealth). Yet, most work on children's resource allocation focuses on contexts where children acquire their own resources. Prior research has shown that children's decision-making depends on *how* they have obtained their resources, either through merit (their own effort) or windfall (no effort). A question that has received considerably less empirical attention is how children engage with *inherited* wealth. The current study introduces 5- to 10-year-olds to a Dictator Game where they allocate tokens (acquired through work, windfall, parent's work, or parent's windfall) between themselves and an absent child. Participants rate the tokens' importance on a 5-point scale, yielding a value score. Collapsing across 'self' and 'parent' conditions, preliminary analyses ($N = 121$ of planned 256) reveal effects of age ($p = 0.0343$; Figure 1a) and value ($p = 0.0451$; Figure 2a), whereby older children and those valuing tokens less tend to share more. Similar effects of age ($p = 0.0339$; Figure 1b) and value ($p = 0.0596$; Figure 2b) emerge when collapsing across 'work' and 'windfall' conditions. Children appear to share similarly whether the resources were acquired by themselves or their parents. Findings will offer new insights into the extent to which children's sharing and valuation of resources depends on whether the resources were self-acquired or inherited.

P2-40 - Episodic future thinking emerges after episodic memory

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Details

We investigated whether episodic future thinking (EFT) and episodic memory (EM) involve the same processes by asking whether these functions emerge together. Twenty-six three-year-old (3's) and 25 four-year-old (4's) Mexican children entered a room where they saw a box on the floor. In the experimental condition (15 3's; 13 4's), the box was locked. Children opened the lock on the box with a key, hid a sticker in it, and closed it again with the lock. In the control (11 3's; 12 4's), the box was not locked. Children opened the box, found a key inside and replaced it with a sticker. After playing for 5 minutes in another room, children were asked between 3 and 5 memory questions about what they had seen and done in the other room (e.g., what was on the floor, what they hid in the box). Then, they were told they were going to get their sticker in the other room. They were asked to take one of four objects with them – one of which was the key required to open the box – and to justify their choice. Significantly more 4's chose the key and said that they chose it to open the box in the experimental (11) than in the

control group (2; $p = .003$). This difference was not significant in the 3's (experimental: 2; control: 0). Yet, all 4's and nearly all 3's (23) answered all, or all but one memory question correctly. This suggests that EFT emerges after EM. Thus, it may involve some processes beyond those involved in EM.

P2-41 - Investigating strategy flexibility in algebra: the role of executive function, procedural fluency, and conceptual knowledge

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Details

Strategy flexibility is an important aspect emphasized in math education (Verschaffel et al., 2009). Being able to flexibly select and efficiently apply strategies allows students to solve problems in fewer steps, leaving less room for error. The current study examines the differential role of conceptual knowledge, procedural fluency, and executive function on students' strategy flexibility in the domain of algebra. We separate strategy flexibility into two aspects: the ability to select strategies adaptively (strategy selection) and the ability to execute the more efficient strategy (strategy execution).

We found that on average, participants used the innovative strategy spontaneously in 10% of the trials. Both procedural fluency ($b = .11$, $t(81) = 4.46$, $p < .001$) and conceptual knowledge uniquely contributed to students' strategy execution ($b = .11$, $t(81) = 4.44$, $p < .001$). However, only conceptual knowledge uniquely contributed to students' strategy selection ($b = .71$, $t(81) = 3.03$, $p = .003$). Executive Function did not uniquely contribute to either aspect of strategy flexibility. The results highlighted different factors that may influence strategy flexibility and have educational implications.

P2-42 - Development of visual perception of fire intensity in early childhood

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Details

A crucial step in models of human behavior in building fires is accurately perceiving fire cues. Prior research indicates that adults are adept at detecting differences in fire intensity using visual cues; this has yet to be examined with young children. The present study extended this research by investigating the development of young children's visual perception of fire intensity. Over 70 three- to six-year-olds completed a comparison task where they judged which of two trains contained more fire. Based on non-symbolic quantity research, the ratio (relative difference) between the intensity of two simulated fires was varied across trials to be smaller versus larger. Significant ratio and age effects were observed: children were more likely to select the train with the greater intensity fire as being 'more' the larger the ratio and the older the child. These results suggest that young children are sensitive to fire intensity using visual cues and have increasingly precise estimates by six years of age. This developmental pattern parallels age-related improvements in visual non-symbolic quantity perception including number and

spatial extent. This novel research can inform the development of child fire perception, contributing to future research identifying how interventions can improve fire prevention training with children.

P2-43 - The nature of word-referent copresence in children's picture books

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Details

Picture books are known to facilitate early word learning (Horst & Houston-Price, 2015). Although experimental research has suggested how a books' visual features could affect learning (Flack & Horst, 2018), little is known about the visual features of commonly-read picture books, and how they support learning. This study addresses this knowledge gap by analyzing word-referent co-presence statistics in 128 picture books. Analyses of 3322 pages and 3968 noun events suggest three key trends. First, co-presence statistics were above what would be expected by chance and within the range found in child-directed speech (Bergelson & Swingley, 2013). Second, a noun's referent typically appeared on the page that noun was printed but not on the surrounding pages, mirroring the temporal properties argued to be ideal for learning (Trueswell et al., 2016). Finally, co-presence statistics were identical in books for younger and older children, suggesting little developmental tuning of this visuo-linguistic property.

P2-44 - Early looking toward the mouth predicts later receptive language in ASD

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Details

Social communication challenges are characteristic of Autism Spectrum Disorder (ASD), and are linked to language difficulties (Peeters et al., 2023). Early looking toward the mouth region of the face could serve as a valuable predictor of later language development (Young et al., 2009). In a sample including infants with a family member with ASD (high-risk) and without (low-risk), this study investigates if preferential looking at the mouth (measured at 3, 6, 9, and 12 months) predicts receptive language skills at 4 years. Repeated Measures ANOVA revealed an age-related increase in looking toward the mouth across the first year ($\chi^2(3) = 31.80, p < 0.001, \eta^2 = 0.16$), while risk group and its interaction with age were not significant predictors. A multiple regression model predicting receptive language at 4 years was significant ($\text{adj } R^2 = 0.39, F(6,21) = 3.84, p < 0.01$), and both looking toward the mouth at 6 months ($t(21) = -3.37, p < 0.01, \text{Std.}\beta = -1.13$) and its interaction with risk group ($t(21) = 2.77, p < 0.05, \text{Std.}\beta = 1.20$) were significant predictors. In the high-risk group, a preference for looking at the eyes instead of the mouth at 6 months has a negative relationship with receptive language scores at 4 years ($r(49) = -0.28,$

$p < 0.05$), while no significant correlation was found in the low-risk group. This relationship highlights the importance of monitoring early gaze behavior in at-risk 6 month olds.

P2-45 - Sortals in counting and the number sense

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Details

Adults understand labels specify units for quantifying: the same group of people is enumerated differently if asked to count “families” vs. “individuals”. As young language learners have not yet mastered the semantics of count nouns, many count discrete physical objects (DPOs) when asked to count groups (Brooks, Pogue, & Barner, 2010; Shipley & Shepperson, 1990). To test if this bias stems from immature counting abilities or how language guides sortals, we examine how children enumerate DPOs when counting vs. estimating number using the Approximate Number System (ANS). Three- to eight-year-olds ($N=202$) were taught that a ball can be broken in two halves, each called “a blicket”. They then counted sets of whole or half balls with a label that matched the display (e.g., “count the blickets” in a 4-half-ball display) and a label that conflicted (e.g., “count the balls” in a 4-half-ball display). Counting strategies were categorized as (1) counting DPOs, (2) counting objects specified by label, or (3) perceptually bound counters, who reject conflicting labels. Children then performed an ANS matching task where they indicated the number of balls or blickets for whole or half ball displays. Children performed identically across counting and the ANS: if children were DPO counters, they also systematically misestimated in the ANS. This suggests this DPO bias does not stem from immature counting abilities, and that the same sortals are used for counting and ANS enumeration.

P2-46 - Children’s understanding of digital rights violations and its influence on consumption

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Details

The consumption of online games presents new challenges for children where they often have to balance considerations of their rights and safety, with considerations of enjoyment (e.g., digital rights work, Gelman et al., 2021). In two experiments, we examine how a common digital rights violation, the unconsented sharing of personal information by an app, influences children’s evaluations of how fun the app is, the app’s moral status, and whether the children would use it. Data was analyzed using mixed-binary regressions. In Experiment 1 ($N=81$, $R=5$ - to 8-years), we find that 8-year-olds, but not younger children, evaluated rights-violating games as less moral and less desirable to play than games that upheld user rights (8-year-old, $ps < .006$), but viewed these games as equally fun. This indicates that morality, but not enjoyment, is likely a stronger determinant of their consumption decisions to play the game. So far, in Experiment 2 ($N=33$), we are finding that making consent more explicit influences 6- and 7-year-old judgments such that they provide lower evaluations when it is made clearer that the rights-

violating game is sharing information against the user's wishes. Together, these findings suggest that young children, by at least 8 years old, view the unconsented sharing of personal information as a rights violation and that such moral issues are given more weight in children's consumption than other (more) salient factors like enjoyment.

P2-47 - Learning gender variation in speech: an acoustic analysis of child-directed speech

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Details

Existing theories of language acquisition assume children learn the 'invariant' phonemes, and ignore the link between speech variation and social meanings (Johnson & White, 2020). Previous research showed that children as young as 2.5 years of age can convey their nascent gender through the way they speak, despite the lack of sex dimorphism in children's vocal tracts and larynges before puberty (e.g., Munson et al., 2022). This indicates that gender variation in children's speech are socially learned behaviors. The cognitive mechanism that allows children to learn socially meaningful variation of speech remains unclear. The current study analyzed whether gendered acoustic features are present in child-directed speech. Caregivers (n=36) with children of 2 to 3 years of age read a male-themed and a female-themed story. Mean pitch, pitch variation, and vowel features (vowel space size and overall formant frequency scaling) were measured. No acoustic differences in pitch or vowel features were found between caregivers of children assigned male at birth versus caregivers of children assigned female at birth. However, female-themed stories were produced with overall lower formant frequencies (consistent with female-sounding speech) and a smaller vowel space size than the male-themed stories. These results suggest that gendered child-directed speech is not the primary cause of children's gendered speech.

P2-48 - Exploring the relation between infant body position and adult language input across the day

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Details

Several aspects of infants' motor development relate to their language development. For example, Walle & Campos (2013) found that increases in productive and receptive language were associated with walking onset when examining differences between infants. We extend past work to ask whether variations in motor behavior across a day predict within-infant differences in language input, providing a mechanistic, real-time link between movement and language development.

We gathered full-day data from 48 4-7 and 11-14 month old infants in 108 monthly sessions. Infants wore accelerometers to classify body position (i.e., supine, prone, sitting, upright, or held by a caregiver) and a LENA recorder to estimate the total number of words heard by the infant. Sessions lasted 5.3-11.9

hours ($M = 9.2$). Body position and adult word count were calculated for each 10-minute interval across the session.

More time spent in both held and sitting positions predicted increased adult words heard. However, infants heard fewer words the more they were supine and prone. For younger infants, spending more time upright was associated with an increase in adult words heard, but the opposite pattern was found in older infants. These findings suggest that developmental links between motor and language development may be mediated by real-time, within-infant variations in language input.

P2-49 - Relations between sitting, object interaction, and caregiver speech input in infants with typical development and infants with cerebral palsy

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Details

Prior work demonstrates that infant sitting development is linked to language development, that sitting facilitates object interaction, and that object interaction is linked to caregiver speech. How do sitting, object interaction, and speech input relate in real time? Additionally, infants with cerebral palsy (CP), who display impairments in sitting and object interaction, are at risk for language delays, highlighting the importance of considering motor-language cascades in atypical development. This study explored the co-occurrence of sitting, object interaction, and caregiver object labeling in infants with typical development (TD) and infants with CP.

We observed 28 infants with TD (M age=5.7m) and 23 with CP (M =11.1m) in a 5-min free play session with a caregiver; groups were roughly matched on sitting skill. Caregiver speech was transcribed, and instances of object labeling identified. For each label, coders scored whether infant and caregiver were touching and/or looking at the labeled object. Infant posture (sitting or non-sitting) was also coded.

Infants heard M =17.4 utterances/min and M =1.5 object labels/min. Labels were more frequent while sitting than while in other postures, especially in infants with TD. M =80% of labeled objects were looked at or touched by infants and M =93% by caregivers, but the proportion of labels co-occurring with looking/touching did not differ by posture. Findings suggest that infant sitting may cue parents to increase use of object labels.

P2-50 - Five- to 9-year-olds' use of wealth and trait information in interpersonal evaluations

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Details

From an early age, children use wealth cues to guide their social judgements (e.g., Yang & Dunham, 2022). However, it is largely unknown how wealth is prioritized alongside other information, particularly personality traits. This research explored children's use of both wealth and traits to inform interpersonal judgements. As part of a larger, ongoing study, 5- to 9-year-olds (N=49) were told stories about four characters with different wealth and trait cues (rich/nice, rich/mean, poor/nice, poor/mean) and asked to infer additional qualities about each character (competence, work ethic, sharing behavior, power, popularity). Mixed ANOVAs revealed main effects of trait; nice people were judged as more competent, hardworking, popular, and as better sharers than mean people ($ps < .05$). Further, nice people were judged as smart regardless of wealth, whereas rich, mean people were viewed as smarter than poor, mean people. A main effect of wealth indicated that the rich were judged as more powerful and popular than the poor ($ps < .05$), with older children (8-9 years) endorsing this more than younger children. Older children also viewed the poor as more hardworking than younger children. This study reveals contexts in which children value wealth or traits in their evaluations, suggesting traits are often strong indicators of stereotypically wealth-relevant features. This also provides support for age-related changes in understanding links between wealth, status, and power.

P2-51 - "I want to see if it's real or not": the influence of informant reality status on children's preference for science exploration

Allison Williams¹, Shoronda Matthews¹, Rebekah Richert², Kathleen Corriveau¹

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Details

This study examines if children pay attention to the reality status of an informant when deciding to explore different scientific properties. Children ($N=42$; $M_{age}=7.15$, $SD=1.54$; 27 female) were introduced to two informants, 1 real and 1 not-real, and heard the informants give conflicting scientific information about novel objects. Children were asked which scientific property they would want to explore. Children's trust, preference for fantasy, science interest, science knowledge, and epistemic curiosity were also measured. Children's preference to explore the scientific property told by the real informant did not differ from chance, $t(42)=1.50$, $p=1.00$. Only children's trust significant predicted their preference for exploration ($B=0.40$, $p=0.007$). These findings suggest that although reality status of an informant does not influence children's preference for testimony about exploring science properties, they are more likely to explore testimony from a real informant if they also trust that informant and believe what they said is correct.

P2-52 - Associations among the home math environment, home executive function environment, and young children's math and EF skills

Isabel Valdivia¹, Jisun Kim¹, Maegan Reinhardt¹, Caroline Hornburg¹

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Details

The Home Math Environment (HME), defined as caregiver-child math interactions in the home (Hornburg et al., 2021), is associated with children's math achievement (Daucourt et al., 2021). The Home Executive Function Environment (HEFE), defined as home interactions, games, and activities that may support executive function (EF) development (Korucu et al., 2019), is linked to EF skill development (Korucu et al., 2019; Soltani Kouhbanani & Arabi, 2023). Understanding the association between HME and HEFE could potentially contribute to the design of interventions that support children's math and EF skills. The present study examined associations among HME, HEFE, and children's (ages 3-5) math and EF skills through a parent survey ($N = 109$). Confirmatory factor analyses showed that the best fitting model (CFI = 0.76, TLI = 0.73, RMSEA = 0.08) was a two-factor - HME and HEFE - model, $\chi^2(386) = 642.95, p < 0.001$. Structural equation modeling analyses showed that the HME factor (direct and indirect) predicted children's numeracy skills ($\beta = 0.32, p = 0.011$) and HEFE predicted EF skills ($\beta = 0.40, p = 0.003$), when accounting for child gender and parent education. However, HME did not predict EF skills nor did HEFE predict numeracy skills. Results contribute to a better understanding of the home learning environment (HME and HEFE), and thus, how parents can engage in specific activities to best support children's math and EF skill development.

P2-53 - A systematic realist review of school-based working memory training: understanding effectiveness, mechanisms, and transferability for improved academic performance

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Details

Working memory (WM) plays a pivotal role in students' learning and academic achievement. However, while empirical evidence supports the positive transfer effect of WMT programs, the focus has primarily been on quantitative assessments of their effectiveness. Neglecting the dynamic and iterative relationship among implementation design, contextual factors, and strategies in the school setting may impede the feasibility, transferability, and sustainability of WMT programs in educational practice.

Hence, drawing on critical realist philosophy, this systematic realist review aims to comprehensively explore how and under what circumstances school-based WMT is effective. The adoption of the I-PARIHS framework enables the diverse nature of implementation across different settings and the interactions among multiple dimensions to be scrutinised. The review will offer valuable insights for researchers and practitioners in the field of education, fostering a deeper understanding of the complexities involved in WMT interventions.

P2-54 - Relations among students' experience of the math error climate, math identity, and math problem solving performance

Caroline Hornburg¹, Maegan Reinhardt¹, Isabel Valdivia¹, Jisun Kim¹, Tamika Mcelveen², Amanda Mayes³, Dana Miller-Cotto⁴, Eric Wilkey⁵, Andrew Ribner⁶, Nydia Prishker⁷, Ma Bernadette Andres-Salgarino⁸, Sarah Powell⁹, Sara Schmitt¹⁰, David Purpura³

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Details

Making errors is a key part of the learning process and a helpful instructional tool, particularly in a math context (Steuer & Dresel, 2015). Teacher responses to student errors create a climate that may welcome errors as learning opportunities or discourage them entirely (Tulis, 2013). The present study examined relations among students' experience of math error climate, math identity (i.e., self-perceptions of math), and problem-solving performance with 3rd-5th graders ($N = 85$). Students' perception of the error climate was significantly related to their math identity ($r = .25, p = .02$), but not problem-solving accuracy ($p = .48$), controlling for grade. When exploring correlations among identity subscales, error climate was related to interest ($r = .30, p = .006$) and competence ($r = .29, p = .009$), but not recognition ($p = .31$). Examination of errors by problem schema and students' own positive (vs. negative) error climate revealed no significant associations. Overall problem-solving accuracy increased by grade. Among incorrect responses, errors indicating conceptual understanding (e.g., computation errors) increased by grade, as idiosyncratic errors decreased. This study only examined single-step problems at one time point; further research should examine relations to multi-step problems, as well as students' response to interventions, which can inform the use of error climate as a tool in math instruction.

P2-55 - Infant vocalization increases when sitting in daily life

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Details

Motor behaviors, such as walking, may facilitate language development by increasing infants' opportunities to communicate with parents and interact with toys. However, not all aspects of language development follow the same pattern: Recent work shows that the growth rate of infants' own vocalizations does not relate to walking. We add to past work by examining whether vocalization relates to sitting, another motor behavior that has been linked with language development. Specifically, we tested within infants, across an entire day, to determine whether sitting prevalence and vocalization rate are linked.

We studied 4-7 and 11-14 month olds in monthly home visits (108 total sessions). We used inertial motion sensors to measure how much time infants sat in 10-minute periods from morning to bedtime.

At the same time, LENA audio recorders counted the number of vocalizations made by the infant in each 10-minute period.

Our analysis demonstrated that vocalization rate is related to sitting, with age moderating the relation. For infants 12 months and older, infants vocalized more during periods when they sat for longer. However, this relation did not hold true for infants younger than 12 months. This illustrates how sitting may serve a different role in facilitating infant vocalization compared with walking. Future work will explore what differentiates younger vs older infants' sitting to further understand links between motor behavior and language development.

P2-56 - Investigating the moderating role of socioeconomic status in the relationship between music training and auditory discrimination

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Details

Scientists claim that music is one skill that increase cognitive and academic abilities in children (Jaušovec & Pahor, 2017) and plays an essential role in developing brain flexibility and language abilities (François et al., 2013). Socioeconomic status (SES) is the strongest predictor of continuing music training in adolescents (Schellenberg, 2006; Wetter et al, 2009; Young et al, 2014). In this cross-sectional study, 86 participants aged 6 to 10 were selected from institutes in Mashhad, Iran. Notably, children in Iran do not receive music training at school so this was their first music experience. Auditory discrimination levels were assessed using the Wepman auditory discrimination test (1960). Additionally, SES was gauged through the Ghodrat Nama socioeconomic questionnaire (2013). Results confirmed that music training duration related to enhanced auditory discrimination ($r=0.39$, $p<0.01$) with SES moderating this effect, suggesting that low SES may reduce the positive impact of music training on children's auditory discrimination.

P2-57 - How beliefs about the acceptability of different kinds of lies relate to the promotion of Santa Claus?

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Details

Although parents regularly encourage their children to be honest, they also share stories about Santa Claus and other fantastical characters that are deceptive (Setoh et al., 2020; Mills et al., 2023). This study ($N = 127$) examines how parents evaluate lies about fantastical characters (e.g., Santa Claus, the Tooth Fairy) and how those evaluations relate to their views on other kinds of lies as well as how heavily they promote the Santa Claus myth. On average, parents rated statements about fantastical characters as acceptable ($M = 5.79$ out of 7), including the most extreme statement that Santa Claus is “just as real

as you and me" ($M = 5.14$). Parents also rated statements about fantastical characters as more acceptable than instrumental lies (e.g., telling children something to control their behavior; $M = 3.42$), $t(119) = 21.07, p < .001$ and white lies (e.g., pretending poor piano playing was beautiful; $M = 4.77$), $t(119) = 7.71, p < .001$. Moreover, parents' ratings of the acceptability of fantastical lies, but not of instrumental lies, correlated with how heavily they promoted the Santa Claus myth, $r(120) = .32, p < .001$. This study supports that parents tend to view lies about fantastical characters as acceptable, and that the more acceptable parents view fantastical lies, the more heavily they tend to promote Santa Claus. Implications for cross-cultural research will be discussed.

P2-58 - What did we learn from the pandemic? Recollections of Estonian schoolchildren.

Pirko Tõugu¹

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Details

Everyday experiences are a major source of learning for children (e.g., Fender & Crowley, 2007; also see Haden, 2010; Leichtman, et al., 2020). Knowledge abstraction improves with age (Esposito & Bauer, 2017); at the same time, it may take time (Elibol-Pekaslan & Sahir-Acar, 2017). This study focuses on children's recollections of the COVID-19 pandemic and aims at defining what children of different ages deem important to know about the pandemic and how this knowledge it related to the quality of their memory of the time.

Hundred and four children aged 6-16 (45.2% girls, $M_{age} = 10.8$) were interviewed about their memory for the beginning of the COVID-19 experience approximately 2 years after the start of the pandemic and asked what advice they would give someone who has not experienced the pandemic. Their spontaneous memory was coded for details and three main topics appeared in their advice response (a) reiterating official requirements and recommendations, (b) restoring hope and providing emotional support, and (c) providing advice for surviving the societal changes. Results for age groups and links to memory details are provided and discussed in the light of current literature on autobiographical memory development and knowledge acquisition.

P2-59 - Does God have to follow the rules? Folk sociology in concepts of religious agents across cultural-religious settings

Kara Weisman¹, **Tamer Amin**², **Florencia Anggoro**³, **Maliki Ghossainy**⁴, **Benjamin Jee**⁵, **Mahesh Srinivasan**⁶, **Rebekah Richert**¹

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Details

As part of a large study of social cognitive development across diverse cultural-religious contexts, we asked children 4-10y to assess whether religious agents (e.g., God, Jesus, the Prophet Muhammad, Lord

Ganesha) are subject to the same kinds of constraints that govern human behavior. This poster will focus on questions selected to measure four aspects of “folk sociology”: kinship relations, differential liking, being part of a hierarchical power structure, and being subject to rules and norms. We present data (total N~700) from the US (including Christians and Muslims), Lebanon (including Christians and Muslims), India (including Hindus and Muslims), and Indonesia (including Christians, Hindus, and Muslims). Preliminary analyses suggest that, compared to items selected for other folk domains (e.g., physics, biology, psychology), sociological items have lower internal consistency. Instead, the sociological domain is characterized by specificity: Specific religious agents are understood to be subject to some but not all of the sociological constraints included here, but which of those constraints are applied varies substantially across religious agents and cultural-religious settings. Nonetheless, these preliminary results suggest that in many cultural-religious settings, religious agents are more likely to be understood as subject to the rules that govern social structures than the “natural laws” of physics and biology.

P2-60 - Children's considerations for moral evaluations of stealing

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Details

Stealing is often considered a prototypical moral evaluation, but recent adult research suggests that may not always be the case. Adult judgments of acts of taking varied based on the authority status of the taker and overall harm that would be caused or prevented by the taking. The present study explores this question in 7- to 9-year-old children. Participants are presented with eight vignettes that all depict acts of taking to benefit a 3rd party. After each story, children are asked whether the act should be labelled “stealing”, whether it was acceptable, and if that acceptability generalizes to other contexts; they also provide qualitative explanations of their acceptability rating. Data collection is ongoing, but expected results are that children will be less likely to use the stealing label and more likely to find the act of taking acceptable in cases where the taker is an authority figure. We also predict higher levels of acceptability when harm is minimized.

P2-61 - Probing nonhuman primate errors on false belief tasks to explore the evolutionary roots of theory of mind

Amanda Royka¹, Daniel Horschler¹, Walker Bargmann¹, Laurie Santos¹

¹ Yale University

Details

Theory of Mind (ToM) is central to human social cognition, yet the roots of this capacity remain poorly understood. Both infants and nonhuman primates show inconsistent performance on false belief tasks, limiting our understanding of what representations characterize the ontogenetic and phylogenetic foundations of ToM. Here, we try to better understand this complex and often contradictory literature

by dissecting both populations' failures. Specifically, we focus on nonhuman primates' characteristic null performance on false belief tasks to test under which circumstances they generate predictions about the behavior of an agent. Across four new empirical studies (n=597 subjects), we find that— despite succeeding on a closely matched control— rhesus monkeys fail to make predictions about how agents with false beliefs will behave even when the agents perform highly unexpected, unlikely actions. We interpret this pattern of performance as evidence that monkeys may have no representation of another agent's future actions once the scene changes outside of that agent's awareness. Overall, this work helps to move beyond the success/failure dichotomy typically used to assess ToM, and instead gives a more precise characterization of primates' signature limits in ToM, which we argue may also be shared with human infants.

P2-62 - Toddlers' sensitivity to the temporal pattern of their failures and successes

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Details

When learners improve, the temporal change in performance carries information about progress; we know we “got the hang of it” after consistently succeeding on a task we used to fail at. While recent work suggests that older children can track their progress (Leonard et al., 2023), past work on infants' use of statistical evidence (e.g., Gweon & Schulz, 2011) raises the possibility that such reasoning may emerge even earlier in life. Here we ask whether 2-year-olds can track the temporal pattern of their performance outcomes. All toddlers played with two toys; they succeeded three times (SSS) on the Control Toy, then experienced both failure and success on the Test Toy. What differed across conditions was the temporal pattern of their performance on the Test Toy: fail-then-succeed (FFFSSS) in the Improvement condition vs. seemingly random (SSFFSF) in the Stochastic condition. Children successfully activated both toys a final time (so the final success was matched across conditions), then were asked to select one toy to show their parent who had not seen the toys. While pre-registered data collection is ongoing with sequential sampling, preliminary analysis with n=30 already shows that more children chose the Test Toy in the Improvement condition than in the Stochastic condition (73% vs. 40%; $p = .14$, Fisher's Exact). The poster will include the full dataset and discuss how toddlers' ability to track their performance over time can guide predictions about their future actions.

P2-63 - Parents' reported approaches to children's science misconceptions

Sam Mchugh¹, Surya Marimuthu¹, Maureen Callanan¹

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Details

Research has investigated children's science misconceptions, however less is known about how parents navigate everyday conversations about misconceptions. When faced with their child's scientifically inaccurate ideas, we asked how often parents focus on Conceptual Change (correcting) vs on Sense-

Making (exploring ideas). After a prompted conversation activity with their 4- to 6-year-old child, 107 parents were asked about a time when their child said something scientifically inaccurate, how they responded, and why. Coding and analysis are ongoing. Two researchers coded 68 responses, resolving disagreements. Preliminary results show that 63% of parents took a Conceptual Change approach, expressing the goal of helping their child correct the misunderstanding. About 2/3 of these parents reported directly providing explanations and 1/3 preferred guiding their child to reach the correct understanding on their own. Only 9% of parents took a clear Sense-Making approach, reporting that they did not intervene because they value their child's curiosity over accuracy. Another 24% of parents reported that their approach depends on the topic, their child's mood, or the context. Future analyses will investigate whether parents' reported approaches to children's misconceptions relate to how they responded to their child's incorrect ideas in the prompted conversation activity, including misconceptions related to health/safety (handwashing and germs) vs general science topics (all birds fly).

P2-64 - See what I mean? Learning verbs via their observational contexts

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Details

Verbs are typically underrepresented in children's early vocabularies (Gentner, 2006; McDonough et al., 2011). One explanation for this is that, while nouns can easily be learned from their observational contexts, verb meanings are scaffolded by syntactic constructs, which are not accessible until later in development (Piccin & Waxman, 2007). The current study asks whether previous demonstrations of tenuous verb learning from observational cues are partly due to the method of assessing learning. Here, we adapted the Human Simulation Paradigm (HSP) to assess verb learning in three ways. First, we asked participants to guess a mystery verb after viewing multiple scenes in which the verb was used, yielding low performance, as in previous HSP studies ($M=0.12$, $SD=0.32$). Then, we asked learners to distinguish between scenes that did or did not contain the mystery verb. Notably, success on this task given an incorrect free response was above chance for both action ($M=0.55$, $SD=0.08$; $p<.01$) and mental verbs ($M=0.53$, $SD=0.08$; $p<.05$), which may be particularly opaque from observational context. Finally, participants rated how similar the mystery verb was to a set of verbs. Participants rated the mystery verb as being more similar in meaning to its true identity than to other verbs ($M_{target}=4.31$, $SD=2.04$; $M_{distractor}=2.93$, $SD=0.84$; $p<.01$). These results shed light on the potential for verb learning from observational cues.

P2-65 - Evaluating content for a computer-based universal screener and diagnostic assessment for K–8 mathematics

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Details

Recent research has found that many U.S. students struggle in mathematics compared to their national and global peers (U.S. Department of Education, 2021, 2022). Moreover, mathematics assessments often lack comprehensive coverage of concepts predicting achievement and growth (Brendefur et al., 2015, 2018; Clements & Sarama, 2008). It is imperative that assessments measure foundational concepts required for students to be successful in mathematics and accurately identify students at risk for mathematics difficulties. In this study, we are evaluating the content developed for a computer-based universal screener and diagnostic mathematics assessment for students in Grades K–3, drawing on research across cognitive development and mathematics education. We will present results of an Item Calibration study, focusing on item difficulty, discrimination, and Differential Item Functioning analyses among 8 school districts across the U.S. ($N = 400$ students per grade). Results will be used to develop an item ability scale; these item ability levels will inform the creation of beginning, middle, and end-of-year forms with equivalent difficulty. The findings from this study will encourage conversations about the use of assessments and data to identify mathematics education opportunities for all students and the implications this has for instructional decision-making.

P2-66 - Examining the impact of a mindfulness-based intervention on contemplative practice and bias reduction in parents and preschoolers

Abby Brown¹, Biju Rajbhandari¹, Morgan Harris¹, Fatemeh Esfandiari¹, Amanda Greene¹, Kenya Wolff¹, Alicia Stapp¹, Stephanie Miller¹

¹ University of Mississippi

Details

Mindfulness-based instruction may relate to changes in cognition (increased reflection, Zelazo & Lyons, 2012) leading to more nuanced and anti-biased thought- particularly during the formative preschool period (e.g., Razza et al., 2013). This study focused on how supplementing a state-adopted curriculum with mindful yoga in a whole-child framework (i.e., addressing social-emotional development, anti-bias, anti-bullying, gardening, nutrition, and physical activity) influenced contemplative practices and bias reduction. Parents' ($n=105$) view of yoga as beneficial, practice of yoga at home, and children's use of breathing techniques when upset or to focus increased from Fall 2022 to Spring 2023 during the curriculum, $Us > 2.45$ $ps < .05$. Parents reported changes related to bias and prosocial behavior in themselves (i.e., endorsing children can play with dolls regardless of gender, talking about diverse cultures at home) and children (i.e., shares readily, considerate of others feelings, $p = .07$). Behavioral data suggested a marginally significant interaction between time of assessment (pre- vs. post-intervention) and intervention group ($n_{intervention}=46$, $n_{control}=22$) on bias toward outgroup related to race $F(1,63)=3.35$, $p = .07$. The control group increased in bias related to race across the year, $F(1,63)=5.34$, $p = .024$, children in the intervention showed no change in bias, $F(1,63)=.03$, $p = .87$.

P2-67 - Training mental rotation in children

Stephanie Grinshpun¹, Karima Elgamal¹, Matthew Baker¹, Samantha Zakrzewski¹, Melinda Mo¹, Komal Khera¹, Ameet Kaur¹, Yingying Yang¹, Frances Connors², Beverly Roskos², Edward Merrill²

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Details

Mental rotation (MR) is the ability to visualize an object's new orientation after a mental transformation. It is an important spatial ability that is commonly used in various aspects of daily functioning. Past research suggests that MR can be enhanced in children through experience with tasks such as puzzle games. The current study included 22 participants aged 4 to 10 years old. Participants were trained with an online puzzle game for a total of 16 weekly sessions with an MR test used to assess ability at baseline, after four weeks of training, and eight weeks of training. Findings indicated that participants had significantly higher scores on the 3rd MR test than at baseline and that MR training significantly reduced performance differences between low and high angle rotations. Additionally, training appeared to minimize gender differences initially observed at baseline. These findings demonstrate that MR training is effective for children ranging in age from 4 to 10 years, that training may reduce differences in MR between girls and boys, and provide support for the effectiveness of an online accessible training program.

P2-68 - Number and size of animate characters in U.S. and Japanese picture books

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Details

We examined the number and size of animate characters illustrated in picture books targeting preschoolers from the U.S. and Japan. We focused on animate characters because previous studies have found that animate objects capture attention more than inanimate objects. Our hypotheses were based on cross-cultural differences found in previous studies of visual attention and visual products. The results found that U.S. picture books had fewer animate characters illustrated than Japanese books, supporting our hypothesis. Our results also found that texts of the U.S. picture books placed more emphasis on animate characters than texts of Japanese books, supporting our hypothesis. These results highlight that visual products that young children are exposed to early might be an important environmental factor contributing to children's development that should be studied further.

P2-69 - An early association between distractibility and emotion understanding: The moderating role of family expressiveness

Yulong Tang¹, Paul Harris²

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Details

We asked if children's distractibility – their tendency to be sidetracked by things going on around them – affects their emotion understanding, and whether any such impact depends on family expressiveness. A total of 165 4- to 6-year-olds and their parents and teachers participated in the study. Children's distractibility was rated by teachers using the Children's Temperament Scale. The Test of Emotion Comprehension (TEC) was used to examine children's emotion understanding. Family expressiveness – composed of positive and negative expressiveness – was reported by parents. The results showed an interactive effect of distractibility and positive family expressiveness on children's emotion understanding. In families with higher positive expressiveness, non-distractible children displayed better understanding of emotion. In families with lower positive expressiveness, no link emerged between distractibility and emotion understanding. We speculate that in a positive emotional atmosphere, non-distractible children more easily focus on emotional events, with more opportunities to talk about emotions with their parents.

P2-70 - Children's reasoning about transgender identity disclosure

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Details

Trans kids who live as a gender (e.g., girl) uncommonly associated with their birth-assigned sex (e.g., male) face stigma. Thus, many share their identities selectively for fear of backlash (Ehrensaft, 2013). We examine how gender diverse kids reason about trans peers' selectiveness when deciding whom to disclose their identities to. Six- to 11-year-olds (N = 303) heard about a trans target concealing their gender identity and a cisgender target (whose identity is consistent with their birth-assigned sex) concealing their gender-consistent name change. Participants predicted whom targets would disclose to from among peers who were either trustworthy or not, popular or not, or had diverse friends or did not. Participants selected peers who were popular, trustworthy, and had diverse friends as confidants for the trans peer (M = .64) more than for the cis peer (M = .59) $p < .001$. They also chose trustworthy peers (M = 0.92) as confidants, more often than popular peers (M = 0.14), or peers with diverse friends (M = 0.78), $ps < .001$. An interaction showed that participants selected the peer with diverse friends for the trans peer (M = .89) more often than for the cis peer (M = .67), $p < .001$. These results suggest that children regard trustworthiness as a critical factor when determining whether peers should disclose, and they deem those with diverse friends as more suitable confidants for trans kids.

P2-71 - It's the thought that counts... or is it? A social cognitive model of gift exchange

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Details

Gift-giving has been described as a form of reciprocity where individuals attend to the intentions of the gift giver and have an obligation to respond in kind (Mauss, 1925). However, little is known about the social-cognitive underpinnings and developmental emergence of children's concepts of gift giving. From early in ontogeny, children distinguish and favor prosociality and good intentions (Vaish, Carpenter, & Tomasello, 2010). With age, children also begin to understand that good intentions can benefit them and show this by reciprocating strategically (Warneken et al., 2019). Here we test whether children attend to (1) effort and (2) thoughtfulness when assessing the quality of a gift. We conducted a survey with vignettes manipulating effort or thoughtfulness in high versus low value gifts. Our participant sample included adults (N = 36) and 5-year-old children (N = 36). Preliminary results suggest that adults consider both thought and effort in a gift exchange. Child results are forthcoming. By deducing if effort and thoughtfulness matter in this type of reciprocal exchange, we can then understand how intentions and motivations affect cooperation.

P2-72 - Not all pattern tasks are equal: predicting children's numeracy skills from early patterning assessments

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Details

Patterning skill (understanding predictive sequences such as ABABAB) is considered highly relevant with the acquisition of early math skills. However, the mechanism of such an association remains unclear. We measured different types of repeating pattern tasks, early numeracy skills, and verbal working memory capacity of 5- and 6-year-old children (N = 49, 49% Female). Patterning skill is strongly associated with numeracy, $r(47) = .61, p < .001$, and the association is still evident after accounting for working memory, $r(46) = .45, p = .002$. Among four types of patterning skills, extending (keeping a pattern going) and abstracting (creating the same structure with different items) predict numeracy to the strongest extent, $r_s = .55, p_s < .001$, followed by pattern memory task (memorizing and recreating the same pattern), $r(47) = .46, p < .001$. Missing item task (finding a missing piece in a pattern) did not correlate with numeracy skills, $r(47) = .24, p = .092$. The current results are generally consistent with previous evidence that repeating pattern skills are associated with math knowledge in a distinct path over and above cognitive abilities, and that pattern abstracting activities require a higher-level understanding of material structures that are most relevant to math learning. These results might have implications for which types of pattern tasks to include in early learning environments.

P2-73 - Maladaptive but malleable: gender-science stereotypes emerge early but are modifiable by language

Michelle Wang¹, Amanda Cardarelli¹, Jonah Brenner², Sarah-Jane Leslie³, Marjorie Rhodes¹

¹ New York University, ² University of Texas at Austin, ³ Princeton University

Details

The consequences of gender-science stereotypes are well-documented, but little is known about the processes by which they arise. We hypothesized that language that emphasizes *scientist* identities contributes to their emergence – even when it does not communicate any stereotypic content – by leading children to view scientists as a distinct *kind* of person.

We developed an interactive online science program for 4-5 year-olds ($n = 467$) that included four science lessons. By random assignment, children were taught with either *identity-focused* or *action-focused* language. Girls in the identity-language condition expressed more male-science stereotypes than girls in the action-language condition ($b = -.26, p = .009$). In addition, in the identity-language condition, girls were less likely than boys to predict that girls are good at science ($b = -.41, p < .001$), whereas in the action-language condition, boys and girls responded similarly ($ps > .10$; see Fig. 1A).

We replicated these findings in a second cohort of children of color ($n = 206$), where girls in the identity condition endorsed more male-science stereotypes over time ($b = .42, p = .003$), but girls in the action condition did not ($ps > .06$; see Fig. 1B).

Together, these studies show that commonplace science language contributes to the development of gender-science stereotypes and subtle changes to children's linguistic contexts durably reduce the acquisition of stereotypes.

P2-74 - Visuospatial perspective taking in individuals with Fragile X syndrome

**Sonia Conde¹, Arielle Hershkovich¹, Romal Bhullar¹, Jack Gregory¹, Nikita Duncan¹, Daria Lasc¹,
Matthew Baker¹, Edward Merrill², Yingying Yang¹**

¹ Montclair State University, ² University of Alabama

Details

Introduction: Previous research indicated that poor performance on some aspects of spatial ability is associated with Fragile X Syndrome (Cornish et al, 1998). Hocking et al. (2012) reported that males identified as FXS premutation carriers performed more poorly than males with normal FMR1 alleles on spatial processing tasks involving mental manipulation of shapes, and on visuospatial working memory. Females with FXS exhibited poor performance on some measures of memory for spatial location (Mazzocco et al., 2006). Our study investigated whether people with FXS also exhibit relatively poor performance in visual perspective taking (PT).

Methods: Participants with FXS ($n = 14$) were matched on cognitive ability to typically developing (TD) counterparts ($n = 14$) using the Raven's-2 Progressive Matrices (Raven et al., 2018). We administered two PT tasks: 1. Three Mountains Task (TMT) modeled after Newcombe and Huttenlocher (1992); 2. Dog Task (DT) modeled after Piaget and Inhelder (1956).

Results: Groups did not differ on the DT ($M = 17.36$, $SD = 5.72$ for FXS and $M = 18.50$, $SD = 4.36$ for TD: $F(26) = 0.59$, $p = .305$, $BF = 3.19$). Groups also did not differ on the TMT ($M = 15.79$, $SD = 4.81$ for FXS and $M = 16.00$, $SD = 4.77$ for TD: $F(26) = 0.12$, $p = .967$, $BF = 3.68$).

Implications: Both groups performed similarly on the PT tasks. Implications include informing future interventions relating to training spatial abilities that affect daily activities associated with independent living.

P2-75 - The impact of short-term model familiarity on two-year-olds' word learning

Jina Ahn¹, Catherine Sandhofer¹, Erica Cartmill¹

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Details

Children's word learning takes place in the context of social interactions. When presented with the opportunity to interact with others, children show partner preferences and learning biases based on their partner's characteristics and positive prior interactions. For instance, when choosing a partner to play with or imitate actions from, children younger than four place greater value on positive social characteristics than on epistemic knowledge. In this study, we asked whether these partner preferences extended to word-learning interactions. Specifically, we examined whether short-term familiarity with an experimenter influenced two-year-old children's ($N = 36$) generalization of novel object labels in a word-learning task. Children established short-term familiarity with an experimenter through a brief play session and were then trained and tested on eight novel nouns by either the same partner or an unfamiliar partner. Two-year-old children learned novel object labels equally, regardless of whether they learned from a familiar or unfamiliar partner. This result suggests that while very young children choose a familiar partner for some tasks, their ability to learn words is unaffected by this type of social relationship.

P2-76 - Is parents' verb use tuned to whether the child knows the verb?

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Details

Caregivers' speech is tuned to children's developmental level (e.g., Newport et al., 1977); however, fewer studies have asked if it is tuned to support vocabulary learning specifically (e.g., Clark, 2010;

Leung et al., 2021). In an extension of Clark (2010) and Cleave and Kay-Raining Bird (2006), we ask how caregivers use verbs they believe are familiar or unfamiliar to their child.

Sixteen parent-child dyads (child ages 30-45 months; target sample size = 40) viewed 12 trials, each depicting two dynamic scenes of actors engaging in actions (e.g., girl jumping, boy running) (Figure 1). Parents were tasked with saying something that would encourage their child to guess which was the target (e.g., “a girl is jumping”). They were also asked whether they believed their child knew each word.

We measured parents’ use of two strategies that should support children’s verb comprehension: repetition and labeling the event participants with content nouns (e.g., “a girl” rather than “someone”). Our preliminary results show non-significant negative correlations between use of these strategies and whether parents thought children knew the words; parents repeated less ($r = -0.21, p = 0.50$) and labeled fewer event participants ($r = -0.31, p = 0.30$) for words they thought their child knew. Therefore, we offer suggestive preliminary support from a new task of previous work showing that caregiver language is tuned to support children’s vocabulary learning.

P2-77 - The role of parent language in children’s understanding of unobservable entities: The case of Chinese secular and Christian families

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Details

Children rely on testimony to learn about the world that they cannot see. They justify their endorsements of the existence of scientific (e.g., germs) and religious unobservable entities (e.g., God) in similar fashions but exhibit greater confidence in the existence of the scientific entities. The present study analyzed Chinese Christian and secular parents’ linguistic patterns in conversations with their children on high- and low-consensus unobservable entities in scientific and religious domains. Results showed that children’s confidence in the existence of unobservable entities was negatively associated with the number of uncertainty cues ($\beta = -0.278, SE = 0.038, z = -7.281, p < .001, OR = 0.757, 95\% CI = [0.702, 0.816]$) and positively associated with the number of causal elaborations in parental discourse ($\beta = 0.726, SE = 0.109, z = 6.688, p < .001, OR = 2.066, 95\% CI = [1.670, 2.556]$). We also investigated variations in linguistic cues (i.e., uncertainty cues, consensus cues, explicit mentions of reality status, and causal elaborations) by domain, consensus level, and parental religious affiliation. This study provides additional evidence for testimonial learning as a cognitive mechanism for children to learn about reality and possibility, and a cultural transmission mechanism for religious beliefs. This study also points to the role of parents’ ethnotheories and affective factors through which culture shapes children’s cognitive development.

P2-78 - Epistemic and social trust in children of different racial/ethnic groups across contexts

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Details

Trust in others serves important purposes in children's lives. Research on trusting unfamiliar others to learn from them (epistemic trust) suggests children prioritize prior accuracy. Less is known about how children decide whether to trust others for social support (social trust). We predict that children's social-category membership and experience with other groups could influence their trust judgments, especially social trust.

To test this prediction, 3 samples of 3- to 6-year-old children that were diverse along multiple dimensions (race/ethnicity, SES, and environment; Table 1) participated in a social trust (Tower task) and an epistemic trust task (Learning task). In the tower task, children and an experimenter built a precarious marble run tower that fell easily; they then chose between two agents (same- or different-race) to keep their tower safe when they left the room. In the learning task, same- and different-race agents on video labeled novel objects; children were asked whose label they endorsed (learning block). Next, children received accuracy information about same- and different-race agents (e.g., one calls a cup a "ball") prior to endorsing their novel labels (accuracy block). Preliminary results suggest that children's trust judgements varied as a function of the type of trust (social or epistemic), children's race/ethnicity, and their environment (Table 1), underscoring the importance of considering these factors to better understand trust processes.

P2-79 - Profiles of Latino home learning environments and their associations with kindergarteners' expressive vocabulary

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Details

Parents help children develop academic skills at home through activities such as book-reading and counting objects. While less studied, activities like eating together and grocery shopping might also promote academic development. Using a person-centered approach, the study identified profiles of home learning environments based on the frequency of engagement in conventional activities (CA; e.g., book-reading and counting objects), and home food practices (HFP; e.g., eating together and grocery shopping) and examined associations to academic skills. Participants were 165 low-income Latino parents and their kindergarteners (*M* age = 67 months, 51% female). Four profiles were identified: (1) 12% high CA /low HFP; (2) 12% low CA /low HFP; (3) 26% high CA/high HFP; and (4) 50% low CA/high HFP. Children in home environments characterized by low CA but high HFP scored higher in expressive vocabulary than children in home environments characterized by high CA but low HFP. Implications will be discussed.

P2-80 - Children from China, Kenya, and the US give reasons to resolve disagreements

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Details

The exchange of reasons in rational discourse is a powerful way to resolve disagreements and reduce polarization. Yet, it is unknown how reason-giving develops in childhood and whether it exists across cultural contexts, with some theorists arguing that reason-giving is predominantly a WEIRD phenomenon. In a preregistered cross-cultural study, we investigated the development of reason-giving in 180 dyads of 5- to 9-year-old children from China, Kenya, and the US. Children were first separately exposed to either perceptual or testimonial evidence regarding the location of a reward. Then, they participated in a decision-making task in which they had to jointly choose one of two possible options to acquire the reward. In one condition, children's individually acquired evidence pointed toward the same reward location. In the second, key condition, children's individually acquired evidence supported opposing locations (Fig. 1). Analyses of deliberative interactions during joint decision-making revealed that children selectively and consistently provided reasons in light of conflicting evidence ($p < .001$; Fig. 2). Importantly, the development and flexibility of children's reason-giving showed almost identical patterns in China, Kenya, and the US. These findings suggest that, from a young age, children across diverse societies possess key capacities for engaging in rational public discourse and resolving disagreements via reasons rather than force.

P2-81 - An adaptive touchscreen task to assess young children's mental rotation

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Details

Mental rotation (MR), or the ability to manipulate object representations, is an important spatial skill evident from infancy. However, infants and toddlers' MR is often assessed using looking time while children's MR requires them to choose among items (e.g., Pedrett et al., 2020; Estes, 1998). We present an MR task for 2- to 5-year-old children ($N = 45$; $M_{\text{age}} = 3.30$, $SD_{\text{age}} = 0.72$; 20 females) that uses a choice response based on an eye-tracking procedure developed by Beckner et al. (2023). Children first were trained to select the house a cartoon giraffe faced (e.g., a house on the left when the giraffe faced left). Then the task progressed through an adaptive two-up, one-down staircase in increments of 15° , starting with the giraffe at 45° . If children selected the correct house on most trials in a block, the next block showed the giraffe at a higher angle of rotation. If children failed on most trials in a block, the next block showed the giraffe at a lower angle. As the angle of rotation increased, children were less likely to succeed. Proportional hazard regression analysis revealed that 60% of children succeeded up to 60° ,

95% CI [47%, 76%], and 29% succeeded up to 120°, 95% CI [18%, 46%], indicating that as a group, children showed evidence of mental rotation. There were no effects of age, sex, or frequency of tablet use on children's performance. Thus, this touch-screen staircase task offers a new tool for assessing mental rotation in young children.

P2-82 - Additivity or ceiling: examining the effects of different patterns of thinking on children's causal reasoning

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Details

Causal reasoning is crucial for navigating the world, but little research has explored how children's beliefs about a causal system impact their inferences. This study investigated how 4- and 5-year-olds' causal beliefs impacted their "backwards blocking" inferences as well as whether associative learning or Bayesian inference better explained their judgements. Children were taught either that two causes together produced a larger effect than that produced by each individually (i.e., an "additivity" rule) or that they produced the same size effect as that produced by either one (i.e., a "ceiling" rule). A third group received no training. Results indicated that 4-year-olds (N=26) engaged in backwards blocking only after additivity training and that their inferences mainly accorded with an associative model, odds ratio = 62.03, 95% CI [6.67, 18732.11], $p < .01$. In contrast, 5-year-olds (N=33) engaged in backwards blocking regardless of condition and produced responses that were largely consistent with a Bayesian model, odds ratio = 7.78, 95% CI [2.15, 35.34], $p < .005$. These findings suggest that the effect of children's beliefs about causal systems on their inferences undergoes a developmental progression between 4 and 5 years of age, and their reasoning may involve a mix of cognitive mechanisms.

P2-83 - Cognitive reflection and family socioeconomic status predict children's explanations of social inequalities

Bianca Vives¹, Zarafshan Bano¹, Samantha Macksey², Michele Villacres³, Breckie Church¹, Andrew Young¹

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Details

Research suggests children who prefer internal over external explanations of inequality (e.g., innate ability differences vs. structural racism/sexism) are more likely to develop social biases. Adults with greater cognitive reflection (i.e., analytic thinking) and socioeconomic status (SES) are sometimes less likely to engage in internal reasoning about social groups. We investigated whether cognitive reflection and SES similarly predict children's explanations of inequality. Five to 12-year-old children (N = 142) completed Rizzo et al.'s (2021) explanations for inequalities task for the domains of race and gender. In this task children chose between internal ("because of who they are on the inside") and external ("because of things that happen in the world") explanations of an inequality (e.g., a man with a nice car

and a woman with a junky car). We also measured children's cognitive reflection (CRT-D) and family SES (composite of parent education and # of household books). Adjusting for age, cognitive reflection was a positive predictor of external explanations of racial inequality, but not gender inequality. Family SES was a positive predictor of external explanations of gender inequality, but not racial inequality. These results highlight individual differences contributing to children's explanations of inequality and may inform efforts to promote external explanations, potentially mitigating the development of social bias and the perpetuation of inequalities.

P2-84 - Children's understanding of social preferences based on quantity and quality of allocated resources

Youjung Choi ¹, Marie-Claire Diehl ¹

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Details

Previous studies have shown that children are able to use resource allocation to make inferences about third-party social relationships (e.g., Liberman & Shaw, 2017). However, no prior research has explored how these inferences are impacted by the use of negative stimuli and stimuli of varying qualities. To fill this gap, the present study presented 4- to 9-year-old children with a total of six stories in which a distributor distributed resources of different quality and quantity to two recipients and asked them to infer which of the two recipients the distributor preferred based on the outcome of the distribution. Preliminary data showed that children can infer the relationships based on positive resource cues but encounter challenges with inferences when given negative resource cues. Children prioritized quantity over quality when evaluating negative resources of equivalent quality (even if they were negative) and prioritized quality over quantity when evaluating negative resources of differing qualities. This study is expected to expand the foundation of children's understanding of social relationships through resource allocation, particularly through the study of negative and different quality resources.

P2-85 - How prosocial majority promotes children's sharing: a goal contagion account

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Details

While numerous recent studies have highlighted the substantial role of majority influence in shaping children's sharing behavior, the specifics of how this influence operates remain less understood. Here we propose that the prosocial majority influence can be explained by a goal contagion account. It posits that children can recognize the prosocial goals of the majority's actions. Moreover, these goals are contagious, encouraging children to engage in prosocial behaviors in their following tasks. Study 1 found that observing another type of prosocial behavior (i.e. social mindfulness) promoted sharing behavior in four and six-year-old Chinese children. And children were also highly sensitive to the goal strength of the observed behaviors. Study 2 revealed that observing highly generous sharing promoted children's

sharing behavior more than observing moderately generous sharing. This learning effect did not diminish even after half a month. These findings reveal the flexibility and enduring effects on children's learning of prosocial behaviors from the majority.

P2-86 - Age and vocabulary knowledge differentially predict timing and amplitude of the N400 during word learning in school-aged children

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Details

Learning words implicitly from context is a primary means of vocabulary growth during childhood and early adolescence. It remains unknown how age and vocabulary knowledge modulate the neural correlates supporting this process. Fifty-three school-aged children (8-16 years; $M=11.75$, $sd=2.60$) learned novel words from sets of three sentences (Abel, Schneider & Maguire, 2018) as their EEG was recorded. Vocabulary knowledge (as measured by the PPVT-4; $M=110.65$, $sd=14.48$) and age were significant predictors of task accuracy ($M=77.38\%$, $sd=14.87\%$): older children ($r=0.58$, $p<0.001$) and children with greater vocabulary knowledge ($r=0.54$, $p<0.001$) were more likely to identify appropriate meanings for novel words. Analysis of the neural data indicated more negative N400 amplitudes across all children to novel words during the second sentence relative to the first sentence. N400 amplitudes were then attenuated and had earlier latencies on average during the third sentence relative to the second sentence. An individual differences analysis revealed that both older children and children with greater vocabulary knowledge exhibited increasingly larger N400 amplitudes across all three sentences. These findings suggest maturation and existing vocabulary knowledge differentially modulate the N400 during the process of implicit word learning from context.

P2-87 - Caregiver beliefs and practices surrounding child development from a racially and socioeconomically diverse sample

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Details

The purpose of this study is to characterize the beliefs and practices of caregivers in the Deep South, a culturally and linguistically diverse (CLD) region, to inform cultural responsiveness of early language interventions and promote caregiver buy-in. When examining areas of child development that are most important to caregivers, black ($N=8$; $M=2.6$, $SD=1.3$) and low SES caregivers ($N=5$; $M=1.8$, $SD=0.5$) valued language development more than any other group. When examining caregiver beliefs about language development, white caregivers were more likely to accurately judge statements about vocabulary developmental milestones, ($M=0.9$, $SD=0.4$) than black caregivers ($M=0.6$, $SD=0.5$). When examining what barriers caregivers face when supporting their child's development, all caregivers reported time as the

biggest barrier ($M=1.6$, $SD=0.8$); however, black caregivers were more likely to rank their own limited language and transportation as a barrier ($M=4.9$, $SD=1.4$; $M=4.6$, $SD=2.1$ respectively) than white caregivers ($M=6$, $SD=0.8$; $M=6.5$, $SD=0.8$). Low SES caregivers were more likely to rank their own limited language skills as a barrier ($M=4.4$, $SD=1.1$) than mid/high SES caregivers ($M=5.8$, $SD=1.3$; $M=6$, $SD=0.8$). The findings from this study highlight differences in beliefs and practices regarding child development among caregivers from CLD backgrounds, which may in turn differentially impact caregiver buy-in of early interventions.

P2-88 - Looking into the crystal ball: children's and adults' outcome and emotion predictions in uncertain situations

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Details

Life is full of uncertainty, creating challenges for how people anticipate and prepare for the future. Eight- to 10-year-olds' and adults' ($N=108$) judged the likelihood (100-point scale; "very sure I will lose" to "very sure I will win") that they would win or lose 11 distinct chance games (probability range =0–1 in .1 increments) and predicted how they would feel (100-point scale; "feel very bad" to "feel very good") winning or losing each game. We assessed these predictions at two time points (~30 minutes apart): (1) *distal*—when first learning about each game; and (2) *proximal*—immediately before playing each game. Participants also completed an emotion regulation questionnaire (Gullone & Taffe, 2012). Although emotion regulation is largely studied in relation to how people *react* to outcomes, it may also relate to how people *envision* the future. We are currently analyzing the data. We anticipate age differences in outcome judgments (e.g., children will forecast more positively, especially for low probability games) and emotion predictions (e.g., only adults will predict feeling worse losing high versus low probability games and feel better winning low versus high probability games). We will test whether there are age differences in the consistency of outcome and emotion predictions over the two time points. We will further explore whether individual differences in emotion regulation relate to how children and adults anticipate outcomes and make affective forecasts.

P2-89 - Investigating non-adjacent dependency learning in 12-month-old infants

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Details

To learn a language, learners must infer underlying structural relations from items that surface in linearly non-adjacent positions. Infants showed successful learning of such non-adjacent dependencies (NADs) in artificial languages at 15 months, but not at 12 months (Gómez&Maye 2005). Yet 12-month-olds are sensitive to distributional-grammatical patterns in their native language, some involving non-adjacent relationships (Geffen&Mintz 2015; Mintz 2006). Despite reported evidence of NAD learning in

12-month-olds (Marchetto&Bonatti 2015), infants could have been using positional cues (i.e., whether a word occurred in its attested position during test) that were confounded with NADs. Since learning NADs may benefit language development (Lany&Shoaib 2020), further investigations into 12-month-olds' ability to learn NADs are needed. Conducted online using a habituation paradigm, this study investigates NAD learning in 12-month-olds. We have collected data from 81 12-month-olds (41 male, $M_{age}=364.5$ days, $SD=11.6$). We fitted a linear mixed-effects regression and found that infants significantly looked longer to the ungrammatical trials than the grammatical trials, showing evidence for NAD learning ($\beta=-0.05$, $SE=0.02$, $p=.029$). In exploratory analyses, we found differences in the looking times between English monolingual infants ($n=52$) and multilingual infants ($n=29$; $\beta=0.12$, $SE=0.04$, $p=.006$), but this effect did not interact with grammaticality ($p=.761$).

P2-90 - Episodic memory supports episodic future thinking for oneself and another

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Details

Episodic future thinking (EFT) – mentally projecting into the future to solve a problem – is supported by episodic memory (EM). The current study investigated the impact EM perspective has on EFT performance in 4-year-olds, as the ability to use future thinking as well as consider others' mental states develops substantially at this age. We hypothesized that an EM of the self will improve EFT for oneself, whereas an EM formed through observation of another will improve EFT for another. Our preliminary data support our hypothesis, with 4 out of 5 children succeeding on EFT-self when the EM was for oneself, and only 1 out of 5 succeeding when the EM was for another. Similar results were found in the EFT-other condition, with 3 out of 5 children succeeding when the EM was observational, and only 2 out of 5 succeeding when the EM was for oneself. This trend suggests that different types of EM support EFT for oneself and another.

P2-91 - Companion animals vs. farm animals - speciesism from childhood to adulthood

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Details

Some animals are treated as companions (e.g., dogs) while others are bred to be eaten (e.g., pigs). This unequal moral evaluation based on species is called speciesism (Caviola et al., 2023). Since little is known about the development of speciesism, our study examines age-related differences in moral attitudes towards animals in samples of children (9-11 years), adolescents (13-18), younger adults (19-39), and older adults (40-99) in Germany. So far, 71 younger adults ($M=25.94$, $SD=5.86$, 15 male, 54 female, 2 n/a) and 43 older adults ($M=51.63$, $SD=7.7$, 12 male, 30 female, 1 n/a) have participated. Participants responded to a speciesism scale (Caviola et al., 2019), judged how well dogs, pigs, and humans *ought* to be treated, and categorized pigs as either food or pet (McGuire et al.,

2023). Preliminary results indicate less speciesism in younger than in older adults ($t(112)=-2.92, p<.01, d=.57$) and that participants who categorized a pig as food were older than those who categorized a pig as pet ($t(112)=1.69, p<.05, d=.33$). Additionally, it was revealed that older (but not younger) adults think that pigs should be treated less well than dogs or humans ($F(1,110)=12.59, p<.001, \eta^2=.10$). Results indicate interesting interactions between categorization, speciesism, and animal treatment and show age-related differences in moral considerations about farm and companion animals. Analyses including all age groups will be presented at the conference.

P2-92 - A cross-cultural study of parental bonding, mentalizing, and mind-mindedness in the United States and Taiwan

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Details

This study examines the difference in maternal mind-mindedness among American mothers, Taiwanese mothers, and Taiwanese Immigrant Mothers. It also attempts to find the relationships between maternal mind-mindedness and mothers' bonding with their parents during early years and their general mentalizing abilities for these three groups of mothers. There were 123 American mothers (Mage = 33.33 years old; SD = 5.31), 129 Taiwanese mothers (Mage = 35.93 years old; SD = 4.05), and 105 Taiwanese Immigrant Mothers (Mage = 36.85 years old; SD = 4.42) participating in this study online. The age range of these mothers' children was between 2 years old and 7 years old. The participants followed the instructions on the research sites to describe their children, complete the Parental bonding Instrument, and complete the Reflective functioning Questionnaire. American mothers were found to have a higher level of mind-mindedness than Taiwanese mothers and Taiwanese Immigrant Mothers, with only the number of mind-related comments taken into account. The relationship between the number of mental attributes and reflective functioning was found positive for American mothers, while the same relationship was not significant for the other two groups. These findings implied that maternal mind-mindedness could work differently among American mothers, Taiwanese mothers, and Taiwanese Immigrant Mothers.

P2-93 - The COVID-19 pandemic: effects on social cognitive outcomes in early childhood

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Details

The COVID-19 pandemic and ensuing lockdowns led to sweeping changes in the everyday lives of children and families, including school closures, remote work/learning, and social distancing. Research on the effects of these changes has focused largely on school-aged children and on mental health and emotional well-being. To date, no study has examined whether the profound changes to young children's social interactions impacted the development of social-cognitive skills in early childhood.

To address this question, we compared 2 cohorts of 3.5- to 5.5-year-old children tested before ($n = 43$) and after ($n = 55$) the COVID-19 lockdown. All children were from California, which had a lengthy stay-at-home order that lasted from March 2020 to June 2021. Children came from a range of socioeconomic (SES) backgrounds, assessed via a composite of parent education and household income.

Children completed 2 traditional false-belief tasks: a change-of-location task with 1 test question (Baron-Cohen et al., 1985) and an unexpected-contents task with 2 test questions (Astington & Gopnik, 1988). Scores were summed to create a total false-belief score (0-3). Controlling for age and language skills, children tested post-pandemic had significantly lower false-belief scores than those tested pre-pandemic, and this effect was larger for children from lower SES homes. These results suggest the pandemic negatively impacted the development of social-cognitive skills, especially for lower SES children.

P2-94 - Children's social evaluations of empathizers

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Details

By age 4, children understand that empathy reflects a positive social relationship between the empathizer and target (Smith-Flores, Bonamy, & Powell, 2023), but do they also positively evaluate empathizers? Four- to 7-year-old children ($N=72$, $M=6.06$ years, $SD=1.07$) heard 6 stories each with 3 unique characters. A good or bad outcome befell the target, and two responders each had different reactions. Children were asked to rate how “okay” the responders’ reactions were and who was nicer. Empathy was rated as more okay than both counter-empathy, $F(1, 284)=73.59$, $p < .001$ (Fig. 1), and neutral responses, $W=1918$, $p < .001$; children also said the empathizer was nicer in both comparisons, $ps < .001$. Counter-empathy was judged to be less okay, $W=282$, $p < .001$, and counter-empathizers as less nice, $ps < .001$, when compared to a neutral response. However, empathy did not carry more weight than helping – children rated counter-empathy accompanied by helpful actions as more okay than empathy accompanied by a lack of helping, $F(1, 280)=120.17$, $p < .001$ (Fig. 2), and helpful counter-empathizers nicer, $ps < .001$. Together, these results suggest that children both positively evaluate empathy and negatively evaluate counter-empathy, but also that their evaluations of helpful actions carry more weight.

P2-95 - Aligning proportionally equivalent whole number and fraction magnitudes on number lines improved estimation accuracy for 3rd through 5th graders with or at risk for math learning difficulties

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Details

Children's fraction understanding is improved by depicting fractions on number lines (Hamdan & Gunderson, 2017; Yu et al., 2022). Whether this intervention is effective for those with math learning difficulties, however, is an open question. To address this, we used a pretest-training-posttest design to explore whether aligning proportionally-equivalent integer and fraction number lines (3:4::3/4:1) improved fraction understanding among third to fifth ($n=72$) graders with math learning difficulties. Fraction, $F(3, 3531.5) = 21.49, p < .001$, and whole-number estimation accuracy, $F(3, 3471.2) = 8.50, p < .001$, improved from pretest ($M_{\text{fraction}} = 73.94\%, SE = 1.78\%$; $M_{\text{whole}} = 81.70\%, SE = 1.26\%$) to posttest ($M_{\text{fraction}} = 77.46\%, SE = 1.79\%$; $M_{\text{whole}} = 83.70\%, SE = 1.27\%$). Improvements were evident after the first session, across stimuli with different surface-level features (i.e., large-component fractions), and persisted after a delay. Training was more helpful for boys—who estimated less accurately at pretest—than girls, for those with lower math anxiety, and for those with more favorable math attitudes. Additionally, math self-confidence increased from pre- to posttest. Alignment of proportionally equivalent integer and fraction number lines may improve fraction understanding for those with math learning difficulties, and benefits are more pronounced for some individuals than others.

P2-96 - Trusting competent or sociable informants? Examining the impact of evaluation modes on children's trust decision-making processes

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Details

Studies of children's selective trust have yielded conflicting findings, implying that children may use distinctive decision-making processes in different contexts. Here, we examined children's decision-making processes in simultaneous evaluation mode (Study 1) and successive evaluation mode (Study 2). In Study 1 ($n = 82, 34$ girls; $M_{\text{age}} = 5.37$ years), 3- to 6-year-old Chinese children evaluated a competent-but-unsociable (or *competent*) informant and an incompetent-but-sociable (or *sociable*) informant simultaneously. In Study 2 ($n = 70, 33$ girls; $M_{\text{age}} = 5.35$ years), children evaluated each of these informants successively. In both studies, children rated the informants' competence and sociability, and indicated their tendency to trust the informants' testimony or not in labeling novel objects.

Children generally preferred to trust the competent informant over the sociable informant (p 's $< .001$), but those in the simultaneous evaluation mode were more likely to trust informants based on competence ratings than those in the successive evaluation mode ($p < .050$, Figure 1), and consequently

showed stronger trust preferences for the competent informant than those in successive evaluation mode.

These results indicate a stronger tendency to adopt analytical thinking when comparing informants simultaneously, highlighting the role of context in decisions about selective trust from early childhood.

P2-97 - The role of preferences and goals in children's happiness attributions

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Details

In our everyday lives, we often grapple with a mix of desires, preferences, and goals—how does this affect our sense of happiness? We investigated children's happiness perceptions for individuals whose simple preferences (like or dislike doing something) conflict or do not conflict with more important goals ($N = 30$ 4-5-year-olds and 30 7-8-year-olds). A linear mixed effects model revealed an interaction between preference valence (like or dislike) and preference type (simple vs. conflicting) ($F(232) = 80.475$, $p < 0.001$, Figure 1). Children across ages attributed higher happiness to characters who did something they disliked (e.g., doing homework) to achieve an important goal (e.g., getting high testing scores), compared to similar actions that did not conflict with a goal. Conversely, children attributed lower happiness to characters who did something they liked (e.g., watching TV) at the expense of a goal (e.g., getting lower scores), compared to similar actions that did not conflict with a goal. Overall, children considered the preference and goal conflicts in making emotional attributions, supporting our hypothesis that, even at a younger age, children incorporate higher-level values in emotional reasoning. These findings deepen our understanding of early social-cognitive development and its connection to goal-directed behavior.

P2-98 - Children's understanding of others' social preferences based on various dimensions of shared similarities

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Details

In daily interactions, we make decisions about who to befriend and who to avoid. Shared similarities are an important factor in shaping this decision (Sunnafank, 1983). Previous research has suggested children can use individual similarities to understand others' social interactions, but it is unclear how different dimensions of similarity affect social preferences. This study seeks to examine children's understanding of others' social interactions based on shared similarities across three dimensions: Language, Preference, and Behavior. Children aged 4 to 7 were randomly assigned to one of the three conditions and watched videos including a Target and two additional actors. The Target exhibited a shared similarity with only one of the actors (spoke the same language, preferred the same toy, or

performed the same behavior). Children were then asked to identify which actor the Target wanted to play with, and which actor shared similarities with the Target. Preliminary data showed children successfully identified which individuals shared similarities. Further, children were best able to infer social preferences of others through shared language. The completion of this study will shed more light on the conceptualization of social preference, and the roles that various dimensions of interpersonal similarities play in this understanding.

P2-99 - Young children's working memory predicts their cheating behaviours one year later

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Details

Cheating emerges in early childhood in the form of covert rule violations for personal gain. The development of executive functioning (EF), a set of higher-level cognitive skills, has been found to predict children's cheating behaviours at an early age. The current study examined the long-term effect of EF on young children's cheating behaviours using a longitudinal design. A total of 153 children of 4 to 11 years of age participated in the online study that assessed their EF and cheating behaviours in Year 1 and Year 2. We evaluated three EF factors: inhibitory control using a Stroop task, cognitive flexibility using a dimensional-change card-sorting task and working memory using backward digit span tasks. Additionally, children engaged in a series of tasks and were instructed to not break any established rules when completing them unattended. The number of activities in which children broke the rules indicated their cheating extent. The majority of children cheated at least once in both years, but their cheating extent decreased in Year 2. Surprisingly, only working memory from both years significantly predicted children's cheating in Year 2. Children with stronger working memory in Year 1 and Year 2 were less likely to cheat or cheat to a lower extent in Year 2. This suggests the specific unique role that working memory plays in the long-term development of children's rule adherence and cheating behaviours.

P2-100 - Children's quantity perception is biased by high caloric foods

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Details

Humans can perceive quantities in an approximate fashion since the first days of life. Can quantity perception be modulated by different types of foods? Modern life has granted easy access to high caloric foods (such as cupcakes), which may be evolutionarily preferred for survival, but has lasting (often negative) impacts on health. To explore how children perceive quantities of different types of foods, across two experiments, we presented children (N=160) two different amounts of food that flashed on the computer screen, too briefly for children to count. One plate contains a more calorie dense food (sugar cookies or cupcakes), while the other has a less calorie dense food (crackers or broccoli). Children were asked to choose which plate had more food. We find that children's numerical

judgment was significantly biased by the presence of high caloric foods, even when controlling for perceptual features. These results provide foundation for future investigations of the link between quantity perception, dietary preferences, and health.

P2-101 - “What’s the score right now?”: Children’s evaluations of Google’s ability to answer current event questions.

Lauren Girouard-Hallam¹, Judith Danovitch¹

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Details

Children use search engines to learn new information, with over half of 6- to 15-year-old children saying that they use Google over five times a day (Osborne, 2012). To examine children’s beliefs about whether Google can answer questions about past and current events, 84 children ages 7 to 10 heard questions posed by a third party. They then indicated whether Google Search and a person could answer the question, and which one would have the better answer. Questions were about a current event (e.g., the weather right now) or a past event (e.g., the weather yesterday).

A multilevel model (MLM) revealed a three-way interaction between age, informant, and question type ($p=.046$). Older children endorsed Google more than younger children in the current event condition. Older children also endorsed the person more than younger children for past events, and less for current events (see Fig. 1). An MLM of the forced-choice responses indicated a two-way interaction between question type and age, where older children selected Google as having the better answer more than younger children in the current event condition (see Fig. 2, $p=.025$).

Children’s beliefs about Google Search and a person were dependent on age and information type. Google Search is a powerful tool for learning about current events, and education about internet search should emphasize how students can use Google to access updating information.

P2-102 - The development of conceptual compositionality in young children

Stephanie Alderete¹, Anna Cao¹, Steven Piantadosi¹, Fei Xu¹

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Details

Compositionality in language states that the meaning of a whole can be understood by the meaning of its parts. We investigate the development of conceptual compositionality (the ability to combine concepts). In our study, 6- to 9-year-olds ($N = 40$) were shown a card with two objects (e.g., a car and a star). They were introduced to two characters (a robot and a wizard) that used their powers to change the card in different ways (e.g., turning one object pink). In the test trials, children were asked to predict what a card would look like after both characters used their powers to change objects on the same card. All participants successfully learned the character’s powers, but only participants 7.5 years and older

succeeded in the test trials ($SE = .5$, $Z = 2.05$, $p = 0.04$). Thus children succeed in a conceptual compositionality task by 7.5.

P2-103 - Children's selective information-transmission: a meta-analysis

Fanxiao Qiu¹, Joanna Park¹, Erika Patall¹, Henrike Moll¹

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Details

Findings from empirical studies in children's selective information transmission suggest that children vary *what* they share depending on *whom* they are sharing it with, taking into account how helpful the information is for a given audience. The current meta-analysis quantifies the average effect of children's selective information transmission based on the helpfulness to the audience and explores effects of a range of moderators. Through a systematic search that yielded 1,600 results, 22 studies met the inclusion criteria. The final sample included 91 effect sizes. Using robust variance estimation, the average effect was medium to large, Hedges' $g = .65$, 95% CI [.28, 1.02], suggesting that children share information based on how helpful it is to the listener. Moderator analyses revealed that neither age, communicative context, task type, nor country significantly moderated the average effect, implying that children's selective information transmission is robust to variations in task type across studies.

P2-104 - Forming friendships through feigned similarity: evidence from preschoolers and adults

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Details

Lying serves as a means to various ends. The present studies identified the phenomenon of feigning similarity as a means of making friends. Study 1 found that adults ($n = 37$) perceived feigning similarity as implying an intention to make friends. In study 2, 5- to 6-year-old children ($n = 82$) judged that a character intended to make friends with peers whom they adapted their preferences to align with. The same group of children also participated in study 3. They were randomly assigned to one of two conditions where a child confederate either extended a friend-making request (experimental condition) or did not do so (control condition). The confederate disclosed their preferences and asked about children's preferences on the same subject. Children in the experimental condition feigned similarity more frequently compared to those in the control condition. Taken together, children understand and practise feigning similarity as a social convention for establishing friendships.

P2-105 - Direct and indirect intergroup contact differentially inform American children's interpersonal and societal attitudes about immigrant groups

Laura Elenbaas¹, Kelly Lynn Mulvey², Christia Spears Brown³, Jane Singman¹, Megan Norris¹

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Details

This experimental study investigated how direct intergroup contact (e.g., friendships) and indirect intergroup contact (e.g., posts seen online) informed 8- to 12-year-old self-identified American children's ($N = 218$) interpersonal attitudes (e.g., prejudice) and societal attitudes (e.g., perceived inequality) about immigrants from Mexico, China, and Egypt (between-subjects). The effects of contact on attitudes differed across conditions. Children reported the highest rates of direct intergroup contact (e.g., neighbors) with peers from Mexico, and their attitudes were based primarily on those *direct* experiences; children with more positive *direct* contact felt less prejudice toward and desired more affiliation with immigrants from Mexico, believed they faced more inequalities in society, and directed more school supplies to a group that was treated unfairly. Children reported the lowest rates of direct intergroup contact with peers from Egypt, and their attitudes were based almost entirely on the content of their *indirect* intergroup contact (e.g., whether overheard conversations made immigrants from Egypt seem kind or hostile); children with more positive *indirect* contact felt less prejudice, desired more affiliation, perceived more inequality, and directed more school supplies to immigrants. Children's reported direct and indirect intergroup contact rates with peers from China were moderate, and relations with interpersonal and societal attitudes were likewise mixed.

P2-106 - Do children's questions about novel words help them retain word meanings?

Laura Janakiefski¹, Kareena Gor¹, Robert Lopes¹, Megan Saylor¹

¹ Vanderbilt University

Details

Asking questions is one way that young children elicit word-related input. Asking what a novel word means may facilitate word learning and improve retention of the novel word. The current study tests whether asking questions to elicit novel word information improves children's novel word retention compared to their retention when listening to the same information. Four- to six-year-old children were randomly assigned to a Question-Asking or Listening condition. Participants were asked to select a novel picture out of an array of novel pictures. In the Question-Asking condition, participants had an opportunity to ask the experimenter questions about the words to select the target referent. The experimenter responded to questions with a standard set of feature descriptions. In the Listening condition, participants heard the same descriptions, but did not have an opportunity to ask first. Children in both the Question-Asking condition and Listening condition used the descriptions to make selections in the moment and retained the novel words above chance at test. There were no differences in children's retention of the novel words across conditions, suggesting that questions may not provide a clear and large benefit to novel word retention. The results of this work suggest that asking questions may support learning by functioning as a tool for children to gain access to new information, but may not support increased retention of the requested information.

P2-107 - NIH baby toolbox executive functioning and cognition domain

**Y. Catherine Han¹, Rachel Flynn², Aaron Kaat¹, Stephanie Carlson³, Lisa Oakes⁴, Philip David Zelazo³,
Richard Gershon¹**

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Details

The NIH Infant and Toddler Toolbox (Baby Toolbox) introduces novel standardized assessments of infants aged 1-42 months, administered on an iPad tablet using automatic coding and scoring. This abstract focuses on the “Executive Functioning and Cognition” (EF-Cog) domain. The visual delayed response (VDR), Visual Familiarization, Learning, and Delayed Memory tasks were selected by a team of domain experts, an expert survey (n=567), and a scoping review and were adapted for iPad administration. These tasks used automated eye-tracking gaze detection for the youngest children and touch at older ages. Measures were normed and validated in a sample of 2550 infants (representative of the US across 12 sites and in both English and Spanish). Here, our analyses focus on a subset of infants that completed the EF-Cog touch tasks in English (Learning n=359, Delayed Memory n=252, VDR n=378). Preliminary item response theory measure-level models had moderate reliability across the latent trait distribution (.67-.79), and these scores correlated with age ($r_s=.31-.47$). Ongoing analyses include generating composite models and confirming them with the full dataset, analyzing the Spanish-speaking sample, assessing test-retest reliability, and assessing validity against other gold-standard measurements (Bayley Scales for Infant Development, Ages and Stages Questionnaire). The final sample will be re-weighted to match the 2022 American Community Survey, and age-adjusted norms will be established.

P2-108 - Exploring emotional contagion for dogs to early adolescents and emerging adults

Kristine Kovack-Lesh¹, Ryan Davis¹, Jacoby Cefalu¹, Julia Meyers-Manor¹

¹ Ripon College

Details

Emotional contagion in dogs has been established in studies with adults (e.g., Custance & Mayer, 2012; Meyers-Manor & Botten, 2020). Less is known about emotional contagion of dogs to humans. This experiment examines if empathy for dogs can impact the emotions of 11-14-year-olds ($n = 27$) and undergraduate students ($n = 23$). Participants viewed pictures of animals, including dogs expressing emotions (happiness, sadness, anger, and tiredness), on a large screen accompanied by corresponding sounds (45-secs per trial) and rated their own emotions on visual analog scales related to happiness, anger, sadness, stress, and tiredness. Results of multiple mixed design ANOVAs showed that the early adolescents and undergraduates did not differ in their ratings for any of the displayed dog emotions (all $ps > .361$) nor did age of the participant interact with displayed dog emotions (all $ps > .173$). However, participants did rate their own emotions differently based on the emotion shown (all $ps < .001$; e.g., higher ratings of happiness when shown a happy dog than a sad or angry dog), suggesting emotional contagion from the dog to the people.

P2-109 - Teaching robots to learn: robot mistakes and learning outcomes

**Celina Bowman-Smith¹, Charlotte Aitken¹, Thubaraka Mahenthiran¹, Elaria Ebeid¹, Edith Law¹,
Elizabeth Nilsen¹**

¹ University of Waterloo

Details

Authors: Bowman-Smith, C., Aitken, C., Mahenthiran, T., Ebeid, E., Law, E., & Nilsen, E.

Background: Children demonstrate increased learning when they teach others versus learning for themselves. Social robots have been used to enhance children's learning outcomes. Yet, there is a paucity of research investigating how children's learning is affected when teaching robots that make mistakes.

Method: 8-10 year-olds ($N=115$) taught a classification scheme to a humanoid robot. Participants worked with either a robot that made **no errors**, a robot that made **logical errors** (mistakes on untaught material), or a robot that made **illogical errors** (mistakes on previously taught material). To examine learning outcomes, participants' knowledge of the classification scheme was tested after the teaching task.

Results: While children reported that the robot that made logical errors learned most from their teaching, they demonstrated the greatest learning gains when teaching a robot that made illogical errors.

Discussion: Children may work harder to teach, and thus learn more, when their tutee is not demonstrating expected learning patterns. This research informs theory of children's learning and the design of effective educational social robots.

P2-110 - Using scalar implicatures to investigate pragmatic language comprehension among AAE and GAE-speaking children

Michelle Erskine¹, Jan Edwards², Yi Ting Huang²

¹ Purdue University, ² University of Maryland College Park

Details

African American English (AAE)-speaking children sometimes have difficulty understanding General American English (GAE) due to phonological and grammatical differences between the dialects – **dialect mismatch**. However, these effects remain unexplored in children's comprehension of pragmatic language where dialect mismatch may be more pronounced since listeners need to go beyond utterance semantics and infer speaker intent. Using the visual world paradigm, this study examined the impact of dialect-specific experiences on GAE and AAE speakers' understanding of scalar implicatures such as "*The girl read some of the books.*" Children's eye movements were monitored as they heard sentences in AAE

and GAE that were paired with photographs of White and Black speaker faces. The results showed that while all children eventually understood the implicature, the speed and efficiency varied based on children's primary spoken dialect. Upon hearing "some", AAE-speaking children did not exhibit differences across any of the speakers. In contrast, GAE-speaking children efficiently generated pragmatic inferences when GAE was paired with a White face, but not when hearing AAE or GAE paired with a Black face. This suggests that in pragmatic language comprehension, dialect mismatch is complex, and interacts with both spoken dialect and the race of the speaker.

P2-111 - Children's social evaluations of sleep arrangements

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Details

Sleep is necessary for human survival. Sleep can also be vulnerable, especially when one is sharing a close sleep arrangement with another person (e.g., sleeping in the same tent). This may be because the two people are not only sharing a vulnerable interaction, but biological and physical interactions as well (e.g., breathing closely and sharing germs; sharing physical touch). Because of the inherent vulnerability and intimacy of sleep, we hypothesize that children may expect only family (kin) to share close sleep arrangements. In a preregistered experiment with 5–7-year-olds ($N=84$), we tested this hypothesis, and compared expectations of sharing close sleep arrangements to another known kin-specific expectation: saliva sharing (Thomas et al., 2022).

Children predicted whether a novel protagonist shared a close sleep arrangement, food likely involving saliva sharing (Thomas et al., 2022), or toys (control trials; Thomas et al., 2022) with kin (parent; sibling) or non-kin (teacher; friend). Compared to control trials, children expected kin to be more likely to share close sleep arrangements ($z=4.19$, $p<.001$) and saliva ($z=5.13$, $p<.001$; replicating Thomas et al., 2022). Children did not reason differently about sharing sleep arrangements and saliva ($z=1.22$, $p=.222$). These findings provide support of our hypothesis that young humans indeed expect close sleep arrangements to involve kin over non-kin, and are sensitive to links between sleep behavior and social affiliations.

P2-113 - An investigation of children's reasoning about data transfers

Breanna Amoyaw¹, Shaylene Nancekivell¹

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Details

When using apps, children frequently share personal information, such as their name, and birthdays. But, how do children represent the transfers of information to apps? Inspired by work on physical ownership, we examine the potential mental models that children may use to represent data transfers, such as a full transfer of rights wherein apps can freely use information in ways similar to the users, and a partial transfer of rights wherein apps, similar to physical borrowing cases, have more limited use of

the information (i.e., their rights are not equal to users). In one study, in progress, children aged 8- to 11-years-old (N=47) were asked to judge what an app and its user is allowed to do with personal data after it was willingly shared. Children reflected on four different actions: saving and accessing (low entitlement) and showing others and selling (high entitlement actions). So far, for all actions, children view the user as more permitted to act on the information than the app ($p < .001$; see Fig 1). Further, children also view low entitlement actions as more permissible than high entitlement actions ($p < .001$). No interactions were found. In sum, we found mixed support for the partial transfer model as the app's actions were viewed as less permissible than users. The findings related to high entitlement actions are discussed in terms of children's concerns about privacy.

P2-114 - Does your child surprise you? Validation of the child surprisingness scale

Kaitline Fournier¹, Patricia Brosseau-Liard¹

¹ University of Ottawa

Details

The parent-child relationship requires parents to take the perspective of their child. This can be challenging for both parent-related (ex: perspective-taking difficulties) and child-related reasons (ex: cognitive skills or temperament). One way these difficulties can arise is through the impression that one's child is surprising or does unexpected things. We created the Child Surprisingness Scale to measure this concept. We developed a 6-item measure to examine how surprising parents' find their child's emotions and behaviours. We conducted two studies where parents of infants and toddlers (study 1: $n = 108$, study 2: $n = 379$) completed an online battery of tasks including this measure in addition to several measures of mental state reasoning. A Cronbach's alpha test of internal consistency demonstrated good reliability for the new scale (study 1: $\alpha = .843$, study 2: $\alpha = .764$), and an exploratory factor analysis revealed that all items converged on one factor. A correlational analysis revealed significant correlations between the Child Surprising Scale and other measures of mental state reasoning ranging from $r = .27, p < .001$ to $r = .47, p < .001$, demonstrating convergent validity. Our results demonstrate that the Child Surprisingness Scale is a reliable measure to assess parents' child-directed perspective taking. Future studies should evaluate the contribution of child-specific characteristics and developmental level to parents' responses on this scale.

P2-115 - Teaching children to play imaginatively: considerations for peer treatment

Lindsey Held¹, Ansley Gilpin¹, Summer Braun¹, Rachel Thibodeau²

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Details

Previous work has found that pretend play skills are negatively associated with aggressive behaviors and positively associated with prosocial behaviors (Fehr & Russ, 2013). Friendlier, less aggressive preschoolers are well-liked (Denham & Holt, 1993). Thus, we hypothesized that after a 5-week play intervention, children in two pretend play conditions (fantastical, sociodramatic) would have

significantly lower victimization scores and higher received prosocial behavior scores than children in the control condition. Our final sample included 144 participants ($M_{age} = 3.49$ years; 53% female) clustered within 28 classrooms and 5 schools. Additionally, 57% of participants were White, 42% Black, and 2% Asian. Our hypotheses were not supported. Compared to children in the control group, children in the fantastical play condition had higher relational victimization scores (10.89% increase from pre-test) and children in the sociodramatic play condition had higher physical victimization scores (14.73% increase) at post-test. These results have implications for pretend play interventions and play interventions at large.

P2-116 - The development of gendered expectations of moral parties

Anastasiia Grigoreva¹, Arber Tasimi¹

¹ Emory University

Details

Do children have gendered expectations of moral parties? Here we asked 5-10-year-olds ($N = 182$, 98 female) to indicate whether boys or girls were more likely to be agents or patients of morally good (e.g., helping) and bad (e.g., pushing) actions. For morally bad actions, all children selected a boy as the more likely perpetrator, and female participants selected a girl as a victim whereas male participants showed no gendered expectations of victims. For morally good actions, children selected their own gender as the more likely benefactor and beneficiary. Thus, although gendered expectations about victims, benefactors, and beneficiaries vary with participants' gender, the expectation that males are more likely to be perpetrators is robust across genders and is already present at age 5.

P2-117 - Assessing neurocognitive and language development in the HEALTHy Brain and Child Development (HBCD) study

Tracy Riggins¹, Julie Kable², Alexandra Potter³

¹ University of Maryland, ² Emory University, ³ University of Vermont

Details

This poster will introduce the neurocognitive and language development battery for the HEALTHy Brain and Child Development (HBCD) Study. HBCD is an NIH-supported study enrolling 7,500 participating families from 27 sites and following them from pregnancy through childhood. A quarter of the sample will be comprised of prenatally substance exposed infants; another quarter will be demographically matched to these families but without substance exposure; and the remaining 50% will be drawn from a representative sample across the US. The battery includes: the NIH Infant and Toddler (Baby) Toolbox (BTB), the Bayley Scales of Infant and Toddler Development, MacArthur Bates Communicative Development Inventories, Vineland Scales of Adaptive Behavior, Sensory Processing Measure, and deferred imitation. These measures selected were based on their sensitivity to brain maturation, the potential teratogenic effects of substances of abuse, and the variations in social and environmental circumstances in which the infants and children are being raised. As data collection is underway,

knowledge of the battery is critical so researchers can prepare to use this unprecedented open-science resource. Data from HBCD is expected to reveal broad insights about cognitive development and how it is impacted by a variety of social and environmental experiences and conditions.

P2-118 - Early social causal learning: Impacting children's learning from and preference for in-group adults

Paloma Iniguez ¹, Lindsey Powell ², Rose Scott ¹

¹ University of California, Merced, ² University of California, San Diego

Details

Children prefer to learn from in-group adults, especially when learning complicated information. Previous research suggests that disconfirming evidence and prompting for the depth of children's knowledge can make children more critical learners. This study examined whether these two factors could reduce the tendency to default to causal information from in-group adults.

5-7-year-olds were introduced to a gender-matched in-group and out-group adult and asked who they wanted to play with (group preference). They were then shown 6 biological effects (e.g., getting the flu). For each effect, they were asked to choose 2 potential causes. Next, they saw the in-group and out-group adults select a cause; whether the in-group adult selected the same (confirming evidence) or different cause (disconfirming evidence) as the child varied across children. For 2 of the effects, children were also prompted for the depth of their knowledge. Children were then asked a second time to select a cause and we measured if children changed their answer. At the end of the study, children were again asked who they wanted to play with to measure changes in group member preference. Preliminary results suggest that across conditions, children are reluctant to change their answer. However, their preference for the in-group adult is reduced when the adult provides disconfirming evidence. Implications for improving causal learning will be discussed.

P2-119 - The relation between mother's self-esteem and school-aged children's reading habits: The mediating effects of mother's school involvement and children's academic stress

Yookyeong Park ¹, Hayeon Park ²

¹ State University of New York, Albany, ² Duksung Women's University

Details

The steady decline in children's reading rates is a concern. School-aged children cite schoolwork as a barrier to reading, followed by access to other media (The Ministry of Culture, Sports and Tourism, 2021). We are interested in finding how various factors mechanistically influence children's reading time, particularly focusing on how maternal characteristics impact children's reading habits. Data from 1,194 Korean children ($M_{age} = 12.23$ years) and their mother dyads were used. The results indicated that the total indirect effect of a mother's self-esteem on children's reading time, encompassing pathways through the mother's school involvement, academic stress, and the combination of both, was

significant ($b = 0.335$, $p < 0.01$), after controlling for children's sex and household income. Furthermore, the direct effect of mother's self-esteem on children's weekly reading time in the presence of the mediators was also found significant ($b = 0.391$, $p < 0.05$).

P2-120 - Multidimensional profiles of Head Start preschoolers' moral self-concept predict subsequent, but not concurrent, aggression

Erin Baker¹, Jamie Gahtan², Rong (Sophia) Huang³, Sumaita Salim², Sojung Park²

¹ University at Albany & State University of New York, ² University at Albany & SUNY Purchase, ³ University of Connecticut

Details

The moral self-concept (MSC) describes how children view themselves as moral agents. Little is known about how MSC relates to moral behavior in preschoolers. One hundred six low-income children ($M_{age}=52.78$ months, $SD=6.61$ months) and teachers participated. In the fall children completed a MSC puppet task. In the fall and spring teachers reported via survey children's prosocial and aggressive behavior (reactive and proactive). Using a person-centered approach to identify profiles of MSC revealed two profiles of behavior: comforting prosocial and helpful aggressors. Comforting Prosocials showed moderate preference for comforting, slight preference for helping, and slight preference for avoiding aggression. Helpful Aggressors showed moderate aversion to comforting, strong preference for helping, and slight preference for aggressive behavior. Subsequent multinomial logistic regression revealed that MSC profiles did not differ in concurrent behavior but did differ in behavior six months later: Comforting Prosocials participated in more reactive aggression than helpful aggressors.

P2-121 - Chinese children's essentialism of socioeconomic status and residency

Tonghui (Kailee) Zhu¹, Xinyi Chang², Xin (Alice) Zhao², Rose Scott¹

¹ University of California, Merced, ² East China Normal University

Details

Social essentialism is the tendency to treat a social category as having an underlying, unchangeable essence that could predict group members' behaviors and traits. To date, little work has examined the development of social essentialism in China. This project investigated the essentialism of two social categories: socioeconomic status (SES) and residency. Residency, a culturally salient social category in China, is inherited and affects access to public services such as education and medical care. We examined how children's essentialism of SES and residency varies as a function of their age, subjective SES, and residency status. A total of 85 5-9-year-olds, 82 12-year-olds and 85 18-year-old high school seniors completed two essentialism tasks that measured whether they perceived each social category as biologically based (Davoodi et al., 2020) or predictive of psychological traits (Mandalaywala et al., 2019). Preliminary analysis suggests that with age, children are less likely to perceive SES and residency as biologically based, but they continue to view both categories as causally informative. Moreover, with age, higher levels of subjective SES become associated with stronger endorsement of essentialist beliefs

for both categories. Together, these results suggest that with development, Chinese children's essentialism of SES and residency becomes more nuanced, and the influence of individual background varies among different age groups

P2-122 - "You didn't take my side": when children think friends will be more upset than non-friends

Alexander Mackiel¹, Alex Shaw¹

¹ University of Chicago

Details

In two studies we assess 4- to 11-year-old children's beliefs about loyalty by exploring how they think others react to putative disloyalty from friends. The first study (N = 124) tells of a person who refuses to take sides between a friend and a stranger and asks children who they think will be more upset about that decision. If children have an expectation of loyalty amongst friends, then they should report the friend as more upset. We find that with age, children increasingly recognize this loyalty obligation, predicting that friends will be more upset than acquaintances. In a second ongoing study (n = 64 out of a preregistered 192), we attempt to replicate this result while adding a control. Namely, we present children with a situation in which a person makes a mistake and then we ask who is more upset at them, their friend, or an acquaintance. Here we predict the opposite of the first study; children should think friends are less upset than strangers because in situations not involving loyalty, friends are more forgiving of each other's foibles. So far, we are finding support for both predictions. We again find that with age, children predict friends are more upset than strangers in side-taking situations. Importantly, our control shows the opposite pattern with children predicting that friends are less upset than acquaintances. We discuss the importance of this work for current theories of the development of friendship and loyalty.

P2-123 - Do weird children start out as or become analytic thinkers?

Qianhui Ni¹, Hongyu Hu¹, Ryan Nichols², Henrike Moll¹

¹ University of Southern California, ² California State University, Fullerton

Details

A core feature of WEIRD cultures is their so-called "analytic" cognitive style (Henrich et al., 2010). Those with an analytic style tend to perceive objects as isolated entities, whereas holistic or relational thinkers tend to view entire scenes and focus on relations between objects (Nisbett et al., 2001). Studies with adults have shown that US citizens tend to think analytically (Talhelm & English, 2020). We report the first developmental study with young children (N = 48; n = 24 children of 3 to 4 years and of 6 to years, respectively) to address whether US children start out or become analytic in their thinking. In an online experiment, children completed the "Triad Task" in which they had to match, e.g., a spoon to a soup (relational response) or a fork (analytic response). Results showed that children of both ages preferred holistic over analytic pairings, $ps < .001$ —a preference that was found to be stronger in older than in

younger children, $p < .001$. The findings suggest that cognitive style fluctuates over ontogeny, and that until they enter school age, US children are not analytic thinkers

P2-124 - Beliefs about masks and vaccines for COVID-19 across three U.S. communities

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Details

The COVID-19 pandemic disproportionately affected people along the lines of age, income, geographic location, race and ethnicity. We examined whether children (ages 5-12; $n=313$) and parents ($n=194$) in three distinct U.S. communities—high-SES university cities, low-SES Black and Latinx communities, and low-SES rural White politically-conservative communities—think differently about masks and vaccines with respect to COVID-19. With increasing age, children in the two low-SES communities were more likely to report that wearing a mask below the nose was incorrect ($p=.002$ and $p=.044$ respectively); children in high-SES communities were highly accurate across ages. Children's accuracy in identifying a loose-fitting mask as incorrect improved with age ($p=.013$) and was higher in university cities than rural communities ($p<.001$). We found a significant correlation between children's accuracy on these questions and their parents' self-reported mask-wearing frequency ($r=0.22$, $p<.001$). Meanwhile, children's self-reported vaccination rates in the two low-SES communities were lower than those in high-SES communities (both $ps<.001$). Children's vaccination status also significantly correlated ($ps<.001$) with their parents' vaccination status ($r=0.44$) and the parental belief that pandemic mask and vaccine mandates were motivated by medical instead of political reasons ($r=0.40$). These results offer an insight into the associations among COVID-19 beliefs, cultural factors, and protective behaviors.

P2-125 - The eye of the beholder: perceiving jealousy in interpersonal interactions

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Details

Jealousy is experienced when an intimate relationship with a beloved is threatened by a rival (Campos et al., 2010). While humans exhibit behaviors indicative of this emotion from infancy (Hart & Carrington, 2006), little is known about the ability to perceive jealousy in social interactions. We investigated whether adults ($N = 36$), 7-year-olds ($N = 38$), and 5-year-olds ($N = 38$) use others' jealousy-related behaviors to infer this emotion.

Participants watched videos of a central character cry when their relationship with one individual (but not another) was threatened. We expected participants perceiving jealousy to indicate that the central character preferred the person for whom they cried when their relationship with this individual was threatened. Analyses indicated that adults (78%, $\chi^2 = 11.11$; $p < .01$) chose the expected option significantly above chance, but 7-year-olds (30%, $\chi^2 = 6.74$; $p = .01$) and 5-year-olds (13%, $\chi^2 = 20.63$; $p < .01$) picked this option significantly below chance. Interestingly, 7-year-olds' performance varied by

participant gender, with girls (42%) succeeding more often than the boys (16%), $\chi^2 = 3.20$; $p = .07$, though gender differences were not present for 5-year-olds ($p = .34$) and adults ($p = 1.00$). Thus, the ability to perceive others' jealousy may gradually emerge in middle childhood, particularly for girls, and is clearly apparent in adulthood. Data collection with adolescents is ongoing.

P2-126 - What's next?: Parents' questions and preschoolers' math skills in China and the US

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Details

Prior research in Western contexts highlights the vital role of parents' questions in children's language development, yet little is known about how questioning varies across cultures and its link to other cognitive abilities. This study investigates the relationship between parents' questions and children's math skills from a cross-cultural perspective. 41 Chinese children and 50 US children ($M_{age} = 4;5$) and their parents were observed during puzzle play, with parent questions coded for linguistic forms, communicative functions, pedagogical styles, and math content. Preliminary results ($n = 74$) indicate cultural differences: Chinese parents tend to use direct pedagogical questions (PQ) providing specific puzzle-solving cues, while US parents favored indirect PQs that were open-ended and reflective. Parental questioning was also shown to correlate differentially with children's math skills in each cultural context. In China, indirect PQs related positively to cardinality and digit recognition skills, orientation questions to mental transformation abilities, and information-seeking questions to number line estimation skills. In the US, ordinal relation questions positively related to mental transformation abilities, and location questions to number line estimation skills. This study underscores how different parental questioning approaches across cultures influence children's math development, providing insights for enhancing early math learning in diverse contexts.

P2-127 - Prosocial risk taking in mid-childhood

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Details

Prosocial behaviors have primarily been examined regarding helping, sharing, and comforting. Yet, other forms are possible. In some contexts, benefitting another person requires taking a risk: prosocial risk taking (PSRT). For example, imagine a child who witnesses a bullying episode, and must decide whether to intervene: will they become victimized themselves? What will their peers think? We present a novel behavioral task designed to measure PSRT in children; participants were from Northern Ireland and aged 7-9 ($M_{age} = 8\text{-years, } 8\text{-months}$, Study 1: $N = 126$, Study 2: $N = 192$, Study 3: $N = 112$). Children chose between gambles to win a prize for themselves and a peer; trials differed in that, for some, making a prosocial choice required a cost (i.e., taking a risk), while other prosocial choices were non-costly. Children were sensitive to the cost between trials, making significantly less prosocial choices when doing

so required a risk (30.2% vs 80.2%, $p < .001$). Children's emotional judgements following the outcome of their gambles supported the interpretation that making the risky choice was prosocially motivated. Children who took a prosocial risk felt worse than those who did not, when they learned that a peer had received a poor outcome, $t(124) = 3.00$, $p = .004$, $d = .62$. Findings suggest that we successfully operationalized a task to capture a novel dimension of prosocial behavior.

P2-128 - Spatial toy play is associated with spatial cognition development in 4- and 5-year-olds

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Details

Spatial cognition is important for functioning in daily life, is associated with math and science achievement, and entering into Science, Technology, Engineering and Mathematics education. We investigated the role of spatial toy play at home in children's spatial cognition development. Eighty 4- and 5-year-old children (45 girls; Age=4.57 years, SD=0.48 years) completed a Mental Transformation task and Spatial Scaling task. Parents completed a Spatial Activity Survey. Access to "moderate spatial" toys at home (science experiment kits; making a volcano) and *high frequency playing with "moderate spatial" toys* was positively associated with mental transformation ($t=2.07$, $p=0.04$; $t=2.17$, $p=0.03$) and spatial scaling ($t=2.24$, $p=0.02$; $t=3.00$, $p < .01$), controlling for age and gender. Higher frequency playing with "not at all spatial" toys (card games; dolls) was negatively associated with mental transformation ($t=-2.55$, $p=0.01$) and spatial scaling tasks ($t=-2.59$, $p=0.01$), controlling for age and gender. Access and play with spatial toys may facilitate spatial cognition in young children and thus provide opportunities for intervention.

P2-129 - Infants remember "objectness" best: examining 18-20-month-olds' representations of objects' featural and categorical identities

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Details

Infants' capacity to represent objects' identities decreases with more objects to remember (Zosh & Feigenson, 2012). Here we examined how much detail – from finer featural information to coarser category information - infants remember about the identities of objects under increasing load.

In Experiment 1, infants (18-20 months, $n=24$) watched a single object (green car) get hidden in a box. On No-Switch trials, infants retrieved the same object that was hidden. On Switch trials, infants retrieved a different object: a red car (Featural Switch), a motorcycle (Within-Category Switch), a cat (Between-Category Switch), or an amorphous non-object (Between-Substance Switch). After infants

retrieved the object, we measured how much time they spent searching inside – if infants recognized that the object that came out was different from the one that went in, they should continue to search for the missing object. Infants searched longer on Switch compared to No-Switch trials only in the Between-Category and Between-Substance blocks ($p < .04$; $d = [.45, .53]$).

In Experiment 2 ($n = 46$) we increased memory load, hiding two green cars inside the box. Infants searched longer on Switch compared to No-Switch trials only in the Between-Substance block ($p = .001$; $d = .49$).

Our results suggest that 18-20-month-olds may default to representing objects' coarsest identities (i.e. basic-level categories like "car"; superordinate categories like "objectness") under representational load.

P2-130 - Gender-stereotyped conformity in YouTube videos viewed by 3- to 5-year-olds

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Details

In 2020, children in the United States aged 4-to-14 dedicate 86 minutes daily to viewing YouTube content (Hale, 2020). It is essential to understand if videos include diverse characters or incorporate biased and stereotypical depictions of gender. This research examines the general frequencies of gender presentation and gender-stereotyped conformity in videos viewed by 3-to-5-year-olds. Results of an online survey of parents across the U.S. suggest that 92% of the characters in the videos were of a traditional, stereotypical binary gender. Of these videos, a surprising 41% did not conform to their gender stereotype (e.g., females engaged in non-feminine roles) whereas 59% did conform to their gender stereotype. Implications of these results will inform discussions on the role of media in shaping children's perspectives and to offer considerations for content creators and educators aiming to foster inclusive and equitable representation in media for young audiences will be discussed.

P2-131 - How does mental rotation training affect calculation skills? The role of state anxiety and calculation type

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Details

Links between spatial and mathematical skills have been found across development, and training spatial skills can improve calculation skills. However, prior findings of this transfer effect are inconsistent, and its underlying mechanisms are unclear. A hypothesized mechanism is that high spatial skills may help

children mentally manipulate information, allowing them to succeed on advanced calculation types, like missing-term (e.g., $7 + _ = 12$) and two-step problems (e.g., $3 + 4 + 5 = _$). Another potential mechanism is that children's state anxiety may be reduced by training if the training makes children feel familiar with spatial processing and less anxious. A reduction in anxiety may free up cognitive resources that support spatial and mathematical processing. We tested these mechanisms based on a prior spatial training study (Gilligan et al., 2020). We conducted pretests at school and delivered the training and posttest one week later for 80 2nd and 3rd graders. Conventional calculation skill (e.g., $7 + 5 = _$) did not differ by condition at posttest ($F(1, 71) = .57, p = .453$), but missing-term ($F(1, 71) = 7.51, p = .007$) and two-step ($F(1, 71) = 10.44, p = .002$) calculation skills were both better in the spatial training than the control group. However, children's state anxiety did not differ at posttest by condition ($F(1, 72) = .37, p = .544$). This study contributes to understanding the role of calculation type and state anxiety in the spatial training effect on calculation skills.

P2-132 - Dynamic assessments more accurately capture culturally and linguistically diverse children's vocabulary knowledge

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Details

Recent research has advocated for dynamic assessments of vocabulary over more traditional, static assessments, as dynamic assessments are more sensitive to linguistic and cultural diversity. Static vocabulary assessments, such as the Peabody Picture Vocabulary Test (PPVT), probe existing knowledge, while dynamic assessments, such as the Quick Interactive Language Screener (QUILS), examine a child's ability to learn a new word. It remains unclear which assessment more accurately captures children's vocabulary knowledge throughout the Deep South—a region characterized by its unique cultural and linguistic environment, which includes the use of Southern White English and African American English. The current study examines whether static or dynamic vocabulary assessments are more sensitive to diverse children's actual language use. To test this, 35 families (child age 3-5) from the Deep South completed the PPVT, QUILS, and participated in a 15-minute recorded play session. Using SALT, the play sessions were transcribed and analyzed to measure the number of different words (NDW) produced by the child. There was a significant relationship between the QUILS and child NDW ($r = 0.50, p < 0.01$), but no significant relationship between PPVT scores and child NDW ($r = 0.26, p = 0.14$). We suggest the dynamic nature of the QUILS vocabulary assessment is more representative of actual vocabulary knowledge than the PPVT among a culturally and linguistically diverse sample.

P2-133 - “Why should I participate in research?” Results from the Project GARDEN family information survey on different families’ motivations to participate in online research

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Details

Project GARDEN (<https://childrenhelpingscience.com/garden/>) is a multi-study collaboration between developmental scientists at ten different universities designed to measure, within-subjects, seven different domains of child development (e.g., theory of mind, executive functioning) for 3- to 7-year-old children primarily in the United States. This poster will focus on analyses for Project GARDEN’s Family Information Survey (up to 350 participating children and their families) examining how child or family characteristics (e.g., SES, location, caregiver educational attainment) may impact families’ motivations to participate in Project GARDEN and their satisfaction with their research experience. Caregivers were asked to rate the importance of different motivations for participating in research, including enjoyment, compensation, convenience, helping science, and features of this particular project. They were also asked to rate their satisfaction with their experience. We will describe participant demographics and relative ratings for different motivations for research participation. Additional pre-registered analyses will examine whether specific family and child demographics relate to their motivations to participate in Project GARDEN and their satisfaction with their research experience. Implications for recruiting diverse family samples into developmental science research and designing it to be approachable and accessible for these families will be discussed.

P2-134 - Children's consideration of knowledge in communicative helping

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Details

Young children routinely help others achieve instrumental goals. Less is known about how they engage in complex, but extremely common types of helping: facilitating others’ goals by providing needed information. Children expect others to verify information before providing it to others, negatively evaluating those who do not. The current study investigates whether, when helping someone achieve a goal requiring information, preschoolers recognize if they have sufficient information to provide optimal help, and actively acquire necessary information before helping. 3-5-year-olds ($N=103$) played a game in which they had to choose the marbles in one box to insert into a toy that provided a high value prize for 5 marbles or a low value prize for 1. Children then helped a new adult in one of three experimental conditions: See 1 (finding 5 marbles for the high value reward required searching), Want 1 (finding 1 marble for the low value reward the experimenter stated she preferred required searching), and See 5 (no searching required). Children were more likely to search in the See 1 (94.1%, $z=4.418$, $p<.01$) and Want 1 (78.8%, $z=3.82$, $p<.01$) conditions, in which optimal help required searching before providing information, than in the See 5 condition (30.6%) that did not. Children thus used information about their own knowledge and the experimenter’s goal to guide their decisions about whether they needed to gather more information themselves before providing help.

P2-135 - "Because she knows more": young children's preferences for teachers' explanations differ based on question type

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Details

Children ask questions to seek information and permission, and teachers respond to children's questions in various ways. The present study examined whether children prefer learning from teachers who provide (i) full versus non-full explanations, and in the absence of full explanations, (ii) pedagogical versus authoritarian responses. Four- to 8-year-olds ($N = 64$) observed pairs of teachers responding to a peer's question using a full explanation, pedagogical, or authoritarian approach. Subsequently, they were asked which teacher they would prefer to answer an information-seeking question and permission-seeking question. Overall, children preferred teachers who provided full explanation responses 65% of the time. However, they were more likely to defer to the teacher who provided non-full explanations for the permission-seeking than information-seeking question ($B = -0.56$, $SE = 0.26$, $p = .04$) and did not differentiate between teachers employing pedagogical and authoritarian responses ($p > .05$). Our results carry implications for educators, suggesting potential adjustments in teaching strategies to enhance children's learning experiences.

P2-136 - Worked examples may only improve estimation accuracy of fractions with small whole number components among 5th and 6th graders with low prior knowledge

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Details

Fraction understanding predicts success in algebra (Booth & Newton, 2012), but children and adults often incorrectly apply whole-number knowledge during fraction tasks (Ni & Zhou, 2005). For example, children and adults estimated equivalent fractions less accurately and further to the right on number lines when fractions had larger (e.g., 15/30) compared to smaller components (e.g., 1/2; Braithwaite & Siegler, 2017; Fitzsimmons et al., 2022). We randomly assigned 5th ($n=52$) and 6th ($n=54$) graders to see correct and incorrect worked examples about segmenting number-lines (Hamdan & Gunderson, 2016) or fraction equivalence (Fitzsimmons et al., 2022) to see if either training improved number-line estimation accuracy and reduced whole number bias. Children were more accurate on a fraction equivalence task at posttest than pretest, $F(1, 106)=4.60$, $p=.034$, $\eta^2=.04$, and when they estimated equivalent fractions with smaller compared to larger components, $F(1, 106)=26.22$, $p<.001$, $\eta^2=.24$. Children were highly accurate and there was no effect of, or interactions with, condition on equivalence or number-line estimation. Exploratory analyses revealed that children with low pretest equivalence knowledge estimated small-component fractions more accurately at posttest than pretest after the segmenting training. Segmenting worked examples may help those with low knowledge estimate small-component fractions.

P2-137 - Infants' expectations for helpers

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Details

Infants recognize acts of helping and preferentially approach individuals who engage in them (Hamlin et al., 2007, Hamlin & Wynn, 2011). Do these preferences merely reflect an evaluation of the helper's past actions, or do infants also expect agents who have helped to help again in the future? We hypothesized that infants would expect an agent who has helped to be more likely to help in the future, relative to a hinderer. To test this hypothesis, we familiarized 14 & 15-month-old infants (N=52) to one agent who helps another agent (a target) climb a hill, and a third agent who hinders the same target from climbing a hill. In test trials, the target needed help in a new context where an obstacle was blocking its path. A nested comparison of mixed effect models revealed that infants looked longer (M=20.9 s, SD=8.87) to unexpected events, in which the original hinderer helped the target, than to expected events (M=17.2 s, SD=8.64), in which the original helper helped, $X^2=11.95$, $p<.001$, $d=.45$. These data are consistent with our hypothesis that preverbal infants take the helpful or hindering nature of agents' past actions as evidence of how they will behave in the future towards the original target of their help. We are currently following up on these results with a second study that examines whether infants expect the original helper, compared to a hinderer, to also be more likely to help a novel social agent with whom they had not interacted with previously.

P2-138 - Facilitating young children's learning of science lessons by cueing attention to contextual information

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Details

Developing endogenous selective attention skills support children's ability to voluntarily select relevant context during ongoing lessons, which in turn facilitates learning of lesson content*. However, it is unclear whether selection of relevant context based on exogenous (i.e., salience-based) mechanisms would similarly benefit learning. In this study, we examined how exogenously cueing children's attention to relevant and irrelevant contextual information impacts learning. Three- to five-year-old children (N = 89) viewed video science lessons while both lesson-relevant and -irrelevant images appeared in the periphery. During some trials, a salient spatial cue appeared around either a relevant or irrelevant peripheral image. We recorded children's eye movements to assess looking to the primary video lesson and surrounding images and assessed learning by comparing performance on content knowledge questions before and after the lessons. Results showed that children overall spent more time looking at lesson-relevant than -irrelevant peripheral images. However, younger children learned less when either the relevant or irrelevant images were cued, whereas older children showed similar learning regardless of cueing. These results replicate prior findings that children preferentially select lesson-relevant context but suggest that selection of this relevant context via exogenous cueing may be detrimental to learning for very young children. *Authors, 2022

P2-139 - Children's evaluation of observable and unobservable properties during scientific reasoning

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Details

Prior evidence evaluation investigations have examined children's reasoning about observable items and immediately verifiable outcomes. The current study examined children's certainty ratings drawn from evidence when reasoning about both immediately observable and unobservable properties with the same task. Participants ($N = 70$) completed an online experimental procedure. This included two conditions each involved reasoning about three levels of evidence. A $4 \times 2 \times 3$ ANOVA (Age \times Condition \times Evidence Level) was conducted, with Age (kindergarten, first grade, third grade, adults) as a between-subjects factor and Condition (observable vs. unobservable) and Evidence Level (conclusive vs. inconclusive vs. guess) as within-subjects factors. For the Observable condition, the ANOVA revealed a significant effect of Evidence Level: $F(2, 130) = 57.78, p < .001$, partial $\eta^2 = 0.47$. The Unobservable condition revealed a significant effect of Evidence Level: $F(2, 132) = 10.39, p < .001$, partial $\eta^2 = 0.37$ and a significant Age \times Evidence Level interaction, $F(6, 132) = 3.99, p = .001$, partial $\eta^2 = 0.15$. Results demonstrate that it was not until third grade that children could successfully reason about unobservable properties. This suggests a difference in reasoning across age groups between observable and unobservable properties across levels of evidence.

P2-140 - The impact of inequality on children's prosocial behaviors

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Details

The present, preregistered studies asked how inequality impacts children's prosociality, perceptions of fairness, and emotions. In Study 1, 4- to 9-year-olds ($N=240$) played a game in which a machine gave the participant fewer (Disadvantageous Inequality, DI), more (Advantageous Inequality, AI), or the same tokens as a peer (Equality, E). We then measured their sharing behavior, emotional reactions, and their judgments about how fair the machine was. Children of all ages judged DI as unfair, whereas only older children judged AI as unfair ($p < .001$). Children also showed negative emotion in DI condition ($p = .003$). However, their sharing behavior was not undermined; rather children shared more with age ($p < .001$). In Study 2, we manipulated inequality as justified or unjustified. Six- to 9-year-olds ($N=155$) played a game against a peer and received fewer rewards despite winning (Unjustified-DI), fewer rewards after losing (Justified-DI), or equal rewards for a tie (Justified-E). Across ages, children viewed Unjustified-DI as unfair but Justified-E and, critically, also Justified-DI as fair ($ps < .008$). DI again evoked negative emotions ($p = .03$) but did not affect children's sharing. These findings are the first to show that by school age, children's perceptions of the fairness of inequality depend on its justifiability. Findings from both studies suggest that although inequality impacts children's emotional state, it may not impact their prosocial behavior.

P2-141 - How do people reach the top? Emerging beliefs about high-status people predict children's aspirations to gain social status

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Details

Early gender and race differences in children's aspirations for high-status jobs are often attributed to their awareness of gender and racial/ethnic stereotypes about who does which jobs. Drawing from work with adults, we studied an alternative possibility that girls and children of color – members of historically lower-status groups – may begin to perceive that status is acquired through negative means (e.g., being selfish). These negative beliefs might, in turn, lower their own aspirations to gain status. Among 191 5-10-year-old children (50% girls, 48% non-White children), we found no overall gender or race differences in children's explanations for how people gain status (specifically, influence, wealth, and power) nor in their overall aspirations. However, children of color did differentiate between the three types of status (specifically, their explanations were more positive for influence than power and more positive for power than wealth), whereas White children did not. Additionally, there were gender and race differences in children's aspirations depending on their explanations. Stronger endorsement of positive explanations for how people acquire wealth predicted stronger aspirations to be wealthy among girls (Fig. 1), especially girls of color (Fig. 2), but not boys, indicating that explanations for status *matter more* for children from lower-status groups. This work highlights a novel reason why children's aspirations for high-status jobs diverge at an early age.

P2-142 - Effects of talker variability on learning similar and dissimilar novel words in 17-month-olds

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Details

Recent work finds that talker variability helps 14-month-olds learn novel minimal pairs (buk/puk; Rost & McMurray, 2009) but hinders their learning of dissimilar-sounding words (neem/lof; Bulgarelli & Bergelson, 2023). The current study tests older infants (17mos) to further investigate the role of talker variability in learning novel similar and dissimilar sounding words. Participants (n=45, data collection ongoing) participated in a two-word Switch task (Stager & Werker, 1997) with novel words that varied in word similarity (minimal pairs; distinct novel words) familiarized in different talker variability conditions (no variability; between talker variability). Analyses test whether infants increase their looking time to the Switch relative to the Same trial, which reflects having learned the word-object link. If talker variability hinders learning when it is not necessary, then even older infants should exhibit difficulty with the talker variability conditions. However, if younger infants struggle with talker variability when it is not necessary due to limited word learning resources, then we expect that 17-month-olds will succeed across conditions. Preliminary results suggest variability differentially impacts learning at 17 months relative to 14 months. Results inform theories of word learning across conditions of varying difficulty.

P2-143 - The emergence of helping in infancy: investigating the interplay of socio-cultural interactions, motor abilities, and infant social cognition

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Details

Within the second year of life, infants start to help others. The developmental origins of helping behavior are debated, though. A relational systems view proposes an integrative framework considering caregiver-child interaction, motor development, and social-cognitive abilities. Based on that, we investigated infants' helping towards their mother and towards an experimenter, assessed with shared chores and instrumental helping tasks at 14 months, in a longitudinal study (N = 118). As predictors, we assessed maternal sensitivity and cooperation/interference within free play following Ainsworth at 6 months. Infant motor development (questionnaire) and social cognition (action anticipation, eye-tracking) were assessed at 6 months and at 14 months. Maternal demonstration of helping (role-modeling) was assessed in shared chores tasks at 14 months.

Path analyses revealed that higher maternal interference at 6 months predicted higher maternal modeling at 14 months, which in turn related to more infant helping towards the mother. Helping towards the experimenter was positively predicted by maternal sensitivity, maternal interference, and infant action anticipation at 6 months. Beyond that, both helping behaviors were positively related to concurrent motor development and action anticipation, and correlated with each other. Overall, these findings demonstrate that infant helping is a complex phenomenon whose explanation requires an integrative developmental framework.

P2-144 - The intersection of parent questions, child skills, and activity context in informal STEM learning

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Details

Adult verbal prompts occur frequently during parent-child play to support children's learning. However, few studies have considered how parent language varies across playful activities. In this study, we examined how open and closed parent questions: (a) differed across three science, technology, engineering, and math (STEM) activities, and (b) related to math, science, and vocabulary knowledge in their preschool-aged children. We video recorded 173 parent-child dyads from low-income households participating in three STEM-related activities: (1) a pretend grocery store activity, (2) a bridge building challenge, and (3) a book read about a science topic. Parent questions were categorized as open or closed according to the presence of key question terms. Results indicate that the three activities elicited different frequencies and proportions of parent open and closed questions, with the grocery store activity containing the most parent open questions, followed by the book read. Both the grocery store and book read activities contained a higher proportion of parent open questions compared to the bridge activity. Children's science knowledge was predicted by (1) the frequency of parent *closed* questions

during the bridge activity and (2) the frequency and proportion of parent *open* questions during the book read. These results enhance our understanding of how parent questions guide young children's thinking and conversations differ across playful learning contexts.

P2-145 - The everyday objects that younger and older USA infants hold

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Details

Holding objects is a foundational experience for multiple developmental pathways. Yet, we know little about the rates and details of these learning opportunities in infants' everyday lives. Here, we report on caregivers' answers to the question "Is your child holding an object? (and if so, its name)" using a novel ecological momentary assessment protocol (Franchak et al., 2023). We sampled the lives of 4-7 month-old (N=58) and 10-13 month-old infants (N=62) in the USA (29 states; mostly white families spanning lower-to-upper SES). Caregivers responded to 10 text survey requests per day, spread from morning to evening, for 4 days per month, across 4 months. We observed coherence (object repetitions) within a striking diversity (many distinct objects) of held objects. Nearly half of the object types arose multiple times, within 196 (younger) and 343 (older) distinct reported objects held in everyday life. That is, infants held a lot of different things but mostly teething rings, bottles, and books. Younger infants held objects an average of .27, and older infants .41, of their waking lives. We highlight lessons about the power of developmentally ordered experiences for adaptive intelligence in both human and machine learners (Sheybani et al., 2023; see also de Barbaro & Fausey, 2022; Smith et al., 2018; Tamis-LeMonda et al., 2019).

P2-146 - The sound of skepticism: children's proficiency in detecting speaker disbelief through prosody

Kate Rho¹, Susan Birch¹

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Details

Subtle changes in pitch or tone of voice, known as prosodic cues, reveal information about a speaker's internal state. Proficiency in understanding these cues influences how listeners assess a speaker's credibility. While adults often link justified skepticism (disbelief in false information) with credibility, it's uncertain whether children can discern a speaker's disbelief through prosody alone and, importantly, when they consider a skeptical speaker more credible than someone endorsing false information. We explored these questions with 56 children (Mage = 7 years, 8 months, SD = 10.52 months, 54% female). The study featured two speakers, a Believer vs. a Disbeliever, expressing beliefs about realistic or farfetched stories. In the Control group (n = 26), children heard verbal statements of beliefs, while the experimental group (n = 30) relied solely on prosodic cues. Participants answered questions about the speakers' belief states, chose who to learn new words from, and answered "Who's smarter?" Children in both groups understood disbelief ($t(25) = 9.400, p < .001$; $t(29) = 4.557, p < .001$), with no

consistent learning preference. Disbelief detection correlated with Theory of Mind (ToM), not age ($r(53) = .327, p < 0.01$). However, age, not ToM, predicted perceiving the skeptical speaker as smarter. Crucially, our study demonstrates that children aged 6-8 can perceive a speaker's disbelief solely through prosodic cues.

P2-147 - Examining commonalities between executive function and effortful control in toddlerhood

Racheal Embry¹, Morgan Harris¹, Fatemeh Esfandiari¹, Amanda Greene¹, Dallas Kiner¹, Ashlynn Payne¹, Abby Brown¹, Stephanie Miller¹

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Details

Researchers have recently emphasized examination of the interconnection between effortful control and executive functioning (EF) because of the involvement of similar regulatory processes (e.g., Bridgett et al., 2015; Zhou et al., 2012). However, less research explores commonalities during toddlerhood. The present study will examine relationships between behavioral measures of EF (tasks requiring conscious control in goal-directed problem solving) and parent reports of effortful control (i.e. attentional focus, attentional shifting, and inhibitory control, Putnam et al., 2006) in approximately 75 14-, 18-, and 24-month-olds. We will also examine how delay of gratification tasks (often conceptualized as a EF and effortful control measure) relate to behavioral measures of EF and parent report measures of effortful control.

P2-148 - Children's responses to racial discrimination during shared book reading predict future evaluations of discrimination

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Details

Scholars often highlight the potential for diverse books to improve intergroup attitudes, yet little is known about the impact of children's engagement with such books. We evaluated how the content of child-adult conversations while reading about discrimination related to children's evaluation of discrimination on a laboratory measure. Children (ages 5-7, N=79) were read a book about a Black child experiencing discrimination. While reading, children were asked discussion questions (e.g., "What would you do to make someone feel better if they were left out because of their skin color?"). Children's responses were coded for themes including if they mentioned race, said they would ask for help, and said they would confront the perpetrator of discrimination (96% coder agreement). Children then completed a task (with a new experimenter unaware of children's reading responses) that measured children's evaluations of racial discrimination (Scott et al., 2023). Children were less approving of discrimination on the lab task when they had mentioned race ($p < .01$), said they would ask a parent for help ($p < .05$), and said they would confront the perpetrator of discrimination ($p < .05$) while reading.

These results suggest that children's ability to engage with racial themes in books is related to a meaningful outcome: marking discrimination as wrong. Future experimental work will compare effects of different books and discussion prompts on children's responses and intergroup outcomes.

P2-149 - Toddlers' interpretation of taxonomically underspecified nouns

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Details

Interpreting the referent of a noun, e.g. *car*, requires lexical knowledge involving categories and concepts. In contrast, the underspecified nouns *one* and *thing* do not designate fixed categories; listeners must consider the referential context, including shared knowledge, to determine the referent. In using *one*, speakers imply that speaker and listener have a shared category in mind, referenced by *one*. Using *thing* indicates speaker ignorance about the category, or its irrelevance. Thus, listeners must deploy subtle pragmatical computations to interpret these expressions. At what age are children able to determine the referents of these two underspecified nouns, and are there developmental differences between them?

We assessed children's interpretation of these terms in the presence of novel objects to equate children on prior experience.

Via Zoom, an experimenter commented on an object using either *one* ("see this one"), *thing*, or nothing ("see this") as a control (Fig1). Children were then asked to select from an object array "another one," "another thing," or "something." 87 2-year-olds (yo, M=28.8 mo) and 57 3-yos (M= 40.8 mo) participated.

2-yos select basic-level matches more for *one* (vs. Control; $p=0.003$) suggesting shape-based interpretation for *one* when conceptual information is lacking (Fig2). *Thing* was indeterminate. We will discuss implications for children's cognitive development in coordinating linguistic, conceptual, and pragmatic information.

P2-150 - Do implicit fairness biases relate to explicit endorsement of inequality?

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Details

Emerging work shows that children and adults hold implicit preferences for fair outcomes over those that put them into disadvantageous, but not advantageous situations. Do these implicit fairness preferences explain children's growing explicit understanding of fairness? In this study, we explored whether implicit fairness preferences are related with explicit endorsements of different forms of

inequality by using an Implicit Association Test and an explicit norm endorsement task of fairness. Preliminary results from N = 81 6-10 year old children (*Mean Age* = 8.60, *SD* = 1.45) showed that children had stronger implicit preferences for equality over disadvantageous than advantageous inequity. These implicit preferences increased with age. Moreover, both types of implicit fairness preferences were not found to be correlated with children's explicit endorsements of corresponding inequitable outcomes. Implications of these findings will be discussed.

P2-151 - Which one is a balide? The effects of prosody and animacy on novel noun learning with children

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Details

Prosody is how words are spoken, including tone, rhythm, and pitch. Prosody relevant to the meaning enhances word learning (Berman et al., 2013). However, it is unknown if children attend to irrelevant prosody and if various prosodies influence children's noun learning differently than adults (West et al., 2022).

In this study, a video trained 10 novel labels (i.e., "This is a *balide*") across 5 prosodies (Happy, Fear, Doubt, Name, Warn) paired to 10 novel referents (Aliens, Objects, or Faces) to test 4- and 5-year-olds' novel noun learning. Test trials instructed participants to choose the correct referent (i.e., Which one is a *balide*?). This train-test sequence was repeated. A Generalization block determined if children extended labels to similar items.

Preliminary analyses with 58 children showed differential effects of prosody across referents. Prosody did not affect learning labels for Aliens or Faces, p 's > .05, but it did affect Objects, p < .05. Children were more accurate with Happy and Fear Object labels than Name, p 's < .05. Generalization scores were more accurate than Test 1 for Objects and Faces, p 's < .001 indicating learning over time. Preliminary results suggest that irrelevant prosody affects children's noun learning, but differently than with adults.

P2-152 - Eclipsing reality: children's belief in astrology and its effects on behavior

Juliette Chartier¹, Jacqueline Woolley²

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Details

Adults who believe in astrology often consider it when making important decisions. We know that children's beliefs in superstitions impact their behavior, yet there is no research on their beliefs in astrology specifically. The current study addresses this gap. We examined children between 9 and 12 on (1) whether they knew about astrology, (2) whether they believed in astrology, (3) whether they were susceptible to the Barnum Effect (the tendency to believe that the vague personality descriptions in

horoscopes apply specifically to oneself), and (4) whether they made decisions based on astrology. We found that children of all ages knew about astrology but did not exhibit strong beliefs in it. Susceptibility to the Barnum Effect, however, was moderately high, with 62% of children agreeing that the personality description was accurate. Age affected children's performance on the decision-making task; younger children who believed in astrology were more likely to make decisions based on it whereas the opposite held for older children. Implications of these findings are discussed regarding children's ability to distinguish science from pseudoscience.

P2-153 - Do you want to know what numbats eat or what numbats look like? Children's use of overhypothesis in reasoning about animals

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Details

Concepts are involved in many fundamental processes, such as learning and reasoning. Surprisingly, children seem to form concepts from experience with a single category member (e.g., after seeing one squirrel eat nuts, they expect squirrels in general to eat nuts). In seminal papers, Shipley (1993, 2000) theorized that overhypotheses, or higher order generalizations, about superordinate categories (e.g., different animals have a characteristic diet) provide constraints on how people learn and reason about basic-level categories (e.g., squirrels eat nuts). Many scholars have cited Shipley's claim (e.g., Gelman & Kalish, 2007; Prasada & Dillingham, 2006); yet, the experimental evidence to back this claim is weak. In a pre-registered study, we explored the scope of overhypothesis use in 4- to 8-year-olds' reasoning about animals. Children ($n = 41$ out of a planned sample of 300) were randomly assigned to one of three conditions. The conditions examined whether overhypotheses guide (1) information seeking by asking participants to select between two properties to learn about an unfamiliar category, (2) the content of existing concepts by asking them to list features of familiar categories, and (3) inductive inferences by asking them to generalize properties from an unfamiliar animal to members of the same/different categories. Preliminary results show that children do not privilege Shipley's (1993, 2000) overhypothesis features, though this finding may be due to low power.

P2-154 - Children learn functional relations through self-directed information gathering

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Details

Functional relations (i.e., relations between inputs and outputs) are prevalent both in everyday life and in science. Do children understand functions before formally encountering these concepts in school, and can they learn functions through gathering relevant information from the environment for themselves (i.e., selecting a few input values and observing the corresponding outputs)? In an initial experiment, 6- to 9-year-olds ($N = 50$) learned about apple growth patterns (i.e., relations between apple quantity and

time) that followed different functional forms (linear, Gaussian, exponential). Children reviewed data on apple quantities at five time points before making predictions about 10 unobserved time points (Fig. 1). Children can learn the functions both when the initial data points were chosen optimally by an experimenter (Prediction Only Trial) and when they were chosen by the children themselves (Sample + Prediction Trial). When selecting data points to learn about, some children choose highly similar points that only shed light on a narrow region of a function, while others select more variable inputs and gain a holistic understanding of a function. Children who use this latter, globally informative strategy have higher learning accuracy, particularly for nonlinear functions. Results suggest that children show an early understanding of a number of functions, and that they are developing informative strategies for actively learning about functions.

P2-155 - A growth mindset intervention promotes girls' motivation towards intellectually challenging activities

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Details

Prior research suggests that starting from the early elementary school years, girls become less interested in activities said to be for “really smart children” compared to boys (Bian et al., 2017). We investigated whether instilling a growth mindset about intelligence could enhance young girls' motivation to pursue these intellectually-challenging activities by undermining the assumption that intelligence is fixed. Seven-year-old children in an *intervention* condition watched animation clips, conveying four key components of a growth mindset about intelligence (e.g., “Our brain is like a muscle. It gets stronger (and smarter) when we exercise!”). Next, children were asked to provide encouraging words to a new child shown in a picture, who believes that they are not smart and that there is little they can do to change their intelligence. Children in a *control* condition watched animation clips that provided basic information about the human brain, along with engaging stories, and were asked to share what they had learned with a new child. We then measured children's motivation for a game said to be only for very smart children. In the control condition, girls were less interested than boys in the game said as requiring brilliance; however, girls and boys in the intervention condition were equally highly interested in this game. These results thus suggest that the growth mindset intervention successfully promote girls' motivation toward intellectually challenging activities.

P2-156 - Do preschoolers selectively teach objective facts instead of subjective opinions?

Elizabeth Gottesman¹, Fanxiao Qiu¹, Henrike Moll¹

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Details

A growing research area studying the emergence of “pedagogical cognition” in children has found that even before entering elementary school, children know a great deal about the goals and the process of

teaching. For example, by age 4 or 5, children understand that teachers should stick to the truth (Pueschel et al., 2023), share general, rather than episodic information (Gelman et al., 2013), and focus on facts that are difficult rather than easy to find out for oneself (Ronfard et al., 2015). What has not, however, been investigated is when children come to understand that teachers should transmit objective facts rather than subjective opinions. In Experiment 1 (N = 80), we asked whether five- and six-year-olds can distinguish between objective information and subjective statements and found that children of both ages have an implicit grasp of that distinction, $p < .0001$. Experiment 2 (N = 80), which is ongoing, investigates whether five- and six-year old children choose to teach fact-based objective information and, conversely, casually share opinion-based subjective information. The findings have implications for understanding children's cognitive development and their role as benefactors of knowledge.

P2-157 - Do 10-month-old infants expect an adult to comfort a crying baby whether the two belong to the same group or not?

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Details

Prior work indicates that infants expect a woman alone with a crying baby to comfort it (Jin et al., 2018). These results are open to two interpretations: (a) infants assume that the woman and baby belong to the same group, and they expect the woman to help an ingroup baby, or (b) infants expect a woman alone with a crying baby to comfort it, whether the two belong to the same group or not. To evaluate these possibilities, 10-month-olds were assigned to an ingroup or an outgroup condition. In familiarization trials, infants were introduced to two women from different minimal groups, each marked by a shirt of a particular color and design. Test trials differed between conditions. In the *ingroup* condition, one of the women folded towels at a table; near the table were a chair with more towels and a bassinet matching the color and design of the woman's shirt. When the baby in the bassinet began to cry, the woman either walked to the chair to gather more towels (ignore event) or walked to the bassinet and rocked it gently (comfort event). The *outgroup* condition was similar except that the woman and baby belonged to different groups. Preliminary results suggest that infants in the ingroup condition look significantly longer at the ignore than at the comfort event, whereas infants in the outgroup condition look equally at the events. These results suggest that infants expect a woman alone with a crying baby to comfort the baby when both belong to the same group, but not otherwise.

P2-158 - Type of analogy during instruction moderates relationships between sixth-grade students' inhibitory control and mathematics learning

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Details

Teachers regularly use *instructional analogies* in mathematics (e.g., Richland et al., 2007). However, students with lower executive function (EF) capacity tend to have more difficulty with analogical thinking and reasoning (see Simms et al., 2017). Recently, Sidney and Thompson (2019) theorized that *implicitly-guided* analogies rely on relational priming and may not depend as heavily on children's EF. To test this, $n = 49$ sixth-graders (data collection stopped in March 2020) were randomly assigned to learn about fraction division with no analogy or with an implicitly- or explicitly-guided analogy to whole number division; inhibitory control was measured using the Flanker task. There were no overall learning differences between analogy types, however, analogy type moderated the relationship between inhibitory control and learning, $F(2,42) = 4.58, p = .016$. This research expands our understanding of how teachers' instructional decisions in mathematics may have heterogeneous effects depending on children's individual differences in EF.

P2-159 - Using books to improve mental rotation skills in 4- and 5-year-old children

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Details

Mental rotation skills predict later achievement in STEM (Wai et al., 2009). Prior research shows that children's mental rotation skills improve after training (Uttal et al., 2013; Hawes et al., 2022). However, most studies only used dynamic stimuli where children see objects rotating. We hypothesized that reading books that practice mental rotation with only static images could improve children's mental rotation skills.

We preregistered a pretest-training-posttest design with 4- and 5-year-olds ($N=80$). Children completed a mental rotation assessment at pretest, 4-6 reading days with an experimenter over two weeks in one of two randomly-assigned conditions (Mental Rotation Book Condition versus Control Book Condition, both researcher-designed books), and a mental rotation assessment at posttest. The Mental Rotation Books involved mental rotation practice while the Control Books did not.

Consistent with our hypothesis, condition was a significant predictor of posttest mental rotation accuracy, $F(1,75)=14.40, p<.001, \eta_p^2= 0.162$, controlling for age, verbal ability, and pretest mental rotation accuracy. Children in the Mental Rotation Book condition significantly improved from pretest ($M=.59, SD=.24$) to posttest ($M=.75, SD=.21$) ($p<.001$), while the control group did not.

Book-reading may be a scalable method for improving mental rotation skills in early childhood, and warrants further intervention studies using book-reading at home or in schools to improve spatial skills.

P2-160 - The interplay of narrative ability and delayed memory recall in children

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Details

The ability to produce a coherent narrative is essential for communication and social interaction. However, narrative proficiency may also contribute to episodic memory because a narrative creates a scaffold for each individual event. Narrative structure bookends the individual events (e.g. a fairy godmother appearing; losing a glass slipper) that occur in the story, thus supporting episodic retrieval. In this study, we compared children's on-the-fly narratives of events they viewed with their later recall of events. We tested a sample of 77 children ages 4- 7 years. Children were asked to narrate six silent German cartoons after watching them once and while they watched them a second time. Narratives were recorded, transcribed, and coded based on a validated coding scheme of narrative complexity focused on goals, attempts, and outcomes (Demir et al. 2014). After an average delay of 7 days, participants were presented with a still image from each cartoon and were asked to recall everything they could remember from the story. Ground truth of each story was established by 10 adults. Preliminary analyses show a positive correlation between narrative complexity at the first session and proportion of details accurately recalled one week later as well as a positive correlation between age and both measures. These findings support the hypothesis that narrative structure supports the later recall of episodic memory, and that age plays a role in facilitating this ability.

P2-161 - Young children understand obligatory and supererogatory actions: Evidence from the U.S. and Korea

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Details

Do young children view helping an ingroup member in need as an obligatory action, but helping an outgroup member in need as a supererogatory, virtuous action? Building on earlier findings (Sánchez Hernández & Baillargeon, 2022), we examined these questions using American and Korean 3-year-olds. Children watched computer-animated events online in a looking-time task using three distinct measures. In a *two-group* condition, children first saw two groups (blue vs. red). Next, a protagonist's ball landed out of reach on a high walkway; across trials, either an ingroup or an outgroup character stood on the walkway. After a 10-s pause, the character returned the ball to the protagonist. During the pause, children persisted more in looking when the ingroup character was present, suggesting that they expected it to help. As in prior findings, children looked equally when either character did help the protagonist. Finally, the two characters were shown side by side. Children looked preferentially at the

outgroup character, suggesting that they viewed it as virtuous for choosing to help even though it was not obligated to do so. In a *one-group* condition, the two types of characters were introduced as a mixed ingroup. Children now expected both characters to help, looked equally when they did help, and showed no preference for either character. These results provide cross-cultural evidence that children view help to an ingroup as obligatory but help to an outgroup as supererogatory.

P2-162 - Analogical processing as a learning effect for the block design task

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Details

Analogical reasoning relies on relational learning environments and structural alignment tends to highlight the alignable differences that promote learning (Gentner, 2010). Similarity is like analogy and thus structural alignment can be used to process similarity matches (Gentner & Markman, 1995). In fact, similarity comparisons are part of the structural alignment process (Markman & Gentner, 1993). Analogical reasoning is not limited to reasoning about static visual stimuli or stories but can also be seen through physical manipulatives. In such a task, when goal states are more similar, participants can recognize the analogy much easier (Zamani & Richard, 2000). We asked whether a learning effect attributable to analogical reasoning could be found with two designs of the Block Design Task. 26 children ($M_{age} = 6.69$, $SD = 0.88$) and 26 adults ($M_{age} = 18.6$, $SD = 0.75$) recreated designs using similar elements, striped diagonal lines. Paired samples *t*-tests demonstrate that while adults were faster at a second design ($t(25) = 2.74$, $p = 0.011$), children were not ($t(25) = 0.630$, $p = 0.421$). This demonstrates that adults may be using analogical reasoning to apply previous problem-solving techniques for faster solutions to novel problems, but children are not. More statistical tests will be conducted to examine specific relationships and support analogical effects. Further implications and future directions will be discussed.

P2-163 - Why is mom doing all the chores?: The developmental roots of gender disparities in unpaid domestic labor

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Details

Women in the U.S. usually have to shoulder the workload of unpaid domestic labor in the home. This burden can act as an obstacle to women's personal and professional goals, even forcing them to choose between a career and a family. Talking to children about this disparity can help provide insight into its developmental origins. In the current study, participants ($N=98$, $M_{age} = 8.9$, $SD = 1.6$) were asked to provide value rankings of job importance from 1-10 for eight jobs; four unpaid domestic labor (cooking dinner, cleaning the house, taking care of the baby, and doing the laundry) and four paid jobs in the workforce (firefighter, doctor, pilot, and construction worker). Both boys and girls valued domestic labor

less than jobs in the workforce and no significant difference was found between genders. Participants' parents' gender essentialism levels were examined in association with children's value rankings, but no significant difference was found. These value rankings were also examined in association with the percentage of unpaid domestic labor participants' mothers completed in the household, and again no significant difference was found. Children may be perpetuating this disparity amongst themselves, and on the whole, do not value unpaid domestic labor very much.

P2-164 - Children's skepticism about a claim is calibrated by social group information

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Details

People routinely align their beliefs to reflect positively on their social group, sometimes even at the expense of truth and accuracy. How much do children know and understand about this process? Children understand that social connections (e.g., friend/enemy) can influence one's beliefs and claims (Lieberman & Shaw, 2020), and are less likely to endorse judgements that might be biased by those connections (Heyman, Fu, & Lee, 2007; Mills & Grant, 2009). The current study extends this to an intergroup context, asking whether children calibrate their beliefs about valanced group-based claims depending solely on the group membership of the claim-maker. Participants ($N=57$ so far of 150 6- to 13-year-olds) were introduced to two minimal groups who regularly competed with each other, and were asked to evaluate claims about these groups. Children had to decide whether they would believe a claim (e.g., Gorps are [not] very helpful) more if it came from a member of the group in question (i.e., Gorps), or from a member of the opposing group (i.e., Flurps). Preliminary results suggest that by at least age 9 children would believe a negative claim more if it came from a member of the group in question, and a positive claim more if it came from a member of the opposing group ($\beta=-0.85$, $z(55)=-6.68$, $p<0.001$). We will discuss the developmental trajectory of this phenomenon and how it may provide promise for combatting the development of partisanship.

P2-165 - Relations between stress, sleep, and parenting style in young children: an exploratory analysis

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Details

Adequate sleep is a critical component of healthy cognitive development. Understanding factors that promote or interfere with sleep early in development is important. This study examined relations between sleep and stress in young children and how parenting influenced these associations. Participants were 200 typically developing children between 4-8 years of age. Parents completed questionnaires on children's sleep problems, stressful life events, and their parenting styles. Controlling for age and sex, experiencing greater stress was significantly related to greater sleep problems ($\beta = 0.24$, $p = 0.002$). Permissive parenting was also significantly related to overall sleep problems ($\beta = 0.24$, p

= 0.002), as well as three specific aspects of sleep: bedtime resistance ($\beta = .22, p = .004$); sleep anxiety ($\beta = .20, p = 0.008$); and daytime sleepiness ($\beta = .21, p = .008$). Findings highlight the importance of understanding the role stress plays on children's sleep and how parents may buffer these effects.

P3-1 - "Todo es ciencia": Mexican-heritage parents' definitions of science

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Details

To further an equitable approach to science learning, we need to leverage an emic perspective of science that is inclusive of families from culturally and linguistically nondominant communities. We conducted qualitative interviews with 18 Spanish-speaking, Mexican-heritage parents of preschool-aged children, and asked parents to share what comes to mind when they hear the word "science." Parents' definitions of science were coded along four dimensions that emerged from the data: (1) the content or topics included in their response, (2) the context of where they saw science happening, (3) the science practices they described, and (4) the beliefs they held related to science. Preliminary analyses show that parents saw science as omnipresent, and often included topics such as nature, humans, animals, technology, and medicine. Science was especially described as happening in schools. Parents often expressed that science is an active process that they or others (i.e., scientists) do, such as investigating, testing, and dissecting animals. Finally, some parents talked about religious and spiritual views related to science, such as believing in higher entities (i.e., God and the universe). The final sample will include an additional 33 Mexican-heritage caregivers. Parents' answers will help advance a greater understanding of what science means to this community and the ways they see science reflected in their everyday lives.

P3-2 - Brief, relevant experience prompts functional tool use in infants

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Details

Studies have demonstrated that children's early tool use is shaped by their observations of skilled social partners and by experiential learning and problem-solving. Little is known, however, about the details of the mechanisms through which children learn to apply these skills appropriately. Here, we gave 147 infants ranging from 12-17 months of age either task-relevant (helpful) or task-irrelevant (non-helpful) training with a novel tool before asking them to imitate an action with the same tool. The helpful or non-helpful training was either hands-on or observation-only, and each infant used only one of three novel tools that differed based on either weight distribution or perceptual salience of the intended handle. Infants who received helpful training were more likely to successfully imitate the action than those who received non-helpful training, however, there was no significant difference in performance

between the hands-on and observation-only groups. Overall, our findings demonstrate that even a brief experience (~2 minutes) with helpful training supported successful tool use when infants engaged in a subsequent task.

P3-4 - What kids choose to read matters: exploring protagonist racial diversity and its impacts in children's self-reported book reading

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¹ University of Rochester

Details

Books are a valuable tool that can expose children to diverse characters, life experiences, and cultures that they may not otherwise encounter. However, existing work on the social nature and influence of children's literature has primarily focused on award-winning or bestselling books, and not on the books that children *themselves* report reading, nor on connections between book content and children's own identities or emerging social attitudes. Here, we linked the racial demographics of protagonists in the books children report reading ($N = 562$ books) with children's ($N = 174$ 8- to 14-year-olds) own racial identities and examined how the racial diversity of children's readership aligned with their beliefs about the causes of racial inequality in the U.S. Our findings revealed that White protagonists were most common and that regardless of their own racial identities, all children were most likely to read these books. However, Black and Latinx children were significantly more likely to read books with Black protagonists than were White children. We also saw preliminary evidence that protagonist racial identities related to children's own emerging racial ideologies. For older youth, the more White protagonists they read about, the *less* likely they were to endorse structural explanations for racial inequality. In contrast, across ages, the more non-White protagonists children read about, the *more* likely children were to endorse structural explanations for racial inequality.

P3-5 - Ongoing racial bias in the PPVT: implications for "word gap" researchers

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Details

The Peabody Picture Vocabulary Test (PPVT) is a receptive vocabulary test with a history of implicit bias resulting in consistently lower scores among racial and ethnic minorities (Finneran et al., 2020). To evaluate whether a new 5th edition of the PPVT, which is normed on a more representative sample, has resolved such biases, the current study conducted an item-level analysis of the PPVT-5 among 124 socioeconomically diverse children (ages 3-5; annual income range < \$5,000-\$100,000) who identified as either Black ($N = 89$) or White ($N = 35$). Black children performed significantly worse ($M = 93.88$) than White children ($M = 108.03$), even when income and age were controlled for ($t(56.80) = -4.00, p < 0.001$). Within each group, items were coded for both response accuracy and frequency of incorrect response choices (foils). While both groups similarly missed 42 items (item difficulty < .20), there were

an additional 27 items commonly missed by Black children. We further identified 13 foils that were selected by over 40% of Black children in lieu of the correct response on these items. Lastly, Black children were more likely than White children to choose incorrect responses on items considered “easier”, regardless of age. Given the overwhelming utility of the PPVT in studies related to the 30-million-word gap, it is critical to acknowledge ongoing issues with this assessment that may be unfairly biased against racial minorities.

P3-6 - Infants' moral trait inferences in protective third-party intervention

Norman Zeng¹, Inderpreet Gill¹, Jessica Sommerville¹

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Details

After observing an agent’s behavior, adults and children can make inferences about that agent’s underlying character traits and use those inferences to predict their future behavior (Kalish, 2002). Preliminary evidence suggests that infants can also make trait inferences in simple situations, as evidenced by their ability to make behavioral predictions across moral subdomains (Gill & Sommerville, 2023; Surian et al., 2018). In our research, we investigated whether infants can also make moral trait inferences in complex multi-party social scenarios. To do this, we used a VOE paradigm and familiarized 12-to-24-month-old infants (N=160) to animated videos in which an aggressor hits and chases a victim before a protector intervenes or a bystander watches from the sideline (Kanakogi et al., 2017). Following this, infants saw one of the previous agents distributing resources equally (fair) and unequally (unfair) between two recipients. Infants looked significantly longer when the aggressor distributed fairly ($t(31) = 2.45, p = .020$) and when the protector ($t(31) = 3.58, p = .001$) and victim ($t(31) = 2.12, p = .042$) distributed unfairly, but looked equally at the bystander’s resource distributions ($t(31) = .78, p = .44$). These findings suggest that infants form trait inferences in complex socio-moral scenarios, expecting aggressors to be unfair, and victims and interveners to be fair.

P3-8 - The coordination of proactive and reactive cognitive control across development: an ERP investigation

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Details

Children transition from predominantly engaging cognitive control reactively, in the moment as needed, to increasingly engaging control proactively, in anticipation of needing it, with development (Chatham et al., 2009). Research suggests that proactive and reactive processes are distinct at both behavioral and neural levels and thus must be coordinated (Braver et al., 2012; Czernochowski, 2014). However, it is not known how these two distinct processes are coordinated within a trial, whether such coordination changes over development, and whether coordination at the neural level influences behavioral performance. This study addressed these gaps by examining neural correlates of proactive and reactive

control via ERPs during a cued task switching paradigm in a sample of adults, 6 and 9-year-old children. We hypothesized that adults would show greater coordination of proactive and reactive processes than children and that this coordination would relate to improved behavioral performance.

Contrary to our hypothesis, we found evidence of coordination of proactive and reactive control only in 6-year-old children, measured as decreased reactive engagement following increased proactive engagement. Additionally, we found that both proactive and reactive control are related to improved control performance as assessed via reaction time; however adults and children differ in the specific reactive control ERP components that show this pattern.

P3-9 - Impact of interactive videos on children's narrative and educational comprehension

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Details

Television and video programs are vital educational resources, especially for children from under-resourced households. Partnering with PBS KIDS, we developed interactive science-focused videos to amplify their educational potential. This study, building on our previous work highlighting the benefits of interactive videos (Xu et al., 2023), investigates the impact of different video watching conditions on narrative and educational comprehension among children. In a randomized controlled trial, 275 children aged 4 to 6 years watched videos under one of three conditions: interactive, semi-interactive, or non-interactive. Results from ANOVA and post-hoc tests showed that children in the interactive condition outperformed those in the non-interactive condition across narrative comprehension, educational comprehension, and combined comprehension. Children watching semi-interactive videos also demonstrated improved performance compared to those watching non-interactive videos, though the difference was only significant for narrative comprehension. The findings align with the narrative dominance principle of the Capacity Model, suggesting that interactive elements, by reducing cognitive load, might enhance children's ability to process educational content more effectively (Fisch, 2000; Jing & Kirkorian, 2020). Future research could further delineate how different levels of interactivity influence early cognitive processing.

P3-10 - Caregiver's impact on 3- to 6-year-old children's mechanistic causal reasoning during contexts of failure

Gauri Harindranath¹, Paul Muentener¹

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Details

This study investigated caregivers' impact on children's mechanism reasoning in the context of failure. Since people make different inferences about their own compared to another's failure, we predicted that caregivers would support mechanism reasoning more when they experienced failure compared to when they observed failure. Seventy-five caregiver-child dyads (3- to 6-years) were assigned to an Observed (n = 38) or Experienced (n = 37) Failure condition. They were shown how to use a novel toy that had a switch mechanism which was then covertly switched OFF (ie., dyads would fail to make the toy work). We manipulated the source of failure between conditions: caregivers failed on their own (Experienced condition) or watched their child fail (Observed condition). We then assessed caregivers' subsequent verbal instructions, and children's exploration, explanation, and generalization. Caregivers used more mechanistic language ($\chi^2(1) = 4.00, p < 0.05$) and children were more likely to find the mechanism in the Experienced condition ($\chi^2(1) = 5.16, p < 0.05$). Yet, in contrast to our predictions, children were more likely to generalize their mechanistic learning in the Observed condition, ($\chi^2(1) = 4.53, p < 0.05$). These findings suggest that although increasing caregivers' informal instruction may lead to an immediate increase in children's mechanism learning, this learning may be more limited compared to when children learn from their own failure.

P3-11 - Can children account for others' knowledge state when making numerical decisions?

Shannon Desbiens¹, Elif Poyraz¹, Jinjing Jenny Wang^{1,2}

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Details

When are children able to access others' perspective? Past research disagrees on the development and nature of this critical ability for daily life. In the current study, we created a naturalistic game environment to assess children's access to others' perspective and whether they can integrate abstract numerical information during this perspective taking process. 134 2-, 3- and 4-year-olds participated in this competitive game with an agent (a puppet controlled by a second experimenter), where each trial the experimenter hides a sticker under one of two buckets. In half of the trials, unbeknownst to the agent, the experimenter presents the child with additional stickers, and the child is asked to decide where to hide the stickers. Preliminary results showed that children not only recognize the information gap between what they know and what the agent knows, but also harness this information gap to their own advantage in order to gain more stickers. Surprisingly, we found no age difference in the pattern of children's performance. These results suggest that children can access others' perspective and integrate numerical information when making decisions by 2 years of age.

P3-12 - Preschoolers, false belief performance, and the development of inhibitory control

Elif Poyraz¹, Alan Leslie²

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Details

After decades of research, young preschoolers' failure in standard false belief tasks remain puzzling, and controversial (Rakoczy, 2023), given that toddlers can be sensitive to others' mental state as a cause of behavior (e.g., Onishi & Baillargeon, 2005; Scott et al., 2020). Theory of Mind Mechanism (ToMM) theory (Leslie, 1994; Leslie, German, & Polizzi, 2005) argues that inhibitory control may play a critical role. The current poster focuses on two cross-sectional experiments which form part of an ongoing series of longitudinal single-case studies using the change point paradigm (Baker et al., 2016). Two hundred and twelve 3-, 4-, 5-year-olds participated in a range of theory of mind tasks of varying difficulty, along with two tasks measuring inhibitory control. Preliminary results provide evidence supporting the theorized relationship between inhibition and belief task difficulty. Implications for how to study developmental change will be discussed.

P3-13 - Reported cross-race play promotes positive STEM competency beliefs and high-status occupation expectations for Black peers

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Details

Stereotypic beliefs about race and science, technology, engineering, and mathematics (STEM) abilities and occupations emerge early in childhood. This study was novel because it investigated whether cross-race play is related to children's math and science competency beliefs and high-status occupation expectations about Black peers. Participants were 983 8- to 11-year-olds (502 female, 58.5% White, 17.5% Multiracial, 8.3% Asian American, 5.6% Black/African American, 4.2% Latinx, and 5.9% not reported; $M_{\text{age}} = 9.64$) from the Mid-Atlantic region of the United States. Results confirmed our hypotheses that cross-race play was related to children's math and science competency beliefs about Black peers ($F(1, 950) = 19.77, p < .001$). Follow-up pairwise comparisons showed that non-Black participants with high levels of cross-race play reported significantly higher beliefs ($M = 3.72, SD = .07$) than did those with low levels of cross-race play ($M = 3.46, SD = .04$). There was also a main effect of cross-race play on children's high-status occupation expectations for Black peers. Children with high, compared to low, levels of cross-race play reported significantly higher expectations ($F(1, 950) = 16.71, p < .001$). These findings demonstrate the novel application of intergroup contact theory to children's STEM ability beliefs and high-status occupation expectations for Black peers and may help guide future interventions for reducing stereotypes and improving belonging in STEM.

P3-14 - Children's memory for events: The challenge of free recall

Susan Benear¹, Obinnaya Onwukanjo², Nora Newcombe³, Ingrid Olson³

¹ New York University, ² Columbia University, ³ Temple University

Details

Early childhood is a critical period for episodic memory development, with sharp behavioral improvements between ages 4 and 7 years. We asked children and adults to view a television episode, a naturalistic task for which there exists a ground truth, and assessed their event cognition, forced-choice recognition for event details, ability to temporally order scenes, and free recall. Children's free recall performance improved dramatically with age, with many young children recalling nothing, even though recognition measures showed retention. However, detail in free recall was related to both recognition and temporal order forced-choice memory performance in our full sample, showing agreement among memory measures. For children, free recall was additionally related to verbal skills and more adult-like event segmentation. We propose that free recall has a more protracted developmental trajectory because it requires more substantial verbal skills and better understanding of event schemas than forced-choice memory tasks.

P3-15 - Toward a theoretical understanding Latine children's prosociality: Mechanisms of intergenerational transmission of cultural values

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Details

Young Latine children show significantly higher prosociality than other racial-ethnic groups (Barragan & Meltzoff, 2021). Is this associated with the cultural values of their caregivers? *Simpatía* is a Latine cultural value involving effusive emotional-relational positivity (Triandis et al., 1984). Here we examined how *simpatía* relates to the development of early Latine prosociality. We conducted the study in an area of LA County where more than 90% of the population is Latine. Using a mobile laboratory and the standardized Fehr (2008) behavioral test of childhood prosociality, we tested $N = 50$ Latine children aged 4.00-7.99 years of age (Mean age = 5.95, 52% girls). Children chose between an option where both themselves and another child would receive a sticker ("1:1 choice") or an option where they would receive a sticker and the other child would not ("1:0 choice"). Independently, caregivers completed the *Simpatía* Scale (Acevedo et al., 2020). We found that 84.00% (21/25) of the children whose caregivers scored above the median on *simpatía* selected the 1:1 choice, and 32.00% (8/25) of the children whose caregivers scored below the median on *simpatía* did so, $\chi^2(1, N = 50) = 13.88, p = 0.0002, \phi = 0.53$ (Figure). These patterns remained significant when controlling for child age, gender, family SES, and maternal education. We discuss mechanisms by which Latine cultural values are implicitly transferred to children, and then manifest in early prosocial behavior.

P3-16 - Impact of sitting support and positioning on infant social attention

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¹ University of Southern California

Details

Face-to-face play and joint attention are cornerstones of early parent-infant interactions and contribute to social-emotional, cognitive, and language development. When infants sit with adult support, they usually face away from the adult. How does this positioning impact visual attention? Facing away likely decreases viewing of faces, which may limit engagement in joint attention. However, eye-tracking studies in toddlers demonstrate that joint attention can be sustained via manual actions without face looking. We asked whether sitting support and positioning impact social attention in the early stages of sitting development.

We observed 10 infants (age 5-7 months) in free play with parents in 2 conditions: sitting on the floor (with adult support if needed) and sitting in a seat; parents chose how to position infants. Infants and parents wore head-mounted eye trackers, and looks to faces and toys were scored. In the seat condition, infants usually ($M=81\%$ of the time) sat face-to-face with parents; in the floor condition, infants faced away (32%) or at right angles (50%). Face looking was more frequent during face-to-face positioning, and was rare when infants faced away. However, joint attention was much higher when infants faced away (49%) than while face-to-face (10%) or at right angles (15%). Findings suggest that facing away from caregivers may support the developmental shift from attending to faces to attending to objects and the early development of joint attention.

P3-17 - Children's and adults' beliefs about wanting versus liking as drivers of emotions and behaviors

Hannah Kramer ¹, Kristin Lagattuta ²

¹ University of Wisconsin - Madison, ² University of California, Davis

Details

Desires (wants) and preferences (likes) are both evaluative attitudes towards objects. How do children and adults distinguish between them? We tested one way that people may differentially construe wanting and liking—their connections to emotions and behaviors. Participants (Study 1: $N = 112$ 8- to 10-year-olds and undergraduates; Study 2: $N = 114$ 5- to 7-year-olds and undergraduates) were told that one person *wants* and another person *likes* the same object (e.g., “Bobbie wants strawberries. Casey likes strawberries.”). Participants then predicted the characters’ behaviors (e.g., “Who is more likely to go get strawberries right now?”), happiness (e.g., “Who will feel happier eating strawberries right now?”), and sadness (e.g., “Who will feel sadder if there are no strawberries right now?”). Eight- to 10-year-olds and adults (but not 5- to 7-year-olds) judged desires (vs. preferences) to be a greater driver of emotions and behavior, with this inclination increasing with age.

P3-18 - Associations between parents' autonomy supportive management language and children's STEM talk during and after tinkering at home

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Details

Our work focuses on children's STEM learning through informal hands-on activities and parent-child interaction (Piaget, 1965; Vygotsky, 1970). We conducted a time series analysis of parents' autonomy supportive and directive language and parents' and children's STEM talk during and after a problem-solving activity (i.e., tinkering). Parents and children ($n = 61$ dyads, $M_{age} = 8.10$) were observed at home via Zoom. After tinkering, a researcher elicited children's reflections, and, approximately 2 weeks later, dyads reminisced together about the experience. During tinkering, the more autonomy supportive STEM talk parents used in one minute, the more children talked about STEM in the next minute, $\beta_{10} = 0.09$, $p < .001$. During reminiscing, parents' autonomy support was also associated to children's STEM talk, $B = 0.18$, $SE = 0.08$, $p = .03$. Results suggest the importance of considering both the content and style of parents' talk that can support children's STEM learning.

P3-19 - Development of children's social preferences based on political partisanship

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Details

The recent rise in political polarization calls for an increased understanding of how children view political identity as a social category. The current study examines whether children use political party labels or voting behavior to prefer people. Currently, 115 parent-child dyads (6- to 12-year-olds) have participated. Parents reported their political orientation (e.g., party preferences, voter history) and political socialization practices (e.g., frequency/content of political conversations). Children completed (1) an interview about their political partisanship ("Which political party would you vote for?", "If you were old enough, who would you have voted for?") and their parent's partisanship; and (2) social preference tasks where people were paired with party *labels* (Republican, Democrat, Independent), *voting* history (voted for Biden or Trump), or political *signs* for Biden or Trump. Children who self-identified a political party ($n=59$) or voting choice ($n=52$) preferred the person that matched their political choice (Label: $M=69\%$, $t(58)=6.82$, $p<.005$; Voting: $M=85\%$, $t(51)=11.59$, $p<.005$; Sign: $M=81\%$, $t(51)=8.98$, $p<.005$). Children also preferred people that matched their parent's voting history (Voting: $M=71\%$, $t(73)=5.71$, $p<.005$; Sign: $M=70\%$, $t(73)=5.85$, $p<.005$) but not political parties (Label: $M=38\%$, $t(83)=1.21$, $p=.23$). Our findings indicate that children use political labels to inform social preferences that may be precursors to political polarization.

P3-20 - The development of children's beliefs about God's causal relevance in everyday life

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Details

Religious adults often appeal to God's intervention in explaining important life events like illness recovery and accidents. Yet developmental research on God concepts is limited (Lane, 2021). We address children's concepts of God as causally relevant—as a being that intervenes in people's lives. 191 6-to 12-year-olds heard vignettes in which characters faced a challenge and were asked if God would intervene, and if so, how. There were 2 high-stakes (medical and environmental threat) domains and 2 low-stakes (achievement and social) domains. Intervention beliefs were strong across domains ($M=76\%$), but with age, children more often assigned God a causal role in high-stakes domains. Children more certain about God's existence were more likely to claim God would intervene. In their explanations, children engaged in coexistence reasoning (e.g., God "making stuff that cures diseases.. the COVID vaccine") and also offered insights into causal ordering (e.g., God "won't help her with the actual fire because that's just nature, but he will help her smell the fire"). Results have implications for knowledge about children's religious cognition and their causal theories.

P3-21 - They are more likely to get sick: examining how children from three community contexts reason about COVID-19 contraction risk across social groups

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Details

The COVID-19 pandemic disproportionately impacts minorities in the US. We recruited 318 children from three community contexts: (1) a predominantly white university town, (2) low-income Black and Latinx communities, and (3) rural, predominantly white communities. We asked children to judge whether age, race, or class affected getting sick, their confidence in their responses, and explanations. Results showed that children in each community reported that old (vs. young) adults were more likely to get very sick from COVID-19 ($ps<.001$), but that race did not affect likelihood of getting sick ($p<.001$). Of those who said older people were more likely and that race did not affect likelihood, 82% and 59% endorsed biological reasons, respectively. At least 47% of children from the university town and Black and Latinx communities (but not in rural towns) said that poor people were more likely to get sick than rich people ($ps<.006$), with 68.35% endorsing structural reasons. Of those in the rural communities who said poor people were more likely (55.66%, $p<.001$), 65% endorsed biological reasons. Older children reported that older people were more likely to get sick and that race or class did not affect likelihood more than younger children. Understanding how children from diverse contexts reason about the COVID-19 health risks associated with different social groups is valuable for assessing where children may benefit from comprehensive education on illness and group membership.

P3-22 - Does current ecological relevance attenuate the effects of chaotic home environments on children's inhibitory control performance?

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Details

Unpredictable home environments are associated with reduced inhibitory control (IC) in youth (Fields et al., 2021). IC requires monitoring for contextual signals and stopping an ongoing action (Chatham et al., 2012). Other cognitive control abilities, particularly working memory updating, are enhanced under more ecologically relevant conditions, especially for youth exposed to environmental adversity (Young et al., 2022). We integrated these findings to investigate whether children from chaotic home environments exhibited reduced IC and whether such differences were attenuated under more ecologically relevant conditions.

Forty 5–8-year-old children completed a Go/No-Go task (Durston et al., 2002). They were instructed to press a button in response to each image except the 'No-Go' image. Stimuli in the Abstract condition were geometric shapes and the No-Go stimulus was assigned, whereas stimuli in the Relevant condition reflected activities in children's everyday lives and children selected the No-Go stimulus. Home chaos was indexed using the CHAOS (Matheny et al., 1995).

The difference in IC between conditions was not significant, regardless of home chaos level. There were trending effects of age and income, consistent with prior research revealing youth from lower household income exhibiting less IC. Our results highlight potential differences among cognitive control processes in the effects of ecological relevance and their interaction with early life experiences.

P3-23 - Differential failure feedback: what parents say and what children infer

Uliana Solovieva ¹, Grace Huang ¹, Lin Bian ¹

¹ University of Chicago

Details

Young children associate brilliance with men (Bian et al., 2017), negatively implicated in girls' future aspirations. Despite the rich documentation of this stereotype, less is known about *how* children develop it. The present project focuses on parental feedback to girls' vs. boys' failure in intellectually-challenging contexts, and explores how children use failure feedback to make intelligence inferences. In Study 1 ($N = 203$), parental free responses to a hypothetical boy's or girl's failure in a brilliance context were coded as motivating vs. comforting (e.g., suggest other activities, focus on other strengths). We found that parents tended to use more comforting feedback in response to the failure of a girl in the brilliance-focused context compared to a boy, $\chi^2 = 4.05$, $p = 0.044$. In the next two studies, 5- to 10-year-old children ($N = 220$) watched videos in which some characters received motivating feedback and others received comforting feedback. With age, children inferred the characters who received comfort to be less smart than the characters who received motivating feedback ($p = .018$; Study 2). These

intelligence inferences extended to groups: children were less likely to attribute intelligence to groups that received comfort than groups that received motivating feedback ($p = .044$; Study 3). Overall, these findings suggest that failure feedback may be a crucial source contributing to children's endorsement of stereotypes about intelligence.

P3-24 - Infants exhibit enhanced learning after observing violations in the social domain

Joanna Zhou¹, Qiong Cao¹, Lisa Feigenson¹

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Details

Infants exhibit enhanced learning about objects that violate physical expectations (Stahl & Feigenson, 2015). But do violations of social expectations also affect infants' learning? Here, we addressed this question by measuring infants' learning following two different types of social expectations. In Experiment 1, 16-19 month-old infants ($N=32$) saw videos in which a person repeatedly reached for Object A over Object B. Then, on the critical trial, infants either saw the person again to reach for Object A (Expected Outcome), or switch to Object B (Unexpected Outcome). Infants then had the opportunity to learn about the person (what her voice sounded like and what language she spoke). We found that infants exhibited enhanced learning about the person following the Unexpected Outcome compared to the Expected Outcome. In Experiment 2, 16-19 month-old infants ($N=19$) saw a cartoon character repeatedly jump over a wall to reach a goal. Then, on the critical trial, the wall was removed and the character either went straight to the goal (Expected Outcome) or still jumped en route to the goal (Unexpected Outcome). Infants then had the opportunity to learn about the character's voice. Our preliminary results show that again, infants exhibited enhanced learning after the social violation. Together, these experiments suggest that expectancy violations shape early learning in the social domain as well as the physical one.

P3-25 - Examining differences in parent-child spatial language use through book reading and play

Ishaan Amrishi¹, Ariel Starr¹

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Details

Prior research has shown that variability in parents' spatial language input predicts children's spatial language production and children who produce more spatial language are more likely to perform well on spatial tasks. In this study, we examine factors that influence individual differences in spatial language use in two naturalistic parent-child interactions. Parent-child dyads ($n=75$, $M_{\text{child age}}=3.52$ years, range: 2-4 years) were first given a wordless picture book and parents were asked to tell a story to go with the pictures. Next, dyads were given blocks to play with for 5 minutes. Parents also completed a series of questionnaires on their beliefs about the utility of play and their child's language, motor, and communication skills. Video recordings from each task were transcribed and coded for types of play, gesture, and language used. Preliminary results from the book-reading interaction demonstrate wide

variability in language: parent spatial language use ranged from 94-236 tokens and child spatial language use ranged from 11-47 tokens. Spatial language use between parents and children was marginally correlated. We also coded for other word types, such as “wh” questions and number words. Additional analyses will examine relationships between parent and child language, gestures, block play, play beliefs, and demographic variables. Through these open-ended tasks, we can study differences in how families use spatial communication in everyday interactions.

P3-26 - Five-year-olds demonstrate adult-like priors about number

Miranda Long¹, Darko Odic¹

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Details

Perception has been described as a process akin to Bayesian inference, or a combination of the sensory input and our expectations (i.e., priors) for what should be. This project explored whether children ages 5- to 8-years-old and adults possess similar priors about number, an abstract form of perception. Specifically, we explored whether priors about the number of objects in the natural world stay the same across development or if these priors change like other priors (e.g., light-from-above). Both children and adults were asked to give their best estimates for the typical number of objects in a variety of scenarios (e.g., In a grocery store, how many bananas are in a bunch?). Overall, the results suggest that children as young as 5-years-old and adults have very similar number-related priors. This work extends Bayesian priors into the domain of number perception, offering insights into the characteristics and signatures of number perception.

P3-27 - Beyond words: revealing toddlers' understanding of mental states through expressions

Qianhui Ni¹, Bella Fascendini², Lisa Miao¹, Jiamin Cheng¹, Henrike Moll¹

¹ University of Southern California, ² Princeton University

Details

How do children react when they see Maxi opening the wrong cabinet and looking for his cherished chocolate? Past research on children's understanding of others' mental states has largely overlooked this affective dimension of epistemic states. The present study investigates children's understanding of others' mental states through their emotional responses. In Experiment 1, 60 three-year-olds observed a puppet show where an agent approached a container, unaware that its contents had been replaced (e.g., cookies with blocks). Children showed more suspenseful expressions in the Deceptive Condition (featuring a cookie box) than in the Transparent Condition (featuring a transparent box), indicating they anticipated the agent's surprise. This demonstrates an early, non-verbal understanding of mental states. Experiment 2 contrasted this with a verbal task, where children often failed to correctly judge the agent's false expectations about the container's contents. The study demonstrates that toddlers have an early but limited appreciation of others' mental states. This early understanding is better captured by expression-based methods than verbal ones. Children's non-verbal facial and bodily expressions offer a

more sensitive assessment of toddlers' understanding of the mind, capitalizing on children's affective involvement when witnessing others act based on false epistemic states.

P3-28 - Simulating infants' tradeoffs between caregiver proximity and exploration using reinforcement learning models

Xi Jia Zhou¹, Chris Doyle¹, Michael Frank¹, Nick Haber¹

¹ Stanford University

Details

Infants must balance interacting with a caregiver and exploring their environment, which involves trading off proximity-seeking with the caregiver and reward-seeking in the surroundings. Previous studies of infant exploration neglected attachment, but the traditional attachment literature is qualitative and lacks models for how infants' attachment styles are learned through experience. Here we consider both attachment and exploration as adaptive reward-seeking strategies given different rewards from both caregiver and environment, including negative rewards due to distressing environmental stimuli and caregiver punishments. We implemented a simple environment with three different types of caregivers (consistently rewarding, consistently punishing, and inconsistently rewarding), and used Reinforcement Learning (RL) to simulate an infant agent that learned to choose between staying with the caregiver and exploring. We were able to generate characteristic behaviors for secure and insecure-avoidant infants, but not the insecure-resistant infants. This study is a proof-of-concept that an environment with a reinforcement learning agent and simple caregiver agents can yield dynamics similar to the archetypal exploration behaviors associated with different attachment styles.

P3-29 - Schooling improves inhibitory control in 6-year-olds independent of age: a secondary data analysis

Jamie Donenfeld¹, Zsuzsa Kaldy², Tashauna Blankenship¹, Martha Ann Bell³

¹ University of Massachusetts Boston, ², ³ Virginia Tech

Details

Entering formal schooling represents a major environmental change for children around the world. The effect of this change – importantly, independent of age – can be measured by exploiting the fact that school entry is determined by an arbitrary cutoff date. We completed a secondary analysis of a data set that was collected as part of a large longitudinal study focusing on executive function development (Broomell & Bell, 2022) to test for the schooling effect. We investigated whether inhibition, working memory, and task switching (using the Stroop, Backward Digit Span, and Dimensional Card Sort tasks, respectively) are impacted by time spent in school for similarly-aged kindergarteners and first graders born close to the cutoff date (75 - 81.5 months, $N = 69$, from the Southeastern US). We found a significant difference between the log-transformed reaction time in the Stroop task: $t(53.97) = -3.83, p < 0.001$, with kindergarteners being slower to respond than similar-age first graders. The difference in the

DCCS or BDS scores was not significant, possibly due to the limited power of our sample. Our result supports the existence of a schooling effect in inhibitory control.

P3-30 - Black and White U.S. children's preferences for racially diverse versus homogeneous groups

Eren Fukuda¹, Natalie Sarmiento¹, Katharine Scott², Patricia Devine¹, Kristin Shutts¹

¹ University of Wisconsin - Madison, ² Wake Forest University

Details

Ample research has assessed young children's preferences for *individuals* based on their race. However, we know little about their preferences for *groups* that differ in racial composition—and we lack tools for measuring such preferences. This is unfortunate because children are often in the position of joining, and negotiating membership in, groups. Accordingly, we created a new measure probing children's preferences for racially homogeneous groups versus diverse groups, and presented it to 5–7-year-old Black and White U.S. children ($N=46$). We found that both Black and White children favored homogeneous groups composed of all racial in-group children ($p=.002$). These results stand in stark contrast to findings based on measures of children's preferences for individuals, where young Black children have exhibited no racial bias, or have favored White children. Our results suggest that different mechanisms underlie how race information guides children's preferences for individuals and groups. Further, our work highlights the importance of studying children's racial preferences using multiple measures; popular measures may fail to capture similarities and differences among minoritized versus majority children. A preregistered follow-up study will focus on replicating these results and probing sources of children's dispreference for racially diverse groups (e.g., concerns about discriminatory behavior).

P3-31 - Artificial intelligence enhances children's science learning from television shows by boosting their response to questions of high cognitive demand

Kunlei He¹, Ying Xu², Julian Levine¹, Daniel Ritchie¹, Andres Bustamante¹, Mark Warschauer¹

¹ University of California, Irvine, ² University of Michigan

Details

Children's learning from television shows can be amplified if they can meaningfully interact with media characters during their video watching. In this project, we partnered with PBS KIDS to develop interactive science-focused videos in which the main character, powered by artificial intelligence, engaged in conversation with children by asking them questions and providing responsive feedback. We studied the impact on children's learning of watching these interactive videos as compared to watching pseudo-interactive videos, in which the media character asks children the same questions and gives generic feedback after a fixed amount of time. The children who watched the interactive videos performed better on a science post-test than did children who watched the pseudo-interactive version. Most interestingly, through structural equation modeling, we have demonstrated that children's increased inclination to actively respond to questions of high cognitive demand – those prompting

prediction, inference, and explanation – mediated this effect. Over the course of an episode, the AI character's responsiveness steadily increased children's verbal engagement, in contrast to steadily diminishing participation observed in the pseudo-interactive condition. This paper sheds light on the feasibility, effectiveness, and mechanism of using conversational technologies to support children's active learning from video watching.

P3-32 - Acquiring word knowledge from low informative input

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Details

When children hear words, the meanings of those words are rarely transparent from the surrounding observational context. Understanding how children learn in a world that consists of largely “low informative” (LI) input is central to current debates in the field (Medina et al., 2011; Smith & Yu, 2008). The current study asks whether the LI input problem depends largely on how and what aspects of learning are assessed. Using adults as model word learners, Experiment 1 deployed an artificial word-learning paradigm with real-world LI naming events. Results revealed that although participants failed in some learning tasks (e.g., word identification task), they succeeded in others (e.g., category learning task). In an ongoing Experiment 2, we are assessing the semantic networks that emerged from exposure to LI naming events. Specifically, we are examining whether LI events create meaningful semantic networks, even when they fail to yield accurate word-referent mappings.

P3-33 - Emotion expectations following positive and negative outcomes

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Details

Infants expect friends to rejoice in each other's goal-directed success. However, they expect neither happiness nor sadness from an observer following a friend's failure (Smith-Flores et. al, 2023). Here we investigated infants' expectations about affiliation-based empathy in scenarios with a different type of value, in which an observer sees a friend experience or be spared from harm. Forty-eight 10- to 11-month-old infants ($M_{age}=10.77$ months, $SD_{age}=0.56$, 24 girls) saw events in which one character was knocked over by a boulder in one block and a second character avoided being knocked over in another. During test trials, an observer, who was positively affiliated with the character, emoted positively or negatively in response to the character's outcome. Infants looked longer at the negative response compared to the positive response in the safe block, $F(1,44)=8.632$, $p=.005$, but not the harm block, $F(1,44)=0.53$, $p=.468$ (Fig1). However, infants' looking to the response types did not reliably differ across the blocks, $F(1,44)=1.643$, $p=.207$. These results indicate that infants expect happiness to follow an affiliate's safety but, as in the previous work, infants did not display clear expectations for how observers react to others' negative outcomes. One explanation for this series of findings could be that

parents try to attenuate negative feelings about failure in early infancy, potentially resulting in mixed expectations of emotions following negative outcomes.

P3-34 - Process or outcome ? Children's understanding of the value of effort

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Details

The value of effort lies not only in the outcome it can bring about but also in the process itself. Do children understand the value of effort in terms of both process and outcome? This study explores this question among children aged 5-10 in China.

We presented 5- to 10-year-olds ($N=93$) with four characters, each working diligently to prepare for an exam. The four characters differ in terms of the processes (enjoying or disliking the process of effort) and outcomes (achieving good grades or not) linked to their effort. We measured children's predictions of each character's motivation to persist.

We found that both the process and outcome of effort play crucial roles in children's predictions ($ps < .001$). Critically, children across ages seem to value the process of effort more than the outcome when predicting the characters' persistence: They predicted that the character enjoying the process and achieving good grades would be most likely to persist, followed by the character enjoying the process but not achieving good grades, and then the character achieving good grades but disliking the process, with the character disliking the process and achieving bad grades least likely to persist (pairwise comparisons, $ps < .001$, see Figure 1).

These findings suggest that children aged 5-10 perceive enjoying the process of working hard as more encouraging and valuable than achieving positive outcomes, emphasizing the importance of fostering a mindset that appreciates the process of effort.

P3-35 - Thinking caps & tin foil hats: children's intellectual humility and conspiracy beliefs

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Details

Research has demonstrated that belief in conspiracy theories can have harmful consequences (Jolley, 2013), but little is known about when these beliefs emerge in childhood and the dispositions that lead to conspiracy rejection or acceptance. For example, Intellectual Humility (IH), the ability to recognize the fallibility of one's own knowledge, is positively related to open-mindedness and critical thinking, which are negatively related to conspiracy endorsement (Porter & Schuman, 2017; Pärnamets et al., 2022). Using work on IH (Krumrei-Mancuso & Rouse, 2017; Danovitch et al., 2019) and adult conspiracies

(Brotherton, 2013), we developed novel behavioral tasks for 6- to 10-year-olds to investigate IH and the developmental origins of children's conspiracy beliefs (CCBs). Children (N = 80) answered questions about 4 components of IH: knowledge assessment, confidence, respect for others' viewpoints, and willingness to revise beliefs, and gave endorsement and confidence ratings for 12 conspiracy vignettes. Results showed a negative relationship between conspiracy theory endorsement and children's confidence but no relationship between overall IH and CCB endorsement. Future studies can refine this methodology to continue investigating variables that may explain how children become adults who believe in harmful conspiracy theories.

P3-37 - Children use causal knowledge to identify better questions during information search

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Details

Gathering information via question asking is an essential and effective tool for learning. However, it also requires learners to select from a near infinite space of possible queries. Here, we investigate a potentially powerful guide for question asking in young learners: the relationship between cause and effect. Children (5- and 7-year-olds) read a storybook about an event with an unknown cause and made several choices between two questions to ask about possible candidate causes. Both questions revealed similar information, but only one had the potential to determine whether a candidate was capable of causing the event described. Participants overwhelmingly selected causally relevant over irrelevant questions, with strong performance in both age groups, for all types of information, and across stories with different surface-level content. These results suggest that young learners are able to employ their prior knowledge of the causal connections between events to identify relevant queries during information search.

P3-38 - Children's motivational beliefs in math, verbal, and spatial domains: relations to gender, grade level, and achievement

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Details

Academic success relies heavily on motivation, including self-concept of ability (SCA) and intrinsic motivation. Past studies show that boys often exhibit greater math SCA and intrinsic motivation than girls, despite similar math achievement levels, whereas girls tend to have stronger verbal SCA, intrinsic motivation, and achievement than boys. However, existing research has primarily focused on adolescents and adults, with minimal exploration of motivation in spatial skills.

This study addresses limitations by examining gender and grade-level differences in SCA and intrinsic motivation across math, verbal, and spatial domains, exploring the impact of achievement on

motivation. A diverse sample of 382 children from kindergarten to 4th grade completed age-appropriate measures of math, verbal, and spatial achievement at T1. Five months later (T2), children completed measures of SCA and intrinsic motivation in the three domains.

We found girls showing stronger verbal SCA and intrinsic motivation than boys, while math and spatial SCA and intrinsic motivation were similar. Boys' math motivation tended to increase with grade level, whereas girls' math motivation tended to decrease. Additionally, T1 verbal achievement positively predicted T2 verbal SCA across grade levels. These findings shed light on the early emergence of gender disparities in math and verbal motivation and emphasize the pivotal role of early achievement in shaping children's verbal SCA.

P3-39 - Representation in positions of power: children's creation of (in)equality in complex social hierarchies

Nicholaus Noles¹, Megan Norris²

¹ University of Louisville, ² Purdue University

Details

Research shows that children value equality in resource distribution (Shaw & Olson, 2012) and exhibit ingroup favoritism in some circumstances (Renno & Shutts, 2015). We asked children to make status hierarchies to see if their hierarchies would be fair or privilege some identities. We presented 80 primarily White 4- to 9-year-olds (41 boys and 39 girls) with a pegboard and asked them to create a three-tiered workplace hierarchy using faces that varied by gender (White Women and Men) or race (Black and White Men). Boys ($M=.85$; $>$ chance) selected more men to be at the top of the hierarchy compared to girls ($M=.15$; $<$ chance) in the Gender Condition, $p<.05$, but boys and girls selected White men and Black men equally to be at the top in the Race Condition. When making selections for the middle tier, boys ($M=.46$; chance) selected more men compared to girls ($M=.33$; $<$ chance) in the Gender Condition, $p<.05$, but selected the same number of White men and Black men. Children displayed an ingroup preference in positions of power for gendered hierarchies and a desire to create diverse racial hierarchies. These results suggest that children value equality when making race-based hierarchies. However, when constructing gender-based hierarchies, boys created hierarchies that privilege men only at the top, while girls, perhaps responding to real-life inequalities, gave more power to women.

P3-40 - From the mouths of babes: relations between children's verbal fluency and emotional functioning

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Details

Emotion fluency is the ability to quickly call emotion words to mind. Previous work has examined relations between emotion fluency, verbal fluency, and emotional experience among adults (e.g., Hegefeld et al., 2023), but not yet with children. For this project, 47 children between the ages of 7 and 12 ($M = 10.6$ years, 24 girls and 23 boys) and one of their parents (mean age = 40.16 years, 42 moms and 5 dads) visited the lab as part of a larger study. In addition to completing surveys regarding emotional experiences, they separately participated in 4 rounds of a verbal fluency task in which they were asked to produce as many words fitting a certain criterion (English words, animals, "A" words, emotion words) as possible within 1 minute. In line with previous work, emotion word fluency was positively related to general verbal fluency for both parents and children ($r_s > .39, p_s < .006$) but not related to aspects of emotional experience. Interestingly, the number of animal words children produced was negatively related to parent-reported child emotional lability ($r = -.29, p = .049$) and the number of "A" words children produced was negatively related to children's self-reported trait anxiety ($r = -.31, p = .03$). Results align with patterns found in the adult literature and indicate that while children's non-emotional verbal fluency is related to aspects of emotional functioning, emotion word fluency, more specifically, is not.

P3-41 - Black and white children's responses to unequal social hierarchies and reasoning for upward social mobility

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Details

Children are aware of discrimination against women and Black people in positions of power (Bigler et al., 2008) and will rectify structural inequalities (Rizzo et al., 2018). In this study, 62 White (31 boys and 31 girls) and 63 Black children (27 boys and 36 girls), were shown hierarchies where White men were overrepresented as bosses compared to Black men (Race Condition) and White women (Gender Condition). Children made two boss selections allowing the hierarchy to become equal. After making selections, children were presented with examples of a boss promoting another White man, a woman, or Black man and asked to explain why the boss made each promotion. Younger children ($M = .82$) promoted more White men than older children ($M = .65; p < .05$). Additionally, girls ($M = .39$) promoted less men than boys did ($M = .9$) and girls promoted men less in the Gender Condition than they promoted White men in the Race Condition ($M = .64; p < .001$). Lastly, Black children ($M = .60$) promoted less White men in the Race Condition than White children ($M = .82$) did, $p < .05$. When asked why White men were promoted, children attributed promotion to merit or ingroup bias (~60% of responses). Women or Black men's upward mobility was attributed to merit or fairness (~68% of responses). Together these findings

suggest that children's age, gender, and racial identity influenced their views on the fairness of social hierarchies and why people with certain identities are powerful.

P3-42 - Children's developing capacity to use visual processing time to infer hidden objects

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Details

Representing the relationship between seeing and knowing is critical to social reasoning and, accordingly, even infants understand the connection between visual access and knowledge. In real-world situations, however, the relationship is not as simple: more complex scenes take longer to encode. Here we explored children's understanding of this relationship. In each trial, children were introduced to two sets of objects, each placed inside an opaque box. Critically, children did not know which box had which set. An ignorant agent then peeked into one box for 1.5s and another ignorant agent peeked into the other box for 5s (order and looking time counterbalanced). Children were then asked to infer which box contained which objects. We predicted that children would match the more complex object with the box that the agent looked longer.

46 5- to 6-year-olds (mean=6.2) completed three trials shown in panel a. Overall, children performed above chance in the `one vs. many` trial (66%; $p < .05$), but not in the `simple vs. complex` trial (48%; $p = .68$) or the `same vs. variable` trial (53%; $p = .43$). We tested for developmental change through a binomial mixed-effects model predicting accuracy as a function of age (with maximal random effects structure for participant and trial type). Children significantly improved with age ($\beta = 1.25$, $p < .05$), suggesting that the nuanced understanding between seeing and knowing may reach maturity around the age of six.

P3-43 - Quality of spatial language in YouTube videos watched by 3-to-5-year-olds: associations with caregiver education

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Details

Spatial language describes how a scene or object relates to its location in space (e.g., *the large triangle is on top of the smaller square*) and is correlated with spatial skill development, which in turn is associated with later STEM achievement. Given that many children access online video content, we ask here whether educational YouTube videos watched by young children include a high prevalence of spatial language and if so, are they watched by children with more-highly educated parents?

An online survey was distributed to parents in the U.S. (N=232) asking them to submit the links of the three most recent YouTube videos their child watched. Videos were coded for educational content and prevalence of spatial language.

We found that only 5% of the language in these educational videos was spatial. Moreover, primary caregiver's education was correlated with the proportion of spatial language present in the child's videos ($r=.28$, $p=.035$). These results indicate that children from advantaged backgrounds gain more opportunities to experience spatial language early in development.

P3-44 - Gender differences in engagement in academic gender-stereotyped tasks under competition

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Details

The well documented gender gap in STEM careers reveals a notable underrepresentation of women compared to men. Despite research into early childhood gender differences in STEM attitudes, the specific factors contributing to women's lower participation in these fields remain unclear. In this study, we investigate how gender differences in math engagement may arise from gender differences in response to competition. Two hundred and one 6- through 10-year-olds were placed in a competitive or non-competitive context and then given the choice to engage in either a math or reading activity to obtain a reward. After completing the selected activity, children were asked a series of questions to evaluate their attitudes towards and explicit gender stereotypes about math, reading, and competition. Children with higher math anxiety were less likely to choose to play the math activity, except for girls in the competitive condition for whom there was no relationship between anxiety and activity choice. We additionally found that boys most often selected the activity they self-identified with in both contexts, whereas girls in the competitive context self-identified less with their chosen activity than girls in the non-competitive context. These findings highlight the impact of social context on children's willingness to engage in math and provide insight into potential factors contributing to the gender gap in STEM.

P3-45 - Children's judgements of contextual racial presentation

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Details

We explored children's (Ntotal = 300, 6-13 years old) judgements of biracial people who engage in contextual racial presentation, defined as changing one's racial identity across contexts. We hypothesized that children would be less accepting of biracial people who contextually present compared to those who maintain a biracial identity. Participants heard a story in which a biracial student, whose teacher prefers either White or Black students, is given an assignment to write about

their identity. The student then maintained their biracial identity (fixed presentation) or contextually identified (identify only with the teacher's preferred race). Participants reported whether the student's identity choice is "OK" or "not OK" and rated the student's trustworthiness. Results revealed an interaction between participant age and condition: as children get older, they are less likely to say that contextual presentation is "OK" and are less likely to rate the student who contextually presents as trustworthy. Given that biracial people frequently engage in contextual racial presentation, it is important to understand if they are judged negatively for this behavior and when these judgements begin to develop as it could have consequences for intergroup relations.

P3-46 - Are toddlers intrinsically motivated to explore their own competence?

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Details

From a young age, children are keen explorers of the outside world: They systematically explore surprising findings and test hypotheses during play. However, less is known about whether toddlers are similarly driven to explore and learn about the self. The present study adapts classic exploratory play paradigms to ask whether toddlers are intrinsically motivated to explore their own competence. In an ongoing experiment, 2-year-old toddlers (N = 9) play Montessori practical life games along with their parents; these toys were verified to be developmentally appropriate and equally appealing to toddlers in an independent norming experiment (N = 14 2-year-olds). Toys are presented in pairs. Within each pair, parents guide the toddler's hands while playing with one toy, which provides *ambiguous* information about the toddler's competence, and take turns playing the other toy independently, which provides *unambiguous* information. At the end of each pair, toddlers are asked to choose one toy to play with independently. To our surprise, preliminary results show that toddlers chose the *unambiguous* toy in 67% of trials (N = 24 trials) to further explore on their own. These initial findings, while intriguing, are preliminary and require further analysis upon data collection from a full sample size of N = 48 toddlers.

P3-47 - Is it worth it? Understanding children's value-based learning strategies during early and middle childhood

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Details

Value-based selectivity involves prioritizing learning high-value information over less valuable information (Castel, 2008). Value-based selectivity is critical for appropriately prioritizing the vast amount of information children are constantly learning (Knowlton & Castel, 2022). However, research on children's value-based selectivity remains limited with little understanding of how it improves across early and middle-childhood and what factors may support its development (Castel et al., 2011; Lipowski et al., 2014). Our research examined developmental differences in value-based memory selectivity in 6

to 7-year-olds and 9 to 10-year-olds (Exp 1, N=77) and the role of active study in this process (Exp 2, N=72). Results revealed 6 to 10-year-olds were similarly proficient in recalling greater high compared to low value items and this difference was independent of developmental improvements in overall accuracy (Exp 1). Both age groups were also similarly and highly effective at actively selecting high versus low value items to learn (Exp 2). Furthermore, children's metacognitive judgements were sensitive to value and correlated with value-based selectivity. However, older children were somewhat better at translating their study choices into more effective recall of high value items. These results suggest that during conditions with clear value differences (1 vs. 10-point items) even young children are highly effective at engaging in value-based memory selectivity.

P3-48 - What is that? Iconicity of images in picture books.

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Details

Parents are encouraged to read to their children, but little is known about the content in children's books at the earliest ages, to children ages 5 and below. Children have an easier time generalizing the images in books to the real world when the pictures are highly iconic (Ganea et al. 2008). In the current study, we investigate the amount of iconicity in the most checked out books in several Indiana counties.

Based on circulation data from 2023, from multiple Indiana libraries, the top 100 picture books from each library will be analyzed. To date, data from two libraries, a rural and urban county, have been coded (n=200). Books were coded as simple lines, basic drawings, detailed drawings, photographs, or mixed, based on Wagner (2017). We are in the process of getting the circulation data from the remaining libraries and will have data from those books coded and analyzed by CDS.

We found that the majority of books in the sample to date included basic drawings (urban n=64, rural n=53), followed by detailed drawings (urban n=35, rural n=39), with few books having simple lines (rural n=1), mixed use of images (urban n=1, rural n=3), and photographs (rural n=4). Thus, children are not being exposed to many picture books with the highest levels of iconicity, but are exposed to a good number of books that make use of some iconicity in the detailed drawing books.

P3-49 - Impossible and improbable events in U.S. and Chinese children's picture books

Adine Deleon¹, Jenny Nissel¹, Jiaying Xu², Yao Lu², Jacqueline Woolley³, Jennifer Clegg⁴

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Details

Children's developing understanding of possibility may be shaped by their exposure to different kinds of events in real life (e.g., Goulding & Friedman, 2021) and in media (e.g., Gong & Shtulman, 2021). Possibility conceptions may differ between the U.S. and Chinese children (Nissel et al., 2023); is this difference reflected in the content of stories that children are exposed to? To investigate children's exposure to impossible and improbable events in fiction, we coded the frequency of impossible (i.e., violating causal laws) and improbable (i.e., statistically unlikely events) in bestselling and award-winning picture books from China and the U.S. from 2012 - 2019, ($n = 73$ Chinese books, $n = 70$ U.S. books). We found that impossible events were more likely to occur in U.S. (56%) picture books than in Chinese picture books (43%), $B = 0.809$, $p = 0.03$, $OR = 1.23$. We did not find differences in the likelihood of improbable events. We will reflect on how depiction of improbable and impossible events in fiction may impact developing possibility conceptions in the U.S. and China.

P3-50 - Past, present and future: children's perceptions of the stability of beliefs in scientific and religious entities

Grace Mccrann¹, Adine Deleon¹, Ayse Payir¹, Jennifer Clegg², Paul Harris³, Kathleen Corriveau¹

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Details

Children are more confident about the existence of invisible scientific phenomena (e.g., germs, oxygen) than invisible religious phenomena (e.g., God, Heaven) (Harris & Corriveau, 2020). But do children think that this difference in confidence has always existed and always will exist? One-hundred twenty-three 5- to 11-year-old US children judged if various religious and scientific entities: (1) are 'real' (*present* judgments), (2) would have been judged 'real' in the past (*past* judgments), and (3) would be judged 'real' in the future (*future* judgments). Children were more confident about the existence of scientific as compared to religious entities, $B = 4.18$, expected people in the future to hold similar pattern of beliefs, $B = 1.63$, but thought that people in the past held a reverse pattern of beliefs, $B = -1.02$, all $ps < .001$ (Figure 1). Children are aware of potential shifts in community consensus across time.

P3-51 - Parents' language about challenges during a wordless storybook task and its relation to children's strategic persistence

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Details

Parent language (e.g., praise) can boost children's persistence. However, we know little about how parents spontaneously discuss *both* costs and benefits of persistence, which may support how children learn to rationally allocate effort (persisting only when rewards outweigh cost). We examined the content and frequency of parent language about persistence and effort, including positive messaging (highlighting rewards or goals of effort, emphasizing persistence and praise) *and* cost-relevant messaging (highlighting setbacks, obstacles, and failure). U.S. parent-child dyads (3-6 years, N=50; coding ongoing) read a wordless book depicting an agent repeatedly attempting to find treasure. Parent speech was coded into categories: costs, rewards/goals, and praise/persistence (Fig. 1). Despite the story involving many challenges, there were more utterances highlighting rewards/goals ($M=9.56\%$, $SD=4.58$) than costs/difficulty ($M=2.78\%$, $SD=2.83$, $t=-11.47$, $p<.01$), or praise/persistence ($M=2.22\%$, $SD=2.36$, $t=-11.7$, $p<.01$). However, there was substantial variation in the proportion of language in each category—rewards/ goals ranged from 0-19.7%; persistence/ praise 0-9.76%; costs 0-9.76%. The poster will use the full sample (N=138 in the U.S., N=88 in Turkey) to examine whether these variations in parents' language predict children's strategic persistence, and test whether language highlighting *both* costs and benefits of sustained effort supports children's strategic persistence.

P3-52 - Children's self-perception of ethnic-racial identity (ERI) and identification of ERI in anthropomorphic characters

Sofia Aparicio¹, Fashina Alade¹, Anissa Eddie¹, Rachel Hahn¹

¹ Michigan State University

Details

Television is a powerful socialization agent (Berry, 2008), and there have been recent efforts to include positive cultural depictions in children's television, yet little is known about television's role in young children's racial-ethnic socialization. This study focuses on children's self-perceptions of their ethnic-racial identity (ERI) (Byrd, 2012; Umaña-Taylor et al., 2014; Williams et al., 2020) and their perceptions of anthropomorphic characters' ERI. Using a semi-structured interview protocol, children ages 4-6 (N=22 $M_{age}=4.67$) completed an identity selection card sorting task ("Me/Not Me," Rogers & Meltzoff, 2017), colored a self-portrait, watched two episodes of an educational television show designed to teach computational thinking using culturally inclusive anthropomorphic characters, and were then asked to draw what the main characters would look like if they were human.

Children's drawings were analyzed using content analysis that takes into consideration the set of coding characteristics developed by (Lutz, 1993; Rose, 2022). Findings reveal that children in this age group, for

the most part, do not have a clear perception of their ERI nor do they perceive the nuances that are meant to establish the ERI of animated anthropomorphic characters.

Findings highlight the challenge of creating anthropomorphic characters that resonate with children and positively contribute to their ERI.

P3-53 - Does parental code-switching impact bilingual toddlers' word learning?

Stephanie Castro ¹, Isabelle Costello ¹, Claudia Wimsatt ¹, Virginia Chen ¹, Maria Arredondo ¹

¹ University of Texas at Austin

Details

Code-switching (i.e., alternating between two languages during speech) is a common bilingual experience. The present study investigates whether parental code-switching behaviors impact young bilingual children's ability to learn new words. Based on Byers-Heinlein et al. (2022), we hypothesized that exposure to code-switching is associated with lower performance in a word learning task. Using a disambiguation paradigm in English and Spanish, we measured English-Spanish bilingual toddlers (N=25, 27–36-month-olds) retention of a novel word for each language (two novel words in total). Parents reported their frequency of code-switching behaviors using the Language Mixing Scale by Byers-Heinlein (2013). Preliminary analyses (n=18) revealed that parental code-switching behavior is not indicative of children's word learning abilities in either language; however, children with less exposure to code-switching behaviors show a trend for better word retention. A subset of looking behavior data (n=7) is currently undergoing manual coding and will be included in the final analysis.

P3-54 - My tablet's about to go dead! 6-year-old children adjust their cognitive strategies depending on whether an external source is reliably available

Yibiao Liang ¹, Zsuzsa Kaldy ², Erik Blaser ²

¹ University of Massachusetts Boston, ²

Details

There are concerns that excessive reliance on external memory (e.g., information on digital devices) can be harmful to our internal memory. We rely on external sources if they are easily *accessible*, *reliably available*, and *trustworthy* (Clark & Chalmers, 1998). The current preregistered study investigated whether young children are sensitive to the reliability of an external source and whether they will flexibly adjust their strategies to reduce the cognitive effort of remembering.

In our tablet-based 'Shopping Game', children picked items from a store that were on the shopping list. Importantly, the store and the list were not visible simultaneously, but children could toggle between them. In the *reliable* condition, children had unlimited chances to refer back to the list. In the *unreliable* condition, children were told that they would only have 1-2 chances before it became unavailable. We predicted that children would spend more time memorizing list items, and make fewer trips back to the list, in the *unreliable* condition.

37 children (16 girls, $M=5.98$ years) were in the final sample. We found that children spent a longer time on the list ($\chi^2 = 23.94, p < 0.001$) and made significantly fewer trips to the list ($\chi^2 = 7.31, p = 0.007$) in the *unreliable* condition. In short, children were sensitive to the reduction in the reliability of the external source and adjusted by relying more on their internal memory.

P3-55 - The development of beliefs about the controllability of positive and negative emotions, thoughts, and behaviors

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Details

Intuitions about the extent to which we can control our emotions, thoughts, and behaviors are an important yet understudied aspect of our theory of mind. The current studies explored the development of these intuitions from preschool through adulthood. Adults, 18-year-olds, middle-schoolers, elementary schoolers, and preschoolers ($n = 24$ per age group) read vignettes describing characters experiencing both positive and negative emotions, thoughts, and behaviors. After each vignette, participants' beliefs about the controllability of the target responses were assessed by asking whether each response was intentional (e.g. Was Ben trying to feel this way?) and changeable (e.g., Could Ben change the way he's feeling?). Results showed that participants differentiated their controllability beliefs by valence and response type. Negative responses were viewed as less controllable than positive ones. Moreover, emotions were viewed as less controllable than thoughts, and thoughts as less controllable than behavior. These patterns were clear by elementary to middle school; however, even preschoolers showed some differentiation in responses based on valence and response type. Finally, with age children showed decreasing endorsement of the ability to change negative emotions. Together, these findings suggest that intuitions about the extent to which we can control our emotions, thoughts, and behaviors take form in preschool and continue to mature and differentiate throughout childhood.

P3-56 - Servals are like cats but with longer legs: parental use of comparison in conversations with their toddlers about categories

Wenyan Feng¹, Amanda Brandone¹

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Details

Parent-child conversation is likely a rich source of information for children's category learning. However, little is known about the ways in which parents convey category information to their children. In the current study, we tested the hypothesis that parents use comparison as a communicative tool to facilitate category learning. Parent-toddler dyads ($n = 51$) were invited to discuss pairs of animals in a customized picture book. Parents' use of comparison was coded and analyzed. Results showed that parents regularly used comparisons when talking about animal categories with their toddlers (in 14% of

parents' on-task utterances). In addition, consistent with the notion that comparison helps children draw connections between known and unknown information, parents were more likely to use comparison when talking about familiar-unfamiliar stimulus pairs (e.g., dog, tarsier) than when talking about familiar-familiar stimulus pairs (e.g., bear, bird). Finally, consistent with evidence that similarity can promote the process of comparison, parents used more comparisons when the items in the stimulus pairs were highly similar (e.g., leopard, tiger) than they were less similar (e.g., turtle, rabbit). Together, these results shed light on how parents use comparison as a communicative tool and help set the stage for future research exploring the impact of parents' comparison use on children's developing category knowledge.

P3-57 - From dinosaurs who eat classmates to ghosts who need friends: an analysis of fantasy presented in children's picture books

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Details

The current study conducted a content analysis of the fantasy-oriented information presented in children's picture books to examine how they contribute to young children's emerging perceptions of fantasy. 100 picture books were randomly selected from best seller lists and analyzed using an open and closed coding method to examine topics raised in past research on children's understanding of fantasy. 89 books included fantasy, either in the images, plot, and/or text, with most being anthropomorphic animals ($M = .87$) or impossible events (e.g., child on moon; $M = .56$). Books used various techniques to blend fantasy- and reality-oriented information, including mixing characters of different reality statuses, or telling a reality-oriented story with fantasy-oriented characters. Finally, the study explored broadly the use of fantasy in learning contexts by comparing the inclusion of fantasy in books by genre: concept books ($n = 46$) designed to explain a topic versus storybooks ($n = 54$) designed to tell a story. Concept books included less fantasy ($M = .24$) overall than did storybooks ($M = .38$), but the reduction was in the plot, and not the images nor text. Therefore, concept books often described real-world topics such as love and inclusion, but used fantasy in the images as embellishment (e.g., children soaring in sky.) Findings have implication for how children's understanding of fantasy develops.

P3-58 - Infants' neural processing of others' actions based on language group

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Details

Social preferences based on language groups emerge in infancy, with infants displaying a preference for looking at and imitating individuals who speak their native language compared to people who speak an unfamiliar language (Lieberman et al., 2017). However, the underlying neural mechanism of these preferences remains unclear. The current study examined infants' neural processing of others' grasping actions based on language group by focusing on three neural indicators: event-related synchronization (ERS) of frontal theta (indicating top-down attention), event-related desynchronization (ERD) of central mu (indicating action processing and mirroring), and right frontal alpha asymmetry (FAA, indicating approach-withdrawal motivation). Thirty-five 8- to 12-month-old English-hearing infants (minimum 80% English exposure) participated. EEG recorded infants' brain responses as they observed an English speaker or a French speaker grasp an object. Although frontal theta ERS did not differ between two speakers, greater mu ERD (i.e., greater action processing and mirroring) and reduced right-frontal activation (i.e., less withdrawal and more approach motivation) were found when infants observed the actions of the English (vs. French) speaker. The differentiation found in mu ERD and FAA by language increased with age. Our findings indicate that, starting in the first year of life, what language a person speaks may modulate how the person's actions are processed in the infant brain.

P3-59 - NIH baby toolbox numeracy and early math domain

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Richard Gershon¹**

¹ Northwestern University, ² University of Denver

Details

The NIH Infant and Toddler Toolbox (Baby Toolbox) introduces novel standardized assessments of infants aged 1-42 months, administered on an iPad tablet using automatic coding and scoring. This abstract focuses on the Numeracy/Early Mathematics domain. The Verbal Counting (VC), Object Counting (OC), Spatial Change Detection (SCD), Who Has More (WHM), Subitizing (SUB), Numerical Change Detection (NCD), and Verbal Arithmetic (VA) tasks were selected by a team of domain experts, an expert survey (n=567), and a scoping review. These tasks capture counting/cardinality, shapes/spatial relations, approximate number system/number recognition, and addition/subtraction. These tasks used automated eye-tracking gaze detection for the youngest children and touch at older ages. Measures were normed and validated in a sample of 2550 infants (representative of the US across 12 sites and in both English and Spanish). Our analyses focus on a subset of infants that completed select touch tasks in English (VC/OC n=383, WHM n=221, SUB n=318, VA n=163). Scores generated from preliminary item response theory models correlated with age ($r_s=.2-.54$). Ongoing analyses include generating and confirming models with the full dataset, analyzing the Spanish-speaking sample, assessing test-retest reliability, and assessing validity against other gold-standard measurements (ASQ, Bayley-4). After re-

weighting the final sample to the 2022 American Community Survey, age-adjusted norms will be established.

P3-60 - The origins of the mental timeline

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Details

Humans frequently represent time using a mental timeline (MTL), a linear model of time. However, we do not know to what extent the MTL might be a product of our biology versus a cultural invention.

This work examines whether 6-month-old infants map temporal order to an MTL. Infants were habituated to a triplet of images presented sequentially from left-to-right or nonlinearly across the screen. At test, infants saw the same triplet of objects presented centrally with an order that was congruent or incongruent with the habituated triplet. If infants spontaneously represent temporal order using an MTL, they should learn the sequence more efficiently when presented from left-to-right relative to nonlinearly.

In Exp. 1 (N=41, data collected in France), infants were tested with sequences of puppet faces. The predicted interaction between habituation condition and test trial type was not significant. In Exp. 2, we tested if using simpler stimuli would improve learning. Preliminary data from the U.S. (N=17, data collection is ongoing in both countries) suggests that the predicted interaction between habituation condition and test trial type is again not significant. These preliminary results suggest that infants may not spontaneously represent temporal order using an MTL and thus do not benefit from a left-to-right spatial presentation when learning a temporal sequence. The MTL may therefore be a product of cultural experiences and emerge only later in development.

P3-61 - Consonant and word development after early cochlear implantation

Mary Fagan¹, Daniela Carvalho², Katia Shank¹, Michele Ota¹, Kylie Davis¹

¹ Chapman University, ² Rady Children's Hospital San Diego

Details

Infants with profound hearing loss show delays in consonant development and word use even after receiving cochlear implants (CIs) at 12 months of age. However, additional research is necessary with infants who receive CIs earlier in the first year. The purpose of this study was to investigate consonant and word production in 16-month-old infants who had received CIs by 9 months of age. Two groups of ten infants participated in the study with their mothers: infants with profound hearing loss; and age-matched hearing infants. All dyads were video-recorded in their homes during free play. Mothers also completed a standardized checklist of word production during the home visit and again 6 months later. Results indicated that infants with CIs produced fewer consonants and fewer words than age-matched

hearing infants at the time of the home visit, and fewer words 6 months later. The results will be discussed in relation to age at implantation, months of hearing experience, and the relative size of delays in comparison to cochlear implantation at 12 months and later.

P3-62 - Joint attention cues for social encoding in infants with a familial history of autism

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Details

Joint attention (JA) is the triadic interaction between two social partners and an object of interest. In studies with typically developing infants, JA improves infant encoding of the target object (e.g. Thiele et al., 2021). Reduced engagement in JA is a stable marker of Autism Spectrum Disorder (ASD) (Charman, 2003), but it is unknown if ASD is also associated with changes in the impact of JA on infant learning. Here, we tested infant object encoding in the presence or absence of JA, collecting data from a population of 9-12-month-old infants (current N = 25, target N = 75) with increased likelihood of ASD diagnosis due to family history. In each trial, participants saw an object and one or two person(s) on screen. The person(s) always looks at the object, sometimes also producing JA cues toward the participant or toward one another and sometimes not engaging in JA. In a test phase, participants then saw the target object paired on screen with a novel object; we calculated the proportion of time participants looked to the familiar vs. novel object in each test phase as a measure of encoding. In contrast to prior work, there was no significant main effect of JA on encoding scores ($F(1, 308) = 0.91, p = 0.34$). We also did not observe a significant interaction between the presence of JA and JA type (direct vs. observed; $F(1, 308) = 0.01, p = 0.92$). The full sample will be compared to data from an infant population without an ASD family history (N = 75, already collected).

P3-63 - Properties of child-directed talk during parent-toddler play with familiar and unfamiliar objects

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Details

Young children learn the names of objects from interactions with their parents, through everyday activities such as play. Although studies have documented that children rapidly learn to link a novel word to a novel object in the laboratory, we know little about how parents accommodate their speech when introducing their child to an unfamiliar object compared to a familiar object during play. Here, in an at-home 20-minute play session (Figure 1), 38 parents self-chose unfamiliar objects (e.g. whisk) and familiar objects (e.g. car) to play with their 2- to 4-year-old toddlers ($M = 2.8$ years, 21 female). We assessed three properties describing how parents referred to the unfamiliar object – i) frequency, ii) verb use, and iii) temporal structure (bursty vs. non-bursty) – compared to familiar objects. Table 1 shows the preliminary results from a single dyad generating 314 parental utterances (transcription is

ongoing). Findings will unveil the unique structures of child-directed talk that support novel word and object learning during play.

P3-64 - Children's trust in information provided by others on YouTube when making moral judgment

Sumi Cho ¹, Hyun Joo Song ¹

¹ Yonsei University

Details

Children acquire knowledge through direct observation in their daily lives, but can also acquire knowledge provided by others (Harris & Koenig, 2006). The present research examined the extent to which children trust verbal information provided by others on media platforms, such as YouTube. After listening to two stimulus stories each describing a child who engaged in a distress-inducing novel action (i.e. making someone cry), 6- to 12-year-old children watched two videos in which an informant made a counterintuitive testimony that the novel action was good or just repeated the story outcome. The videos either appeared to be played on YouTube (YouTube condition) or did not (Control condition). Children were then asked to indicate whether the novel action was good or bad. The results revealed that children in the YouTube condition, unlike those in the control condition, conformed to the informant's counterintuitive testimony. Children in the YouTube condition were significantly more likely to state that the distress-inducing novel actions were good after hearing the informant's counterintuitive testimony. In contrast, children in the control condition were likely to state that the novel actions were bad regardless of the informant's testimony. The results suggest that children may be susceptible to information conveyed by others through online platforms, contributing to the previous evidence on contextual factors that influence children's learning through others' testimony.

P3-65 - The effect of linguistic context on Korean 3-year-olds' verb learning

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Details

Korean 24-month-olds learn verbs better in sparse linguistic contexts with omitted arguments in contrast to English-acquiring peers favoring rich contexts including noun arguments (Arunachalam et al., 2013), suggesting the optimal context for verb learning may vary across languages. However, even in the "ideal" sparse context, Korean toddlers performed at chance levels. The current research examined when and how Korean children prove verb learning above chance levels by testing 3-year-olds. They were first taught novel verbs by viewing scenes described by either a sentence mentioning both subject and object (rich context) or omitting them (sparse context). Unlike prior research, a sentence introducing event participants preceded the critical sentence, providing discourse support to aid sentence comprehension. Children were then asked to identify which of two scenes depicted the novel verb. One scene showed the familiar action on a different object, and the other showed a different action on the familiar object. Preliminary results revealed that participants successfully associated novel

verbs with familiar actions in both sparse and rich contexts. In post-hoc analyses, girls performed above chance only in sparse contexts, whereas boys did not show such a pattern. Thus, by the age of 3, Korean children learn verbs in both rich and sparse contexts at least with discourse support, but the optimal context for Korean verb learning may still be the sparse one for some children.

P3-67 - Children's reasoning about groups: examining beliefs about the benefits of diverse and homogenous teams

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Details

Children reason about groups based on features such as group size, the relationship of members, and the social properties members possess (Plötner et al., 2016; Richardson et al., 2023). An under-explored question concerns children's reasoning about group diversity. In this study, children are introduced to a racially diverse co-ed group and a racially homogenous same-gender group, both of which are competing to develop a novel object. Participants evaluated group dynamics, judged which group will develop the best object, and which group will finish fastest (forced choice and explanation data). Pilot data showed that adults (N=100) believed the diverse team would create the best object (M=0.80, SD=0.40, $p<0.01$), citing better idea generation and creativity, and the homogenous team would finish fastest (M=0.67, SD=0.47, $p<0.01$), citing greater social cohesion. Preliminary data of children aged 5-8 (N=33) showed they believed the homogenous team would make the best final product (M=0.58, SD=0.50, $p=0.22$) and finish fastest (M=0.64, SD=0.49, $p=0.09$), while judging both groups equally in idea generation and collaboration. Collection and analysis of children's data is ongoing. Data will be discussed in the context of explicit and implicit models of diversity beliefs.

P3-68 - "Being a mathematician" does not affect children's persistence on math tasks

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Details

Describing science as an identity (being scientists) rather than action (doing science) decreases children's science engagement, particularly for girls (Rhodes et al., 2019). However, whether identity language similarly affects other domains is unknown. Mathematics is vital to examine because of stereotypes such as math requiring innate intellect (Chestnut et al., 2018). This study examines whether the language children hear before performing a math task affects their persistence. First graders (N = 120; Mage = 6.28 years) were randomly assigned to one of three conditions: identity language ("be a mathematician"), action language ("do math"), or the control ("do an activity"). Children heard this language when introduced to math concepts (e.g., subtraction). Persistence was measured by how many math problems children chose to answer. A survival curve analysis examined persistence levels across conditions, controlling for accuracy. There was no main effect of condition on persistence $\chi^2(2) = 2.82, p$

= .24. Additionally, when participants' gender was added to the model as an interaction, we found no effects. We found similar results in a parallel study where math was presented as spatial problems (N = 112; Mage = 5.52 years). These results suggest that action-focused descriptions of math did not benefit children's math persistence more than identity or non-math language, adding to the discourse of what language to use with children.

P3-69 - Theory of mind predicts children's cheating one year later

Kanza Batool¹, Liyuzhi Dong¹, Kang Lee¹, Catherine Ann Cameron²

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Details

This longitudinal study investigates the relationship between theory of mind development and rule-breaking behaviors in young children over a two-year period. Theory of mind, encompassing first-order and second-order understanding, was assessed in Year 1 and Year 2, exploring its influence on instances of rule-breaking in Year 2. Participants aged between 5 and 7 years were assessed using theory of mind tasks. Findings revealed intriguing patterns regarding theory of mind's influence on rule-breaking behaviors. First-order theory of mind in Year 1 exhibited a significant negative association with the instances of rule-breaking in Year 2, suggesting that a more advanced understanding of others' perspectives at an earlier stage could potentially mitigate rule-breaking behaviors in subsequent years. However, the second-order theory of mind in Year 1 did not significantly impact Year 2 rule-breaking behaviours. Second-order theory of mind in Year 2 exhibited a negative association, implying that a decline in this aspect of theory of mind in Year 2 related to decreased rule-breaking behaviors. These findings underscore the nuanced role of theory of mind development, specifically first-order understanding in Year 1, and declining second-order understanding in Year 2, in shaping rule-breaking behaviors among young individuals. Understanding these developmental nuances may offer insights for interventions that foster prosocial behaviors in childhood and beyond.

P3-71 - Children's confrontation of racial discrimination: testing a method for increasing anti-racist action.

**Mahika Mohan¹, Katharine Scott², Eren Fukuda¹, Natalie Sarmiento¹, Nicole Huth³, Patricia Devine¹,
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Details

Recent research provides evidence that children are capable of standing up to other children's racially discriminatory behavior (Scott et al., 2023). However, such confrontations are relatively rare among young children. In the present study, we evaluated whether observing confrontations of discrimination could increase young children's own confrontation behaviors. Children ages 5-7 (N=154; 87 girls, 67 boys) were randomly assigned to one of two conditions. In the intervention condition, children were read storybooks about child characters standing up to discrimination. In the control condition, children

were read storybooks about animals. After book reading, we presented children with instances of racial discrimination perpetrated by another child and measured whether children confronted the perpetrator of bias (Scott et al., 2023). Children in the intervention condition were significantly more likely to confront the perpetrator of discrimination (i.e., send a message addressing their discriminatory behavior; $\chi^2=5.15$, $p=0.02$, 95% CI: [0.11, 1.55]) and were also more likely to mention racial discrimination explicitly in their message ($\chi^2=7.06$, $p=0.008$, 95% CI: [0.28, 2.00]). These findings demonstrate that modeling ways to confront bias can help children know what to do and encourage them to engage in anti-racist behaviors.

P3-72 - How well do children remember events while hearing verbs?

Jane Childers¹, Faith Perry¹, Trinity Coatney¹, Jenna Rossignol¹, Anelena Castillo¹, Lexcel Penafiel¹

¹ Trinity University

Details

Learning verbs is difficult. Researchers studying verb learning usually make assumptions about children's memory for events. To address this gap, 18 three-year-olds ($M_a=42m$;range=36-47ms) and 19 four-year-olds ($M_a=54m$;range=48-59ms) were shown 2 events and tested on their memory in 5 test trials: new agent(new agent, old action), new action(old agent, new action), old(same agent, same action), conjunction(old agent, old action, new combination), and all new(new agent, new action); repeated with 2nd set. Children correctly gave more 'yes' responses in the old trial than other trials ($ps<.02$), and false alarmed more in conjunction and new agent trials ($ps<.05$) than in the trials with new actions. As children falsely remembered old actions more than new actions, this suggests they were treating the action as more important than the agent, as appropriate in verb learning. These results will be compared to a similar eye-tracking study with adults, and linked to verb theories.

P3-73 - "Where's your monster going?": Children's story and STEM talk during tinkering and reflections.

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Details

This study examined whether and how storytelling might support children's engagement and talk about science, technology, engineering and mathematics (STEM) during a tinkering activity and reflection after. A total of 77 children ($M_{age}=6.9$ years, 28 boys) and their parents were observed in a story-based tinkering program in a museum exhibit. The sample was 61.5% White, 16.7% Asian, 15.4% Latine, 3.8% Black, 1.3% Native Americans and 1.3% Mixed. The program asked participants to help a monster move across safely through construction of a shadow. A subset of families ($n=49$) received a story facilitation strategy. We coded families' engagement in STEM talk (e.g., identifying problems, planning, redesigning, setting goals, and testing) and story talk (e.g. character, settings, problems/goals, dialogue) while tinkering. Then a researcher elicited children's reflections about tinkering, and these were also coded for

child's STEM talk. Multiple regression analysis shows that families' STEM talk during tinkering significantly predicted children's STEM talk in the reflections, $B = .469$, $t(67) = 2.41$, $p < .01$. Ongoing analyses consider further how families' talk about stories and facilitation strategies used by educators enhanced associations with STEM talk.

P3-74 - Does the similarity of nouns across sentences influence children's grammatical knowledge of verbs?

Ayeleen Merchant¹, Jizette Bayron², Emily Haynes¹, Tali Filstein², Rayna Manchala¹, Laura Lakusta², Jane Childers¹

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Details

This study asks whether children can compare multiple sentences during verb learning, and learn about the grammatical uses of those verbs. Three-year-olds ($n=36$) and four-year-olds ($n=28$) heard verbs in one of two training conditions: all similar (same agent, same patient) or all varied (different agent, different patient). In each, children heard cartoon characters produce four sentences with the target verb and then were asked to say which character "said it best" (one grammatical, one ungrammatical) in two test trials; repeated for 3 sets. Change of state and caused motion familiar and novel verbs were tested. One key result is 4-year-olds' responses differed from chance in the all varied ($M=.66, SE=.06$; $t(12)= 2.85, p=.015$) and not the all similar condition ($M=.53, SD=.05$; ns); 3-year-olds responded at chance across conditions. Therefore, hearing sentences with varied nouns may aid verb learning by 4 years, perhaps due to statistical learning, syntactic bootstrapping and/or structural alignment mechanisms.

P3-75 - When is it wrong to not believe? Investigating the role of race and gender identity in children's evaluations of epistemic injustice

Erika DeAngelis¹, Melissa Koenig²

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Details

Epistemic injustice (EI) is when prejudice against a speaker's identity (e.g., race/ethnicity, gender) leads a listener to discredit a speaker's testimony. This is the first experiment to investigate children's sensitivity to the harm of EI and the influence of race and gender identity on their evaluations. This online study included 125 4- to 10-year-old children (M age = 6.9 years, 62 female, 49 BIPOC). Participants viewed animated videos in which a perpetrator believed the anecdotes of one speaker but not another. Each character's race and gender varied based on assignment to one of three conditions (Fig 1). After each video, participants evaluated how wrong it was to believe one person but not another (**EI evaluation**), how much the perpetrator should be punished (**punishment rating**), and how much they liked or disliked the perpetrator (**preference rating**).

Across conditions, participants' EI evaluations (*Mdn* & *IQR* = 1) were significantly lower than chance (*Mdn* = 1.5), $V = 1109.5$, $p < .001$. Linear mixed-effects models showed a significant main effect of age on children's punishment and preference ratings, but no significant effect of condition (Fig 2). Specifically, average punishment and preference ratings declined with age. Thus, even young children seem to recognize the harm of EI but show age-related differences in how they evaluate perpetrators. Future work should elucidate the specific contexts in which children evaluate EI perpetrators differently.

P3-76 - Getting tall: compositionality and statistical sensitivity in adjective acquisition

Suji Jung¹, David Barner¹

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Details

In a previous study, Barner & Snedeker (2008) found that 4-year-olds use statistical criteria to interpret gradable adjectives like *tall* and *short* from a young age. However, given that even 2-year-olds have some preliminary knowledge of these words and the sizes of objects, the question arises whether children younger than 4 might also interpret gradable adjectives via a statistical standard, or if they instead resort to other heuristics described in the literature (e.g., Smith et al., 1988). We conducted two experiments to investigate if 3-year-olds are sensitive to statistical differences between sets when interpreting *tall* and *short*. In Experiment 1, we found that 3-year-olds, in contrast to 4-year-olds in a previous study, failed to shift their *tall* and *short* judgments of novel objects when the distractor objects were added. However, in Experiment 2, when the average size of distractors was manipulated more strongly, and when we excluded objects that were labeled as both *tall* and *short* by the same child, we found some preliminary evidence of a statistical sensitivity for *tall*, but not for *short*. We conclude that children may begin to use set-based statistical criteria to interpret gradable adjectives by 3 years of age, but that this knowledge is not as easily detected due to a still developing semantic knowledge and sensitivity to statistical differences between sets.

P3-77 - Children's in-group preferences: a large-scale analysis on racially diverse children's race-based social judgements

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Details

Previous research demonstrates White children show a seemingly consistent preference for their racial in-group, while minority children's preferences are more varied. However, these studies have employed a wide range of methods, making comparisons across studies difficult. The current study recruited a large sample of children ages 4- to 6-years-old ($N = 666$) belonging to the United States' four largest racial/ethnic groups (Black, Latine, Asian, and White) in five geographic regions (Durham, NC; Honolulu,

HI; Long Beach, CA; New Haven, CT; Seattle, WA) to broadly examine their race-based social judgments in identical measures of racial attitudes, interpersonal distance, resource allocation, and status perception. Overall, children demonstrated consistent in-group biases in the attitude, resource allocation, and interpersonal distance measures, but did not associate their in-group with higher status. When analyzed separately by race, only White children tended to show attitude, resource allocation, and interpersonal distance in-group preferences above chance and sometimes significantly more than children in other racial groups. Additionally, Latine children showed significant preferences towards their out-group in the resource allocation measure, a pattern not found in other groups. These results provide more insights into how a child's racial identity may influence their race-based social judgements.

P3-78 - Assessing new creativity measures: exploring early childhood creativity across contexts

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¹ University of Alabama, ² Hampden-Sydney College

Details

Despite creativity's prediction of academic success and positive outcomes, its developmental trajectory and context dependency are less known. Moreover, there are no accepted parent informant measures of creativity. Therefore, the current study created a new parent and teacher measure, The Childhood Creative Preferences Task, and altered a validated teacher measure of creativity for parent report. We hypothesized that the new parent and teacher reports would correlate with each other and child creativity measures. 97 preschool children ($M = 4.30$ years $SD = .65$), their parents, and teachers completed new and existing creativity measures along with convergent measures of creativity. Results demonstrated that parent and teacher reports of creativity correlated with informant reports of related constructs, such as imagination (r 's = .45 - .59), but parent and teacher reports did not correlate with each other, nor with child-direct measures. More research is needed to develop measures of childhood creativity across contexts.

P3-79 - Children's social approval for girls and boys engaged in brilliance-required activities: the impact of race

Vanessa Lazaro¹, Lin Bian¹

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Details

Women's underrepresentation in academic fields and professions emphasizing brilliance persists as a prominent societal concern. The present study focuses on early antecedents of this gender imbalance by investigating the developmental changes in young children's social approval of boys and girls who pursue brilliance-required activities. Importantly, we took an intersectional perspective to explore whether children consider race in their social acceptance. Five- to- 9-year-old children ($N = 207$) were presented with pairs of Asian, Black, and White gender-matched characters. One character was depicted as enjoying a game requiring brilliance and the other enjoyed a game requiring effort. Participants were

asked to choose the character they liked more, an indicator of their social approval. With age, children became increasingly likely to approve of White boys pursuing activities requiring brilliance (vs. activities requiring effort). However, this effect did not extend to White girls, Black boys, or Asian boys. In fact, children with age exhibited more disapproval towards White girls and Black boys engaged in brilliance-required activities. Our data suggest that, as early as elementary school, children's social approval in contexts valuing brilliance becomes gendered and is racialized. These findings highlight the importance of employing an intersectional approach to identify the specific developmental mechanisms underlying disparities at the crossroads of gender and race.

P3-80 - Children's social evaluations of transgender identity concealment

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Details

Transgender children living as their gender (e.g., girl) rather than their sex assigned at birth (e.g., male) may conceal being trans from others. Peer support is crucial for the well-being of trans youth (Durwood et al., 2021), yet concealing a trans identity may hinder the support trans children could otherwise receive from peers. We examined 6-11-y.o. cisgender and gender-diverse children's ($N = 305$) evaluations of trans identity concealment. Participants heard about a trans target who concealed a social transition and a cisgender target who concealed a gender-consistent name change; they then rated how acceptable each target's concealment was and how much they liked each target. Participants endorsed the trans target's concealment, and gender-diverse participants ($M = 4.44$) were more accepting than cisgender participants ($M = 4.41$), $p = .034$. Moreover, participants were more accepting of concealment in trans than cisgender targets, $F(1,291) = 5.20$, $p = .023$, $\eta_p^2 = .02$. However, unlike cisgender children, gender-diverse children liked trans targets more than cisgender targets who concealed, $F(2,286) = 3.85$, $p = .022$, $\eta_p^2 = .03$. Our findings suggest that regardless of their gender identity, children show widespread support for how trans peers manage their identities. Future work should investigate factors influencing children's judgments of trans identity concealment and whether these may be linked to anti-transgender prejudice later in development.

P3-81 - Diversity in the development of cognitive flexibility throughout kindergarten and first grade: Early and delayed developers and implications for internalizing and externalizing psychopathology

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Details

Cognitive flexibility is a critical executive function skill that enables children to flexibly modify behaviors and adapt to new demands. Whereas most children tend to improve cognitive flexibility in elementary school, the development of cognitive flexibility throughout kindergarten and first grade is not homogenous. Using data from a large nationally representative dataset

(ECLS-K: 2011, N= 15,827, 51.20% male; 48.50% White) our study aimed to identify latent subgroups of children characterized by different developmental trajectories of cognitive flexibility throughout kindergarten and first grade. Our second aim examined consequences of diversity in developmental trajectories of cognitive flexibility for internalizing and externalizing psychopathology in the second grade. Using a growth mixture modeling approach, our analyses identified early (91.05%; 50.4% male) and delayed (8.95%; 59.4% male) cognitive flexibility groups and demonstrated that delayed developers have higher levels of externalizing and internalizing problems in the second grade. Taken together, our findings suggest that for a small sample of children cognitive flexibility abilities are not fully developed during the first two years of formal schooling, representing a significant vulnerability for internalizing and externalizing psychopathology.

P3-82 - Exploring the impacts of illusory control on children's social learning

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Details

Research on selective social learning, or children's preference to learn from some individuals over others, has typically focused on children's use of cues to differentiate learning sources when choosing from whom to learn. However, not much is known about children's preferences to even engage in social learning in the first place. Two studies investigated children's illusory control, or overconfidence in their abilities, and its influence on their decision to endorse or seek help from informants. Children were first randomly assigned to experience success or failure locating objects to manipulate their illusory control. In Study 1, 5-year-olds ($n=81$) then chose whether to answer questions by themselves or with the help of an informant. In Study 2, 7- and 8-year-olds ($n=80$) chose whether to endorse one of two information sources, then could request help from either of them for subsequent questions. Results show prior success influenced children's decision to trust informants, but only for questions like the ones in the manipulation (i.e., pertaining to the location of objects). Children's confidence in their learning skills and a parental measure of their leadership attributes correlated with their trust towards informants, highlighting the need to further explore individual factors. These findings provide further insight of the manifestations of illusory control, with the aim of improving our understanding of children's learning techniques.

P3-83 - How do children's beliefs about emotions impact their judgments of fairness?

Emma Yu¹, Peter Blake¹

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Details

Research on children's fairness has found that children view unequal distributions as unfair and show negative emotional responses to inequality. In two preregistered experiments, we tested whether there is a causal link between children's understanding of recipients' emotions and their fairness judgments in a third-party resource distribution (4- to 7-year-olds; N = 266). We manipulated the emotions (happy vs. sad) of the disadvantaged child (Study 1) or the advantaged child (Study 2) and included control conditions. Participants also rated how they would feel as the advantaged and disadvantaged recipients of the same distribution. In both experiments, the emotion manipulations changed children's emotion ratings for the recipients and how they themselves would feel, but did not change fairness ratings relative to controls.

Combined these results suggest that children's beliefs about the emotions of recipients of inequality are malleable but do not impact fairness judgments in this age range.

P3-84 - Partner traits predict children's forgiveness in a repeated Prisoner's Dilemma game

Montana Shore¹, Peter Blake¹

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Details

Forgiveness is an important means of repairing social relationships and requires a victim to adopt a positive view of a transgressor. Willingness to forgive may thus be influenced by beliefs about the transgressor's character as well as the victim's own traits. Here, we investigated the impact of these two factors on children's forgiveness in a social dilemma.

We tested 6 to 11 year olds (N=202) in a Repeated Prisoner's Dilemma (RPD) game in which pre-programmed partners defected at different points. Forgiveness was measured as cooperation in the subsequent rounds. After the RPD, children were asked about partner traits (e.g., friendly, honest) and a composite variable was created. Child traits were assessed using the Strengths and Difficulties Questionnaire (SDQ).

Both age ($p < .001$) and positive partner traits ($p < .05$) predicted forgiveness, but SDQ variables did not. We consider implications for the developmental mechanisms of forgiveness.

P3-85 - Bilingual Latine families' language use during book reading activity with preschool-aged children

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Details

Bilingual speakers often use translanguaging or mixing of languages, but little is known about how young children engage in translanguaging with their parents during everyday interactions. This study explored Latine Spanish-English bilingual parents' and their 3- to 5-year-old children's translanguaging during shared book reading. One goal is to characterize the complexity of bilingual parent-child conversations while engaging with books as resources. Families had immigrated to central California. Twenty-six Latine dyads were invited to share two children's books about nature: a wordless narrative book about the ocean, and an expository book about the sun. Overall, 81% of the families engaged in translanguaging. When reading the narrative book, 65% of parents and 58% of children used translanguaging. With the expository book, 58% of parents and 62% of children used translanguaging. We coded word-focused (e.g., translating a word) and context-focused (e.g., changing language to voice a character) translanguaging. Children and parents used similar frequencies of the two types of translanguaging across the two books. Individual families demonstrated considerable variability in the use of translanguaging by children and parents. Ongoing work considers how translanguaging may expand opportunities for science practices such as observing, explaining, and predicting, using books about nature designed to introduce similar conceptual material in either narrative or expository form.

P3-86 - Predictors of skill expression in infants' everyday behavior

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Details

Although acquiring new motor skills can create opportunities for perceptual and cognitive development, new skills can only facilitate development if they are expressed in daily life. For example, learning to sit, cruise, and walk may lead to more daily sitting and standing experiences. However, caregiver choices and variation in activities (e.g., playing, eating, and running errands) have the possibility to alter daily skill expression. Infant devices—jumpers, highchairs, car seats—also allow infants to sit and stand without acquiring those skills. We examined whether skill acquisition and/or age predict sitting and standing time. Caregivers of 3- to 24-month-olds reported infants' activity via text message surveys sent 10 times/day for 4 days; this allowed us to estimate the proportion of time spent sitting and standing (skill expression). Caregivers also reported whether infants could sit, cruise, and walk (skill acquisition). Cruising and walking ability, but not age, predicted increased standing time. In contrast, age but not sitting ability predicted increased sitting time. The unforeseen finding that sitting acquisition does not predict increased sitting time demonstrates that what infants can do may not necessarily translate to what infants really do in daily life. Variability in skill expression can depend on diverse factors, such as infant routines, illustrating the significance of unpacking developmental contributions to infant experiences and subsequent learning.

P3-87 - Parent support for autonomy during block play and children's spatial ability: A study of families in China and the U.S.

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Details

Emerging evidence suggests that parent-child block play stimulates children's spatial thinking, but the role of parents' support for autonomy during block play in children's spatial development remains understudied. Drawing on self-determination theory, this study aimed to identify autonomy support styles during block play and their relations to children's spatial ability. A secondary goal was to evaluate cultural similarities and differences among American and Chinese families. We observed 176 families of 4- and 5-year-olds in China (N = 83) and the US (N = 93) during a 10-minute block-building activity and assessed children's spatial ability with the Children's Mental Transformation Task. Cluster analyses revealed two styles of autonomy support in both cultures: *collaborative-constructing* and *autonomy-granting*. The former style features parent-child joint play and collective goal-setting, whereas the latter features parents making time for their child to construct independently and following child-initiated goals. For Chinese families, controlling for child age and spatial language, parents' *autonomy-granting* style was associated with children's better performance on the spatial task ($B = 0.37, p < .05$). This pattern was not observed in American families, where child sex and family income were at play. We will underscore the study's cultural perspective and its implications for children's spatial development.

P3-88 - The development of intersectional impression formation among diverse children

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Details

Children interact with peers who possess intersectional identities (gender and race), yet most intergroup research to date tends to focus on each identity separately. Our investigation assessed intergroup attitudes (liking) and behaviors (interpersonal distance, resource allocation) among an ethnically diverse sample of 4-6-year-olds across 5 U.S. regions (N=619; Asian, Black, Latiné, and White girls and boys). Children tended to show the most favoritism towards same-gender same-race peers, the least favoritism towards different-gender same-race peers, and middling favoritism towards same-gender different-race peers, a pattern that was more distinct among older than younger children. Target gender impacted children's attitudes and behaviors more than target race; a pattern that held for both White children and children of color and was stronger among girls than boys and for younger compared to older children. Our findings contribute to the understanding of how children of color evaluate and treat others considering both race and gender.

P3-89 - Perspective taking on children's behaviors: parent versus child views on child prosociality and aggression

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Details

Parents and children do not share the same perspective on children's emotions: Parents judge that children feel more optimistic and less worried than children self-report (Lagattuta et al., 2012). Reasonably, reflecting on children's behaviors (visible actions) should be an easier task for parents than interpreting their child's mental states (e.g., emotions, thoughts). We tested parent vs child views of children's prosociality and aggression. Four- to 10-year-olds ($N=148$) reported the frequency (5-pt. scale) they engaged in several prosocial and aggressive acts. Parents predicted how their child would respond to the same items, and parents also evaluated their own prosociality and aggression with these measures. All age groups and parents had acceptable internal consistency ($.65 < \alpha < .84$). Although parents and children shared views on children's prosociality ($r = .18, p = .03$) they did not agree about children's aggression ($r = .07, p = .39$). Parents evaluated their children as more aggressive compared to child self-report ($F = 208.22, p < .001, \eta^2 = .59$) and this pattern held across age ($p < .01$). We also found evidence for anchoring and adjustment: Parent self-views and their reports about their children correlated ($r > .21, p < .02$); however, parents viewed themselves as more prosocial ($F = 45.82, p < .001, \eta^2 = .27$) and less aggressive ($F = 859.96, p < .001, \eta^2 = .88$) than their children. These data highlight children's developing self-evaluations and perspective taking challenges.

P3-90 - Unfold home and childcare numeracy environment and their associations with preschool children's numeracy skills

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Details

Preschool-aged children's numeracy skills positively relate to their later math learning. The evidence about associations between early numeracy environments in both home and childcare settings and children's numeracy skills is scarce. The purpose of the current study is to fill this gap. Participants were 131 parent-child dyads and 58 teachers of these children. Children's numeracy skills were assessed with PENS (Purpura, 2021). Parents provided demographic information, frequency of home numeracy activities, parents' knowledge of children's math skills, and parent number talk. Teachers provided demographic information, likelihood of implementing math activities, and teachers' knowledge children's math skills. Structural equation modeling was used to examine the structure of the HNE and CNE, and their associations with children's numeracy skills. The HNE constructed by the five indicators yielded a reasonable global fit (CFI = .918, RMSEA = .077). The latent variable representing the HNE was positively associated with children's numeracy skills, $r = .24, p = .018$. The CNE was constructed by the

three indicators, yielding a perfect global (CFI = 1.000, RMSEA = .000). The latent variable representing CNE was not significantly associated with children's numeracy skills. Estimation of a joint model examining associations between HNE, CNE, and numeracy skills yielded reasonable global fit (CFI = .80, RMSEA = .072). Implications were discussed.

P3-91 - Foreign language use and its impact on the brain structure

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Details

Bilinguals exhibit greater grey matter volume (GMV) in brain areas related to executive function (EF) or language (Olulade et al., 2016) and better white matter integrity (Deluca & Voits, 2022) compared to monolinguals. The current study investigated that foreign language experiences, to varying degrees, can also influence brain structures. We tested 41 Korean young adults who have learned English as a foreign language mostly in formal educational settings since childhood and have limited exposure to a bilingual environment. Their brains were captured by magnetic resonance imaging techniques. Their English proficiency and the extent of social use of English was assessed by Languages and Social Background Questionnaire (Anderson et al., 2018).

GMV in regions related to EF, such as the left medial orbitofrontal cortex, exhibited a significant correlation with social use of English but not with English proficiency. Furthermore, GMV in this area were better predicted by the social use of English especially in individuals with lower English proficiency, suggesting that the brains of less proficient foreign language learners may benefit more from actively engaging in social interactions using foreign languages. White Matter integrity of the left Cingulum, an area related to EF (Bubb et al., 2018), also exhibited a significant correlation with social use of English. These findings suggest that foreign language usage, rather than proficiency, can influence brain development.

P3-92 - Changing minds: intervention and causal theory of mind

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Details

Prior studies of Theory of Mind have primarily asked observers to predict others' actions given their beliefs and desires, or infer agents' beliefs and desires given observed actions. If Theory of Mind is a causal theory, people should also use it to plan causal interventions. The intuitive causal model predicts an asymmetry: to induce a new action, one has to instill both the relevant belief and desire, whereas to prevent a likely action, it suffices to remove either of the relevant belief or desire. In this study, we use these asymmetric causal interventions to probe the structure of Theory of Mind. Adults (N=156) and older children (N=40, 8-10 years), but not younger children (N=42, 5-7 years), selectively intervene on both

beliefs and desires to cause agents to act but intervene either on beliefs or desires to prevent an action. To understand why the younger children did not distinguish between interventions, we ask children (5-7 years) to predict others' actions following interventions on others' belief, desire, or both. In preliminary results, young children correctly predict a new action will happen selectively after interventions on both belief and desire, but not either alone. These findings support the idea that people have a causal Theory of Mind, and both adults and children by age eight can use it for planning and intervention.

P3-93 - "It's the circle of life": children's reasoning about familiar and novel life cycles

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Details

Educational materials frequently introduce life cycles to children, and these transformations can be depicted in many ways (Menendez et al., 2020; Wood & Stocklmayer, 2021). The way that life cycles are visually represented may impact children's understanding of biological processes. In particular, circular life cycles may lead to misconceptions about the transition between generations. In two pre-registered studies, we examined the impact of the visual presentation (circular vs. linear) of life cycles on children's understanding of generations. We showed 4- to 8-year-olds circular or linear diagrams of three different life cycles. We asked them to determine whether the organism in the final stage "could grow into" the first stage. We presented familiar organisms in Study 1 ($n = 103$) and novel organisms in Study 2 ($n = 103$). In both studies, the majority of children (~75%) stated that the organism in the final stage could *not* grow into the organism in the first stage, and their judgments were not influenced by visual presentation (in Study 1, $\chi^2(1) = 0.02, p = .89$; in Study 2, $\chi^2(1) = 0.62, p = .43$). These findings show that children understand the biological processes represented in life cycles, even when the visual depiction may lead to potential misunderstandings.

P3-94 - Investigating early mathematical skills differences between STEM and non-STEM students

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Details

While the differences between skills and abilities between STEM and non-STEM majors have been well-studied, few studies have attempted to detect these differences while they are still in the developmental process. To fill this gap, we are interested in exploring how mathematical skill sets differ among STEM and non-STEM students during the early developmental stage of their skills (middle school). In this study we examined the ASSISTments 2017 dataset, which contains the mathematics assessment scores of middle-school students (who have completed college by now). A preliminary analysis revealed that the two groups differed significantly in accuracy and time required to answer math questions correctly. By categorizing questions according to their labeled skill sets, we are able to segment them into three main categories: "Algebraic expression and computation", "Geographic interpretation and calculation", and

"Applications with real-world implications" (Table 1). Using two-sample t-tests, no significant differences in accuracy or time taken to answer application questions were observed between the groups, but significant differences between the groups in graphical and algebraic questions were noted. Such results are important for understanding how these early skillset differences would affect learning outcomes, and to inform education interventions and policies relevant to STEM education. The rest of the features in the dataset will be analyzed to reveal further insights.

P3-95 - Predicting preschoolers' numeracy skills from measures of language

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Details

Both language and math are systems of abstraction and symbolic representation. Two early academic skills children learn are print awareness and understanding cardinality. The development of these two skills bears striking similarities. The duality of the larger set (the word) and its individual components (letters) parallels the duality of the numerical set and its individual units. Furthermore, becoming proficient in understanding cardinality necessitates the understanding of number words. The purpose of this study was to examine the connection between print awareness, math language, and numeracy skills. A total of 321 3-5-year-olds participated in this study. Participants had the following racial/ethnic backgrounds: 41% Black, 35% White, 20% Latine, 2% Asian, and 2% Multiracial. Children were tested on a picture description task, print awareness skills, cardinality, and numeracy skills. Picture descriptions were coded for use of cardinal labels (e.g., "three birds"), spatial prepositions (e.g., "in", "on"), and math language (e.g., "more", "some"). Results showed that early numeracy and cardinality knowledge were most strongly predicted by use of math language ($b = 0.54, p = .002, 95\% \text{ CI } [0.20, 0.88]$) and print awareness skills ($b = 0.79, p < .001, 95\% \text{ CI } [0.65, 0.93]$). Spatial prepositions and cardinal labels were not consistent predictors of math knowledge. These results yield insights into the interwoven cognitive fabric of early language and math skills.

P3-96 - The role of Latino skin tone bias in children's judgments of trustworthiness

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Details

Numerous studies have examined discriminatory and prejudiced attitudes toward various racial-ethnic groups in the United States. However, less work has studied the presence of colorism, that is, preferences for individuals within a racial-ethnic group who have lighter skin tones. In particular, research is needed on the development of colorism in children and in relation to the Latinx/Hispanic community. In the present study, child participants ($N = 19$) of all racial backgrounds aged 7-9 years saw faces of three Latinx/Hispanic women with dark, medium or light skin tones (counterbalanced between

subjects) who gave differing statements about objects. Children were asked to endorse one of the statements, then were asked questions about their perceptions of the speakers and their own skin tone shade. We found that children's endorsements differed significantly across skin tones ($F(2,54) = 9.29, p = 0.0003$). The statements of the medium-skin-toned speaker were endorsed most often, despite having the skin tone that the fewest children identified with. Participants who identified with the darkest-skin-toned speaker tended to endorse her statements the least. Moreover, the dark-skin-toned speaker was least frequently selected as most liked or most trusted. The study's findings suggest a possible negative in-group bias while also providing evidence of social biases against dark skin tones. Additional data collection is in progress to explore the unexpected preference for medium skin tone.

P3-97 - Children's emerging ability to balance internal and external cognitive resources

Lily Dicken¹, Thomas Suddendorf¹, Adam Bulley², Muireann Irish³, Jonathan Redshaw¹

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Details

In a world full of calendars, maps, and smartphones, humans must learn to manage internal and external cognitive resources. Here, we show how children begin to perform this delicate balancing act between mind and world: weighing up when to rely on their unaided capacities and when to offload cognitive demand. Australian children aged 6 to 9 years ($N = 120, 71$ females) were tasked with remembering the locations of 1, 3, 5, and 7 targets hidden under 25 cups. In the critical test phase, children were provided with a limited number of "tokens" to allocate across trials, which they could use to externally mark target locations and assist future memory performance. Following the search period, children were invited to adjust their previous allocation of tokens. Although 8- to 9-year-olds prospectively allocated proportionately more tokens to more difficult trials, 6- to 7-year-olds did so only in retrospect. During middle childhood, humans become increasingly adept at weighing up when to rely on their unaided capacities and when to offload cognitive demand.

P3-98 - Gender bias in parental praise of infants

Junyi April Chen¹, Jillian Lauer²

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Details

Across cultures, men and boys report greater confidence in their intellectual abilities than women and girls (Diseth et al., 2014; Furnham, 2001; Reilly et al., 2022). We explored one mechanism via which gender differences in intellectual self-concepts may become socialised in early childhood: gender bias in parental praise of young children's intelligence. Specifically, we examined gender bias in British parents' ($N = 82$) praise of their 9-month-olds during everyday interactions, assessing parents' praise of their infants' intelligence ("you're a *clever* lad"), as well as their general praise ("good girl") and appearance praise ("you *pretty* girl"). Parents praised male infants for their intelligence 3.22 times more often than female infants ($p = .014$), but provided similar levels of general and appearance praise to infants of both

genders (IRRs<1.17; *ps*>.56). This striking gender bias in parents' infant-directed praise may lay the groundwork for later gender inequalities in children's intellectual confidence.

P3-99 - It's the counterfactual thought that counts: counterfactual reasoning without counterfactual language

Siyang Zhang¹, David Rose¹, Hyowon Gweon¹, Tobias Gerstenberg¹

¹ Stanford University

Details

Young children often struggle with counterfactual questions. One possibility, however, is that the use of counterfactual language in prior work has masked children's ability to reason counterfactually. The current work tests counterfactual reasoning without counterfactual language by asking whether children would appreciate those who prevented negative outcomes; this requires considering what would have happened in the relevant counterfactual situation. In Experiment 1, we presented children (Age:3-6) with scenarios where Granny dropped two objects (e.g., an egg and a basketball) that were each caught by a different person before hitting the floor. Children were asked which person should receive the thank-you sticker. We found that children across all age groups preferentially chose the person who prevented the worse outcome from occurring (e.g., thanking the person who caught the egg), $p < .005$. In Experiment 2, children were asked which of the two objects they or Granny liked; the results raised the possibility that children's judgments about what Granny liked could potentially explain the results in Experiment 1. Experiment 3 (ongoing) aims to rule out this possibility by showing Granny dropping two identical objects (e.g., two glasses) onto two different surfaces (e.g., tiled floor vs. a soft beanbag). With the complete dataset, the poster will discuss how eliminating the demands of counterfactual language can help understand the development of counterfactual reasoning.

P3-100 - Preschoolers' gender differences in third-party punishment is related to parental distribution of care

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Details

An increasing understanding of prosocial norms in the domain of empathy-based comforting marks moral development in preschoolers. Simultaneously, important changes in gender development occur. Preschoolers prefer playing with same-gender peers, and gender stereotypes can develop by observing behavior. Empirical data suggests that normative views could constitute two distinct factors: Normative representation (e.g., evaluation) and norm enforcement (e.g., third-party punishment). Assuming that norms are constructed through social interactions, it is interesting to explore how gender influences this development and whether gender-specific behavior is more prevalent in households with unequal distribution of care.

Normative views about comforting were tested cross-sectionally in four- and five-year-olds ($N = 123$; 62 girls) using vignette stories and puppet scenarios. No gender differences in normative evaluations were found, but norm enforcement behavior differed with boys engaging in more third-party punishment ($W = 1353$, $p = .034$). Gender differences are larger in households of unequal distribution of care ($n = 80$; $W = 896$, $p = 0.008$).

These results are in line with previous research where boys engage in more punishment of selfishness. Being exposed to unequal distribution of care conveys gender differences more strongly, leading children to be more likely to engage according to gender-typical expectations.

P3-101 - Influences of processing time on accent-related biases in children and adults

Ajna Kertesz¹, Anisha Abbaraju¹, Alyssa Skoff¹, Catharine Echols²

¹ University of Texas at Austin, ² University of Texas

Details

Both adults and children show accent-related biases that typically favor native-accented over foreign-accented speakers. These biases are sometimes attributed to stereotyping or status/membership-signaling properties of accents. However, another less explored explanation is that the cognitive difficulty of processing accented speech leads to negative affect, which then results in negative social judgements. In our study we examined both processing time and social preference of accented speech in adult (18-22 years) and child (3-6 years) populations. We used three different accents, American English (AE), New Zealand English (NZE) and Turkish (TR), to explore both the native and familiar properties of accent that may influence processing as well as social preferences. Data from 117 undergraduates suggests that while reaction time is slower to the AE speaker, participants respond more accurately to the AE speaker and rate her as more believable and smarter than TR speaker. Preliminary child data from 15 participants suggests that reaction time is faster to AE and significantly slower to the TR speaker. Lastly, child participants rate the AE speaker as smarter and more trustworthy than the TR speaker. The NZE speaker was not significantly different from the AE in either dataset. Interpretations of the findings, and their implications, will be discussed.

P3-102 - Diversity in felt gender identities among British and Chinese children

Yumeng Wang¹, Jillian Lauer¹

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Details

In this study, we addressed a notable gap in our understanding of gender development: the incidence of non-binary gender identities among children. 373 British and 116 Chinese 5- to 11-year-olds completed a two-item felt gender-identity scale, answering “how much do you feel like a [girl/boy] on the inside?”. Children’s responses clustered into three groups: “girl-aligning”, “boy-aligning”, and “non-aligning” with either binary gender. Across samples, 25% of children were categorized as non-aligning (<1% aligned

with the binary gender associated with the opposite sex). Female children and older children were more likely to be categorized as non-aligning than male and younger children. Children categorized as non-aligning displayed less gender-stereotypical behavior than children aligned with a binary gender, indicating children's felt gender identities manifest in observable variation in gender expression. These results demonstrate considerable diversity in felt gender identity throughout middle childhood, highlighting the importance of inclusive approaches to studying children's gender identities.

P3-103 - Children associate science and math achievement with high social status across cultures

Rui Wang¹, Anran He¹, Jillian Lauer¹

¹ University of Cambridge

Details

Science, technology, engineering, and mathematics (STEM) fields are marked by persistent social-group inequalities: Women, people of color, and individuals from disadvantaged economic backgrounds remain underrepresented in STEM (Royal Society, 2014). Here, we propose a novel account of the origins of these social-group disparities, finding that children not only perceive high-status individuals to possess greater STEM competence but also form stereotypes about the STEM abilities of different social groups based solely on their relative statuses. In Study 1, 180 British children reported that high-status children were more likely to succeed than low-status children in science and math, but not writing, ($p < .001$). In Study 2, 184 Chinese children perceived a novel high-status group to be better at math, but not writing, than a novel low-status group ($p < .01$). These preliminary results suggest that children specifically ascribe greater STEM abilities to high-status individuals and groups, potentially contributing to early emerging inequalities in STEM self-concepts.

P3-104 - The effect of media richness on various kinds of children's selective trust

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Details

This study investigated the influence of media richness on children's epistemic and social trust. Sixty-two five- and 7-year-olds interacted with an adult via either video-chat or voice-chat. Two trust measures of trust were employed: a hybrid-object-labeling game (assessing epistemic trust) and a delay-of-gratification task (assessing social trust). For the labeling game, both age groups using video-chat aligned their beliefs about hybrid objects with the adult's $F(1, 58) = 16.96, p < .001$. For the delay task, 5-year-olds exhibited longer waiting times in video-chat than voice-chat ($z = -4.937, p < .001$), while 7-year-olds showed similar wait times in both conditions ($z = -0.271, p = .786$). See Figure 1. These findings suggest that media richness can influence epistemic and social trust in younger children but only epistemic trust in older children. Potential explanations for age and condition differences are discussed, including the capacity for video-chat to foster directedness and adult's pedagogical intentions.

P3-105 - The effect of modality and social contingency on retention and generalization of novel words

Megan Lorenz ¹, Sarah Kucker ²

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Details

Word learning occurs in many contexts, including across modalities (book-reading vs. digital media) and social contexts (shared reading/co-viewing vs. non-social). Importantly, learning is enhanced for book-reading over videos and when social partners are contingent and engaged. However, how modality and social contingency interact to support language acquisition is unknown. The current study compared multiple aspects of word learning across such conditions. Fifty-two 2.5-to-3-year-old children and a parent either read a book or watched a video that taught them four novel word-object pairs. Half of parents elaborated on the story's content, while the other half simply read the text as it was or watched the video quietly. Children were then tested on their retention and generalization of the words. Overall performance on the retention and generalization trials did not differ significantly between modalities nor across social-contingent conditions. However, children learned the words at levels significantly above chance for all conditions except the non-social-contingent book condition, yet only children in the social-contingent book condition generalized the words significantly above chance (Figure 1). Collectively, these results suggest that modality and socially-contingent interactions may not differentially impact children's initial word learning but may have consequences for later generalization.

P3-107 - More is better? Children's reasoning about generous donation

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Details

While generosity is undoubtedly considered a moral virtue, engaging in generous giving behavior does not always lead to a good reputation. This is particularly the case when these acts may damage the reputations of others. In collectivist cultures, where there is a significant emphasis on the social consequences of individual actions, even well-intentioned gestures can be viewed negatively if they are perceived to have adverse effects on others. The present study aims to explore this hypothesis from a developmental perspective, involving 256 8- to 12-year-old Chinese children. Children were presented with a vignette and asked to evaluate a protagonist in which the protagonist shared more than another peer in a donation task. We manipulated whether the peer's reputation was negatively affected by the protagonist's generous donation (reputation damaged or undamaged), as well as the social relationship between the two (friend or stranger). The results showed that children's evaluation and friend-making willingness were more negative when the reputation of the peer was damaged. Additionally, older children tended to hold an overall more negative attitude towards the protagonist than younger children. However, there was not a significant main effect of the social relationship or other interactions. These results suggest that children's evaluation of generous acts is not solely based on the act itself, but also on its social consequences.

P3-108 - Seeing versus hearing: how moral stories with different degrees of anthropomorphism impact children's prosocial learning?

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Details

Children are usually exposed to narratives before they can read, and story-telling helps them to learn about the social world around them. Despite the prevalence of human-like animal characters in moral stories and the well-documented role of story characters in early learning from stories (e.g., Richert et al., 2011; Li et al., 2022; Russell & Cain, 2022), it remains unclear how animal characters portrayed anthropomorphically (also called anthropomorphism) impacts children's prosocial learning.

The present study examined the contributing role of images and language, at varying degrees of anthropomorphism, in moral stories on 6-year-olds' (N=158) sharing behaviors. Results, based on a 2 (high or low anthropomorphic character image) × 2 (realistic or anthropomorphic language) experiment with a baseline control condition, showed increased prosocial behaviors (i.e., sharing stickers with peers) **only** after hearing the story in which highly anthropomorphic images were paired with anthropomorphic language. Additionally, children with lower levels of anthropomorphic beliefs were more likely to understand realistic-language (vs. anthropomorphic-language) story, but story comprehension was not related to their sharing behaviors. The findings reveal the fine-grained impact of anthropomorphic stories on children's prosocial learning through anthropomorphic beliefs and story comprehension, adding new insights into early socio-cognitive development in the informal learning context.

P3-109 - Children's perceptions of math and spatial domains

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Details

Strong links between math and spatial abilities and attitudes have been well documented. For example, both math and spatial anxiety exhibit early emerging gender differences, and spatial anxiety is a strong predictor of math abilities. Thus, it has been proposed that spatial attitudes may inform math attitudes, particularly early in development. The current study explores the extent to which children (grades K-3; N=175) believe math and spatial abilities to be related (with reading abilities as a control). We evaluated children's beliefs about how excelling in one subject relates to performance in the other two domains. Results indicate a developmental shift, such that younger children associate math and reading, and older children associated math and space. Further, children treated strong spatial abilities as indicative of overall academic success, suggesting the spatial domain may be considered privileged. Results have important implications for understanding factors that inform beliefs about STEM domains.

P3-110 - How often do verbs and relevant events co-occur? Evidence from everyday interactions in Latin America and the US

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¹

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Details

There is little data showing how often verbs and events co-occur in speech, or how often word-to-world mapping is possible. In Study 1, two 45-60 minute interactions between 12 monolingual Spanish-speaking dyads (19-36 months, *Mage*= 28m) were transcribed and coded for exact time verbs were said and presence of a relevant event; proportions adjusted for overall talkativeness. For children, the average rate of events co-occurring with action verbs was 17%(ave.prop.verb=.17,SE= .05), which was similar to parents', 16%(ave.prop.verb=.16,SE = .04); combining these, children said/heard action verbs while seeing relevant events 33% of the time. Study 2 includes a similar U.S. sample (n= 12;23-36 months, *Mage*= 29m). For children, the average rate of verb+event was 16% (ave.prop= .16; SD=.09),which was similar to parents' 18% (ave.prop=.18; SD=.06); again, relevant events co-occurred with verbs about 1/3rd of the time(34%). These results are important because theories rely on verb+event co-occurrences but rates of co-occurrences are unknown.

P3-111 - Young children punish transgressions regardless of their perceived severity

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Details

Punishment is an essential way in which individuals maintain cooperation. Speaking to the foundational nature of punishment, research has demonstrated that young children are willing to incur personal costs to punish wrongdoings. Despite documenting this behavior in childhood, we have yet to better understand what factors promote punishment in childhood. Building on previous research, the present pre-registered investigation examined whether the perceived severity of a transgression influences the onset of punishment behavior in childhood between 5 and 12 years of age (*N* = 210). We tested this by using a well-established third-party punishment paradigm where children can sacrifice their own resources to remove resources from a transgressor. Importantly, we presented children with different transgressions (property destruction, theft, selfishness) and measured children's perceptions of those transgressions. We predicted that children would generally perceive property destruction and theft as more severe than selfishness and that children would correspondingly be especially inclined to punish such transgressions at earlier ages. We did not find support for this possibility. Instead, children judged the transgressions in the predicted ways, but younger children did not differentially punish these transgressions. These results show that the emergence of children's punishment behavior may not be tethered to their perception of the transgression.

P3-112 - The role of talker-specific accent information on children's referential communication

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Details

Mental perspective-taking and executive function are crucial to the comprehension of referential expressions. However, affiliation with mental inference target could undermine children's ability to reason about other people's perspective and accent has been suggested to be one of the strongest linguistic cues that could affect children's linguistic-based biases. The aim of this study was to investigate whether talker-specific accent information would affect children's interpretation of referential expressions. Forty-five 4- to 6-year-old children in the United States completed the director task as a measure of reference comprehension with two directors, one with a familiar accent of American English and one with an unfamiliar accent. Children were also administered one false belief understanding measure (unexpected transfer) and one executive function measure (Dimensional Change Card Sort). The performance in the director task was worse when the director had an unfamiliar accent. The results also indicated that executive function and false belief understanding were related to reference comprehension performance when the director had a familiar accent but executive function was the sole predictor of performance when the director had an unfamiliar accent. Overall, our results suggest that talker-specific accent information could potentially influence how children recruit their mental perspective-taking and cognitive skills and hence their performance in reference comprehension.

P3-114 - Must there be an explanation? Children and the principle of sufficient reason

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Details

Children make sophisticated explanatory judgments (Liquin & Lombrozo 2020; Gopnik 1996). Do children also make the metaphysical explanatory judgment that everything *must* have an explanation? If they do, this would conform to what philosophers call the Principle of Sufficient Reason (PSR; Melamed & Lin, 2021). In this study, 80 6-9-year-old children ($M_{age} = 7.92$, $SD_{age} = 1.21$) were shown statements across domains (Psychology, Biology, Nature, Physics, and Religion) and were asked if they agree or disagree that each statement must have an explanation. As a comparison, children were also asked about coincidences, which adults believe don't need an explanation (Partington et al., 2023). Children's judgments conformed to the PSR. In general, children thought that the psychological, biological, natural, physical, and religious statements must have an explanation, binomial $ps < .0001$, and this belief didn't differ between domains, $ps = 1.00$. Notably, we found a change in age for children's endorsement in the necessity of explanations for coincidences: 7-9-year-olds thought that coincidences don't need an explanation compared to the other domains, $ps \leq .006$, but 6-year-olds didn't distinguish coincidences from the other domains, $ps \geq .529$. This particular finding raises questions about children's understanding of coincidences. Together, this research is the first step at uncovering the development of our metaphysical explanatory judgment.

P3-115 - Associations between parents' scientific process language and children's science inquiry

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Details

Parents foster children's science learning through conversations about scientific processes. In this study, parents (N = 70) completed a demographic survey and were then videotaped engaging in two science activities with their four- to five-year-old child (i.e., balance scale, circuit). Immediately after, children's scientific inquiry was measured using a standardized tool. Interactions were later transcribed using the Child Language Data Exchange System (CHILDES) and coded for questions (open-ended versus close-ended) and references to science process language. We processed data in SPSS to quantify codes and identify associations between variables. While the frequency of questions did not relate to child outcomes, parental questions containing scientific processes were positively associated with children's science process talk and scientific inquiry scores. However, these associations were observed during the balance scale activity and not the circuit activity. Thus, the incorporation of scientific processes in parent-child interactions shows promise for children's science acquisition.

P3-116 - "I just followed the number line": examining children's strategies for interpreting and constructing graphs

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Details

Interpreting and constructing graphs can help build skills that are foundational for statistical literacy and critical thinking, as graphs require children to engage in numerical and spatial thinking. While studies of older children and adults indicate variability in ability and strategies for engaging with graphs, few studies have examined the development of young children's understanding of graphs. The current study examined variability in children's graphing strategies with a focus on the roles of math ability and math anxiety, two factors that have shown to be critical to strategy use in other early math domains. In the present study, children ($n=172$, $M_{age}=71$ months, 49% male) completed measures of graphing ability and strategy use. Coded strategies included: use axis labels, use relative quantities, identify exact quantities, decomposition, and counting. Children also completed measures of math ability and math anxiety. Preliminary analyses indicate that strategy use relates to accuracy ($r(170)=.839$, $p<.001$), such that children who used more sophisticated strategies solved more problems correctly. Strategy use also positively relates to math ability ($r(170)=.920$, $p<.001$) and negatively relates to math anxiety ($r(170)=-.172$, $p=.024$). Additional analyses will further examine factors related to graphing errors, and results will be discussed in terms of understanding individual differences in strategy use, with implications for the development of statistical thinking

P3-117 - Exploring demographic differences in parents' selection and implementation of character-based strategies with their children

Cassia Caruth¹, Milena Batanova¹, Lena White¹, Meredith Rowe¹, Richard Weissbourd¹

¹ Harvard University

Details

Despite robust research on parenting practices that cultivate empathy, gratitude, and diligence in children, limited data exists about whether and how diverse parents take up strategies to promote these virtues. This study offered 295 U.S.-based parents strategies to do with their 7-10 year-olds, and examined if demographic differences (Table 1) existed in parents' virtue selection and implementation. After choosing a virtue to focus on, parents were randomly assigned a strategy and given 3 feedback surveys over 8 months about take-up, dosage, and fidelity. The majority of parents reported doing their strategy each wave. Most parents reported weekly use (high dosage) and following the content as intended (high fidelity). Parents with higher income and education were more likely to select diligence and gratitude than parents with lower-income and education (Fig. 1). Among empathy parents, higher earners reported less dosage and fidelity (Fig. 2). We found no significant differences in dosage among diligence and gratitude parents based on demographic characteristics. Across virtues, Hispanic parents reported higher fidelity than other parents (Fig. 3). Results suggest that character-based strategies can appeal to diverse caregivers, yet some demographic differences exist. Qualitative responses on the questionnaires will help us understand these demographic differences and work toward more culturally-attuned strategies.

P3-118 - Codeswitching during shared reading among bilingual parents and children

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Details

Language exchanged during shared reading (extratextual talk) is a valuable source of input, particularly for dual-language learning children. Switching between languages (codeswitching) is common in speech and can be even more frequent in the text of bilingual books. However, how bilingual parents codeswitch during shared reading interactions remains poorly understood. Here, we analyzed extratextual talk during shared reading among Spanish-English bilingual parent-child dyads ($N = 43$; $M_{\text{age}} = 3.8$ years, $SD = 0.51$), and provide the first comparison of extratextual talk across two book formats: an English-only book and a bilingual book that included frequent switching. Preliminary results ($N = 6$) show that across both book formats, parents provided significantly more extratextual talk in Spanish compared to English [Fig. 1A]. Although parents codeswitched frequently when introducing extra-textual talk for both types of books, they codeswitched more when reading bilingual books [Fig. 1B]. Thus, we have the first evidence that the types of books that bilingual families read may shape their language use, and future analyses will explore links between language use and both parents' and children's proficiency. Findings have implications for understanding how parent-child shared reading interactions shape bilingual language development.

P3-119 - Parental math engagement with preterm and full-term toddlers

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Details

Prior literature suggests that children born prematurely disproportionately struggle in math later in life. Additionally, as early math ability correlates strongly with later math and reading, a growing body of literature examines how parental practices support young children's learning of number concepts at home—referred to as the home numeracy environment. In this study, we compare the home numeracy environment of preterm and full-term toddlers. We also explore how birth status affects counting skills. A sample of 20 2-year-old toddlers and their parents completed a picture description task to assess the frequency of parents' number talk with their children, a child counting task, and a home numeracy questionnaire for parents. Interestingly, parents of preterm children used more number talk than parents of full-term children; however, parents of preterm children also reported participating in significantly fewer home math activities even after controlling for home literacy activities. Limited evidence of a significant difference between birth status (preterm or full-term) and child's counting skills was found. Overall, these findings illuminate the need to differentiate between different aspects of the home numeracy environment (namely, parental number talk and home math activities) and provide opportunities for future expansion involving answering questions about how parental beliefs about their child's ability may affect the type of engagement children receive.

P3-120 - Being powerful may not be gendered, but being powerless is: children's gender attributions of socially powerful agents

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Details

Previous studies show children associate social power with boys more than girls. It is unclear whether the gender-power association is based on social category membership (i.e., being male) or having certain gendered attributes (i.e., being masculine). Thus, we investigated whether children assign gender and stereotypically gendered traits differentially based on power status. As prior work shows children can more easily identify powerful characters in malevolent scenarios, we also tested whether power valence affected these associations. 146 5-to-8-year-old children saw two vignettes featuring powerful and non-powerful characters that were not explicitly gendered in malevolent and benevolent contexts. Children made inferences about the gender of each character and rated how feminine and masculine they perceived the characters to be. Children were not more likely to identify the powerful character as a boy ($B = -.06$, $p = .54$, $OR = .94$) even when the character displayed power in a malevolent way ($B = .55$, $p = .12$, $OR = 1.72$). However, in malevolent power scenarios, children rated non-powerful characters as significantly more feminine ($M = 2.86$, $SD = 0.73$) than masculine ($M = 2.54$, $SD = 0.63$; $p < .001$), while there was no significant difference between masculine and feminine ratings for the powerful characters.

Thus, while children may not always associate being male with being powerful, they may tend to associate femininity with not being powerful.

P3-121 - Evaluations of competence in domestic dogs (*Canis lupus familiaris*)

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Details

The ability to evaluate agents using observed behavior is critical for navigating the social world. Social evaluation emerges early in human development; infants prefer prosocial over antisocial agents and children choose competent over incompetent agents. While this pattern of evaluation is well-documented in the human species, an open question concerns whether social evaluation is uniquely human. Comparative research suggests that evaluations of prosociality are shared across many species. However, less is known about nonhuman animals' evaluations of competence. Here, we explore whether dogs, a species who evolved alongside humans and shares a social environment with humans, demonstrate human-like evaluations of competence. In Experiment 1, we found that dogs do not preferentially recruit a competent human collaborator to assist with a puzzle. However, dogs looked longer at competent humans compared to incompetent humans suggesting that dogs can visually discriminate between collaborators on the basis of competence. In Experiment 2 we found that dogs prefer to interact with the winner of a competitive tug-of-war rope game. Notably, dogs did not prefer to interact with agents who acquired identical ropes in a non-competitive interaction. Taken together, these data suggest that dogs demonstrate sensitivity to human competence but may use this information differently than human children when choosing social partners.

P3-122 - Writing and reflecting: how middle school students learn from data visualizations during field trips

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Details

Field trips present valuable opportunities for students to engage in STEM practices and learn about STEM concepts (DeWitt & Storksdieck, 2008). However, how students engage in learning activities, such as whether they annotate data visualizations through drawing and writing, can impact their learning (Ainsworth et al., 2011). We examined how annotating data visualizations during a field trip to the Gulf of Maine Research Institute impacted middle school students' STEM language use when reflecting about the activity immediately after. In one field trip activity, 89 5th-6th grade student groups conducted a mock black sea bass stomach dissection and viewed a corresponding data table on an interactive touchscreen about the types of marine species that black sea bass consume. Students could annotate the data table by drawing or writing on the touchscreen as they considered whether black sea bass may

be a threat to the lobster population in Maine. Students' short post-activity reflections were analyzed for use of STEM-related language. Students who annotated the data table by writing more than three words used more than twice as much spatial, $F(2,69) = 4.19$, $p = .019$, and math language, $F(2, 69) = 6.34$, $p = .003$, in their reflections as students who did not write. We will highlight connections between annotations and STEM language use across a variety of activities and data visualizations and discuss implications for field trip activity design.

P3-123 - Infants' attention biases towards caregivers vs. strangers reflect social network size

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Details

Infants rely on developing attention skills to orient to and hold focus on social partners. Infants rapidly develop attention biases towards faces in the first month of life and very young infants preferentially look at their caregivers compared to strangers. Prior work has suggested that infants may show increased biases to attend to stranger faces with age. However, these findings have been mixed and the mechanism underlying this increased attention to stranger faces remains unclear. One possibility is that infants' attention biases to caregiver vs. stranger faces relates to the number and diversity of people that infants regularly come in contact with. In the current study we are investigating links between the size of infants' social networks and the development of attention biases to caregiver vs. stranger faces among 4- to 9-month-old infants (preliminary $N = 14$; target $N = 150$). We recorded eye movements as infants viewed multi-object arrays containing the caregiver or stranger face. We measured frequency and speed of orienting and duration of looking to the faces. We also measured infant's social network size using the Child Social Network Quality scale (Burke et al., 2022). Preliminary results indicated that infants with larger social networks may be more biased to attend to stranger faces ($r(12) = -.459$, $p = .099$). Ongoing data collection and analyses will further explore these findings.

P3-124 - Knowledge-behavior gap: does prosocial norm understanding predict actual prosocial behavior?

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Details

Early in development, children act on behalf of others in three prototypical ways: children will help, share, and comfort in response to others' instrumental need, material desire, and emotional distress, respectively (Dunfield, 2014). Prosocial behavior develops partly through interactions with others (Dahl, 2015), which leads children to internalize expected standards of behavior (Chudek & Henrich, 2011). Thus, children gain a normative understanding of prosocial behavior as they mature (Paulus, 2014). Yet despite knowing how they *should* behave, children don't always act on this knowledge (e.g., Smith et al., 2013). This study explored whether knowledge of prosocial norms predicts children's prosocial behavior

across three varieties of prosocial behavior. Overall, 190 3.5- to 7.5-year-olds were presented three vignettes describing helping, sharing, and comforting in two children – one with a need and one with the opportunity to be prosocial - and asked what should be done. Later, children were given the opportunity to engage in helping (i.e., opening a blocked door), sharing (i.e., giving up resources), and comforting (i.e., offering reassurance after a teddy was broken). McNemar tests revealed inconsistencies in the prosocial knowledge-behavior gap: norm endorsement predicted comforting and sharing frequencies, but not helping. Thus, prosocial interventions need to educate children on how to act on their prosocial norm knowledge.

P3-125 - How peer informant gender impacts children's novel word learning and recall

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Details

Children use environmental cues to facilitate word learning. Although past research indicates children prefer learning from ingroup members, no previous research explores children's word learning and learning retention when informants are gender ingroup and outgroup members. This study investigates if 5-year-olds (N= 51; 26 female) learning of novel word-object pairs is impacted by informant gender via an experimenter guided tablet study. After familiarization establishing informants' equal reliability, informants labeled novel objects, each one receiving a total of two novel labels, one from each informant. Learning of the novel word-object pairs was assessed in two tests: (1) immediately after learning and (2) after a 10-minute delay. Participants demonstrated above-chance recall of novel word-object pairs during the immediate and delayed tests, regardless of informant group membership. The present findings highlight that children's gender-based learning preferences may not align with children's actual learning when both informants have demonstrated that they are equally knowledgeable.

P3-126 - Individual differences in third and sixth graders' fraction understanding and relations to executive function and spatial/relational reasoning

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Details

Understanding the nature of cognitive skills in early childhood is essential as they predict later financial, career, and academic success. Prior work suggests that both executive functions (EFs) and spatial skills are foundational for mathematics performance, yet only a few studies have examined them in concert. We conducted a secondary analysis of two datasets used in previous studies: The first consisted of 3rd graders ($n = 51$, from school districts with 7.9 to 18.8% non-White population and 47 to 50% female), whereas the other consisted of 6th graders ($n = 68$, 79% white, 38% female). Participants completed tasks assessing their EFs, spatial/relational reasoning ability, and fraction understanding. Using a k-means clustering approach, we found that two clusters were optimal in both grade levels, based on

performance on fraction number line estimation and fraction comparison tasks. For 3rd graders, the clusters differed more on the estimation than the comparison task; the converse was true for 6th graders. Further analysis showed that for 3rd graders, the clusters significantly differed on working memory tasks, but not spatial reasoning. For 6th graders, the clusters significantly differed on inhibitory control and patterning tasks. Overall findings highlight the role of EFs and spatial reasoning. They may point to students' increasing attention to the relational structure of fractions and integration of both whole numbers and fraction magnitude knowledge.

P3-127 - Shifting standards for the same work: youth use different standards when judging performance based on wealth status and race

Sky'asia Wright¹, Emme Edwards¹, Rose Beacham¹, Margaret Belenky¹, Melanie Killen², Amanda Burkholder¹

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Details

Shifting standards refers to using different metrics for performance based on stereotypic expectations of social group members, such as viewing fathers cooking dinner three nights a week as more competent than mothers cooking three dinners per week. There is a paucity of work investigating whether youth use shifting standards of performance based on wealth status and race.

121 9–14 year-olds read three pairs of identical statements about high and low wealth characters related to work ethic and intelligence (e.g., “X got 90% on his math test”) and three pairs of identical statements related to friendliness and respectfulness (e.g., “X helps the teacher clean up the classroom 2 times a week”). Participants rated characters on Likert scales (e.g., 1 = *really unfriendly*, 5 = *really friendly*), and averaged composites were created for each trait. Between subjects, characters were depicted as Black or White.

Displaying shifting standards based on economic status, generalized linear models showed youth rated wealthy peers as more hardworking, friendly, and respectful, $p_s < .001$, and marginally more intelligent, $p = .054$. For work ethic, youth rated poor Black children as more hardworking than wealthy White children (Figure 1). Additionally, White youth rated poor children as more hardworking than wealthy children, $p < .001$, and wealthy children as less hardworking than Black youth, $p < .025$ (Figure 2). We will discuss implications related to prejudice and intersectionality.

P3-128 - Examining the relationship between fantasy orientation and skepticism or credulity in children

Ansley Gilpin ¹

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Details

We investigated whether children who have a preference toward fantasy (fantasy orientation) are more likely to have a fantasy bias, that is, be more credulous or skeptical, and how children with no bias may compare on related constructs. Participants (N=379) ranged from 3-5 years of age including teacher informant report. Bias was measured by asking children whether novel entities were real or pretend, with scores of 80% or more as “real” or “pretend” indicating a bias. Findings suggest bias does not differ by age, gender, ethnicity, executive function, or vocabulary. Rather, children with a credulity bias (e.g., believe novel entities are real) are more likely to personify objects, have higher scores of pretense and fantasy orientation, emotional lability, and their teachers rate them higher in fantasy, specifically impersonation. Results are discussed in terms of how fantasy orientation and fantastical play may be related to skepticism and credulity.

P3-129 - Ratio discrimination across formats in 6-month-old infants

Michelle Hurst ¹, Amanda Woodward ², Susan Levine ²

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Details

Although preschool-age children can compare area-based proportions (e.g., pie charts), they make systematic errors with discrete proportions (e.g., dots; Hurst & Cordes, 2018). In contrast, infants can readily track and use discrete proportions (McCrink & Wynn, 2007; Denison & Xu, 2012). Here, we ask whether infants’ attention to and discrimination of proportion also varies across continuous vs. discrete formats. Six-month-old infants (via Children Helping Science; Scott & Schulz, 2017; Sheskin et al. 2020) were randomly assigned to condition in a 2 x 2 design: (1) Rectangle or Dot stimuli and (2) harder (2:1 vs. 3:1) or easier (2:1 vs. 4:1) comparisons. Using a preferential looking design, infants were familiarized to one ratio (10 trials) and then presented both a familiar and novel ratio at test (4 trials). In preliminary analyses (N=46), infants looked longer at dots (vs. rectangles; $p=.02$), and their looking significantly decreased across trials for both, as expected ($ps<.05$). On test trials, the overall pattern is consistent with a novelty preference on easier comparisons of dot-based proportion but not harder dot-comparisons (as in McCrink & Wynn, 2007) or on either rectangle comparison. However, this pattern is not significant on average and is only significant on the second test trial. Together, this suggests that inherent differences in the visual-spatial information across formats may contribute to differences in how proportion is encoded.

P3-130 - Who brags about what? Children's gendered expectations of bragging

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Details

Self-promotion, or the act of communicating positive traits or qualities about oneself, is a useful behavior to signify competence—something women may desire to do to achieve equal status to men. When women engage in self-promotion, however, they suffer negative social evaluations for acting immodestly. Men, on the other hand, do not. Do children think that self-promotion is a male behavior—and is it always attributed to males? To address this, we focused on a behavior that is inherently self-promotional and familiar to children: bragging. We asked whether children (ages 6-10 years old; $N = 181$) have expectations about who brags (boys vs. girls), and about what (ability vs. resources vs. kindness). We found that, with age, children are more likely to expect a boy to brag. Moreover, boys were also more likely than girls to expect boys to brag. Finally, we found different expectations for who brags about their general ability (e.g., a child who frequently says “I’m so good at this”), their resources (e.g., a child who frequently says “I have so many great toys”), or their kindness (e.g., a child who frequently says “I’m so nice”). Whereas children in the ability condition expected boys to brag, children in the resources and kindness conditions showed no bias for whom they expected to brag. Our results show that to children, bragging is not a male behavior per se, but instead is associated with males in certain domains (i.e., ability).

P3-131 - Children's and adults' reasoning about generic statements concerning social kinds

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Details

In two studies, we explore the role of counterexample type in judgments of generic statements about social kinds. In Study 1, children (ages 5-10; $N=72$) and adults ($N=101$) were presented with generics concerning the preferences or abilities of a series of 10 novel kinds of people (e.g., "Leams love birds") and for each, asked which of 2 depicted social groups was referenced. Both groups contained the same amount of positive evidence (members with the generic property) and differed only in whether counterexample members showed positive (an alternative property) or absent counterevidence (no property given). *Results.* Both children ($M=.88$, $p<.001$) and adults ($M=.95$, $p<.001$) more often selected the samples displaying absent counterevidence, indicating that alternative properties are more likely to block a generic interpretation. This intuition became stronger over childhood ($p<.05$).

In Study 2 (ongoing), we use a converging task to explore the strength of different types of counterexamples. Participants (projected $N=180$ children ages 5-10 and 200 adults) will see samples of novel social kinds and, for each, asked whether they agree or disagree with a corresponding generic statement. We will vary the proportion of counterexamples, and whether the counterexample members display positive or absent counterevidence. This study will test whether adults and children are less

likely to agree with social generalizations when presented with negative vs. absent counterexample evidence.

P3-132 - Dual language learning, working memory, and math achievement in kindergarten

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Details

In 2020, over five million dual language learners (DLLs) were enrolled in U.S. public schools (NCES, 2023). Prior research has documented DLLs' cognitive advantages in executive function, including working memory (WM; Adesope et al., 2010). WM is critical for complex cognitive activity such as mathematical cognition, yet less is known about the relations between DLLs, WM, and early math learning. The present study examines the relations between kindergarteners' language status, WM, and end-of-year math achievement drawing from the Early Childhood Longitudinal Study 2010-2011. The R package *lavaan.survey* was used to conduct a structural equation model predicting children's math achievement by their language status at kindergarten entry, initial WM, and growth in WM across the school year, controlling for age, sex, and SES. The results suggest that DLLs (home language of Spanish, working towards English proficiency, $n=712$) and Spanish bilingual children (home language of Spanish, proficient in English, $n=1469$) had lower initial WM and comparable rates of WM growth to English monolinguals ($n=10589$). Math achievement was predicted by WM and language status, with no difference between monolinguals and bilinguals and a significant difference favoring monolinguals relative to DLLs. These results take a first step towards unpacking the complex relations between DLLs, WM, and mathematics achievement, with implications on how to best support diverse early learners.

P3-133 - Do parents' scientific or religious values relate to the lies they tell their children?

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Details

Parents teach their children that honesty is virtuous. Despite this, parents vary in their views about lying to children, with some parents endorsing some types of lies acceptable to varying degrees (such as fantastical lies and instrumental lies to control children's behavior). Yet, little is known about what factors contribute to this variability. The current study examines parents' attitudes about science and religion as factors that may influence how acceptable they think it is to tell children fantastical and instrumental lies. Parents ($N = 225$) of 4- to 10-year-old children rated the acceptability of different kinds of lies. They also completed measures examining their attitudes about science (i.e., their personal interest in science, views of science and scientists, and the utility of science; Szechter & Carey, 2009) as well as the Duke University Religion Index, measuring religious involvement and belief (Koenig et al., 1997). We plan to construct linear models regressing these science and religious measures on parents' acceptability of telling their children fantastical and instrumental lies. We anticipate that parents who

are more favorable of science will be less accepting of fantastical and instrumental lies. Given that past research findings are mixed (Heyman et al., 2013, Setoh et al., 2016), we will also explore how different aspects of religiosity relate to the acceptability of fantastical and instrumental lies. Implications will be discussed.

P3-134 - Examining the reliability and validity of a parent-report executive function rating scale

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Details

Parent report of child behavior plays a crucial role in measuring children's executive function (EF) skills in ecologically valid settings. However, there are few valid parent-report measures of children's EF skills. In this study, we examined validity and reliability of a 14-item EF extension subscale of the Children's Behavioral Questionnaire Very Short Form (CBQ-VSF) in a midwestern urban US parents of children ages 3-7 years old ($N=136$). Items in the EF subscale demonstrated good internal consistency ($\alpha=.79$). Within the CBQ, the EF subscale was negatively correlated with surgency ($r=-.19$) and negative affectivity ($r=-.36$) and positively correlated with effortful control ($r=.42$). We also found a significant correlation between the EF subscale and a behavioral composite measure (Forward and Backward Words Span, Gift Delay, and Minnesota Executive Function Scale) of EF ($r=.25$), but this was no longer significant when we controlled for age. These findings suggest the EF subscale of the CBQ may be an appropriate parent report measure of child EF. Future research should further examine the psychometric properties of this subscale as well as explore its associations with other lengthier parent report measures of EF.

P3-135 - 20-month-olds use syntax and semantics to map from sentences to spatial relations

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Details

When are infants able to flexibly map between their set of early-emerging spatial concepts (e.g., containment) and their developing spatial vocabulary (e.g., The cat is *in* the box)? We investigate this by asking when infants understand that both the syntactic and semantic properties of a sentence serve to constrain the kinds of spatial relations that the sentence may be used to describe. We test 20-month-old Hungarian infants' understanding of sentences involving the locative suffix *ban* (meaning "in") and use containment relations with reversible participant structure to investigate whether infants use (i) the semantics of *ban* to differentiate between containment and other spatial relations (the bucket is in the box vs. next to the box) and (ii) the syntax of *ban* sentences to understand the participant structure of the containment relation (the bucket is in the box vs. the box in the bucket), especially when this goes beyond canonical spatial relation schemas (the cat is in the box vs. the bucket is in the box). We also examine the role of vocabulary size in infants' developing understanding of the sentence-relation mapping. We find that 20-month-olds do use both syntactic and semantic properties of *ban* sentences

to understand which containment relations are expressed, but only those infants who produce more words than their peers.

P3-136 - Youths' expectations for social mobility take both race and wealth status into account

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Details

Youth expect Black children to grow up with less wealth than White children. No research that we know of has investigated whether these expectations are driven solely by race or by an expectation that Black children start with less wealth. The present study disentangles youths' perceptions of social mobility by systematically varying race and wealth status.

57 Black and 64 White 9- to 14-year-olds from diverse economic backgrounds viewed one of two conditions: 1) a rich Black child and a poor White child or 2) a rich White child and a poor Black child. Participants rated how much money each child would have when they grew up on a 5-point Likert scale. They also selected the job the character would have (janitor, teacher, or doctor).

Generalized linear models revealed youth overall expected rich characters to have more money and more prestigious jobs as adults, $ps < .001$, although children expected poor characters to have more money than did adolescents, $p = .024$. For expectations of money, ratings varied by participants' own wealth status (higher or lower compared to the sample median) and condition (Figure 1). When the Black child was depicted as rich, higher wealth youth expected the character to have more money as an adult than did lower wealth youth. Lower wealth youth, overall, expected Black characters to have less money than their White counterparts. These findings show that youths' expectations for social mobility are impacted by both race and wealth status.

P3-137 - Exploring children's motivation to pay a cost to follow rules

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Details

Prior work suggests that children are motivated to follow rules. However, these studies are often fun, and thus arguably intrinsically motivating (Over & Carpenter, 2011; Kenward, 2012). Therefore, questions remain about the strength of children's normative motivations.

We explored whether children are willing to forgo a desire in favor of following a rule in the relevant context. 120 4- and 5-year-olds ($M_{age} = 4.95$, $SD_{age} = 0.58$) encountered two marble runs—one "boring"

and the other "fun". Children then heard either contextually-relevant, irrelevant, or imperative rules about the toys.

Our results demonstrate that preschoolers willingly incurred a personal cost to follow a rule perceived as relevant or imperative ($ps < .001$) but not for an irrelevant rule, $p < .654$. This research highlights the role that norms play in regulating children's behavior and raises questions about the cues children use in order to determine which rules to follow and how often.

P3-138 - Understanding whether and which indicators of socioeconomic status predict cognitive strategy selection for a visuospatial science task

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Details

Cognitive strategies play a key role in achievement, and could help to explain why students of differing socioeconomic backgrounds perform differently on visuospatial reasoning tasks and measures of science achievement. Students from differing socioeconomic backgrounds may rely on differing reasoning mechanisms during cognitive tasks. Socioeconomic status (SES) can be measured in a variety of ways (e.g., family income, parental education, area deprivation) and understanding which of these elements relate to outcomes can be informative to policy and future research. Middle schoolers ($N = 56$) completed two visuospatial reasoning tasks: domain-general (matrix reasoning) and domain-specific (genetics) and had their cognitive strategies measured through self-reported verbal & visual strategies and by eye tracking. Results revealed that education and area deprivation did not significantly impact self-reported strategy use in either domain but income did significantly predict self-reported strategy use for the science task ($b = -.08$ $t(23) = -2.59$, $p = .02$) such that lower-income students relied more on visual strategies and higher-income students relied more on verbal strategies. Differences in strategies measured by eye tracking will also be presented to further illuminate the relationships. Results demonstrate differences in cognitive strategies for students of differing income backgrounds and that this depends on the domain of task and the measure of socioeconomic status.

P3-139 - Will I help or befriend? Children's and adults' coordination of the social past when evaluating traits and making sociomoral decisions

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Details

The current study investigated children's and adults' trait evaluations and willingness to help or befriend agents who have both helped and harmed in the past. We further tested connections with attachment security to explore whether individual differences in relational history inform how children and adults reason about these ambiguous sociomoral situations. Four- to 10-year-olds and adults ($N=197$)

responded to trials, each featuring an agent interacting with another person: *mostly harmful agents* harmed twice and helped once, whereas *mostly helpful agents* helped twice and harmed once. Participants evaluated each agent as nice or mean, and they predicted whether they would befriend or not befriend, and help or not help someone who acted like that agent. All participants self-reported their attachment to their primary caregiver (10-item scale); caregiver reports were also obtained for children. Preliminary analyses revealed that all age groups more often evaluated mostly helpful (vs. mostly harmful) agents as nice and judged that they would help and befriend them ($ps < .001$). Across trials, we further documented age-related decreases in “nice” judgments (4-7yrs > adults, $ps < .021$), and age-related increases in decisions to help agents, even mostly harmful ones (4-5yrs < 8-10yrs < adults, $ps < .003$), with no age differences in friendship decisions. Further analyses will test associations among age, trait evaluations, befriending, and helping, including relations to attachment.

P3-140 - Unveiling curiosity: a multi-dimensional exploration of K-3rd graders' curiosity

Natalie Hutchins¹, Natalie Evans¹, Jamie Jirout¹

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Details

Evidence suggests that curiosity and resulting exploration and persistence can support academic performance and longer-term well-being (Von Stumm et al., 2011; Kashdan & Steger, 2007). Yet, despite its importance, past research suggests that curiosity seems to decline with schooling (Engel, 2011; Post & Walma van der Molen, 2018). While there have been efforts to better measure and understand children’s curiosity, theoretical conceptualizations of curiosity in children vary and many studies include only one measure. Here, we examined two cohorts of K-3rd graders’ ($N=98$) curiosity through three newly developed measures focusing on different facets of curiosity: uncertainty exploration (UE), information seeking (IS), and a self-perception (SP) survey with two test times in the second cohort. Preliminary findings show differences among the three tasks, with a lack of associations suggesting distinct aspects of curiosity being measured on each task (all $p > .05$; r values from $-.07$ to $.22$, except UE and SP, $r = .27$, $p < .05$). Stability between timepoints was observed within two tasks (r values $.50$ -. 52 ; p values $< .001$; UP $r = .12$, $p = .38$). Despite the popular belief that children become less curious with age, we did not see any differences in curiosity across age in our sample (p values $.2$ -. 9). These findings suggest the complexity of understanding curiosity in children and the importance of work on developing reliable and valid measures of it.

P3-141 - Exploring the developmental origins of gender stereotypes: children's emerging beliefs about social hierarchies

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Details

Pernicious gender stereotypes that attribute greater competence to men and greater warmth to women emerge by 7 years of age (Bian et al., 2017; Kim et al., 2023). In the present research, we explored a novel account of the developmental origins of these gender stereotypes, considering whether children's emerging beliefs about gender differences in social status may spur their acquisition of these gender stereotypes during middle childhood. In two studies of 312 American 5- to 12-year-olds, we found that children associated high social status with competence more so than warmth and with boys/men more so than with girls/women, and developmental change in children's gender-status associations related to their increasing endorsement of gender stereotypes about competence and warmth across middle childhood. These results advance our understanding of the origins of influential gender stereotypes about competence and warmth and inform pragmatic approaches to mitigating these early-emerging biases.

P3-142 - The crazy cupcake game: collaboration and competition in young children

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Details

Board games have been found to promote numerical learning in children, yet gender differences in response to competition may differentially impact learning outcomes. We had 44-70 month old children play a linear board game to promote numerical understanding in one of three conditions: competition (only the winner received stickers), collaboration (both players received stickers), or neutral (participants received stickers based on the number of games they played). The children met with the experimenters for five sessions. During the first visit, they completed a pre-test that included a numerical magnitude task, a number line estimation task, a modified Give-N task, and two sharing tasks before playing the linear board game. The posttest, including those same four activities, was administered in the last visit after playing the board game. The goal of the study was to determine whether distinct social contexts promote (or hinder) learning, and whether girls and boys were differentially impacted. Preliminary results showed no learning changes from pre- to post-test, however, gender differences in collaboration/competition were observed, with girls tending to use more collaborative strategies.

P3-143 - Death is an open book: investigating parent attitudes toward using death media with their children

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Details

Previous work describes Western practices of shielding children from death (Ariès, 1974; Rosengren et al., 2014). We explore the relationship between practices surrounding death and parents' comfort in using death media with their children. In a survey including 115 parents in Boston, Massachusetts, we found that among those inclined to shield their children from death portrayed in books ($n = 12$), 75% reported participating in death rituals, and 16.6% reported having death-related discussions with their children. Conversely, of parents comfortable with death portrayed in books ($n = 103$), 73.7% participated in death rituals, with 52.4% engaged in death-related discussions. A logistic regression model indicates a significant association between comfort reading about death and having discussed death with children ($p < .05$). These findings challenge the notion of U.S. parents shielding their children from death, suggesting an opportunity for positive interventions to enhance parental awareness and understanding of death communication.

P3-144 - Boundaries of early forgiveness: the impact of apology type and transgression frequency on children's forgiveness decisions

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Details

Cooperation is crucial for human societies. Thus, when it is damaged by transgressions, we must ameliorate the damage and repair our cooperative relationships. One key aspect of this repair is forgiveness. Yet forgiveness may most usefully serve to repair cooperation when it is bounded, i.e., when it is preferentially directed toward those who promise to be better future cooperators.

We examined early boundaries of forgiveness in 3 studies. In Study 1, 6-year-olds ($N = 38$) exhibited greater forgiveness toward accidental and intentional transgressors who showed remorse versus no remorse ($ps < .05$). Study 2 (ongoing; planned $N = 48$) extends this work by manipulating the type of apology. Initial data suggest that 6-year-olds are more forgiving toward transgressors who offer elaborate apologies rather than simple ones. Study 3 (piloting completed) will further extend this work by asking whether 6- to 8-year-olds (planned $N = 120$) are more forgiving toward occasional than repeated transgressors. We expect that all or nearly all data for Studies 2 and 3 will be collected before the conference.

Our findings thus far suggest that children as young as 6 display nuanced forgiveness boundaries, revealing a sophisticated understanding of both the nature of transgressions and the quality of transgressors' apologies. This allows children to identify and forgive better cooperation partners, thereby contributing to the success of cooperation.

P3-145 - Infants' manipulation complexity is influenced by object affordances

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Details

Manipulation complexity (MC) is a novel way to index fine motor skill. Measuring MC involves examining contrasts in (1) unimanual or bimanual manipulation; (2) synchronous or asynchronous use of the hands; (3) dependent or independent finger use; and (4) in objects that deconstruct, whether the hands manipulated one object or multiple objects. The purpose of the current analysis was to determine if infants' manipulation can be ranked according to difficulty. We hypothesized that the order of difficulty varies based on the affordances of the object. We predicted differences in cumulative rank between objects that deconstruct versus those that do not deconstruct. Ninety typically developing infants were assessed for MC at 6 monthly visits from 9-14 months of age from a battery of 13 objects (8 deconstruct; 5 do not deconstruct). Preliminary Guttman analyses suggest that object affordances do affect difficulty order, which has important implications for measuring MC across infancy.

P3-148 - The role of environmental context in scaffolding children's word meanings

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Details

Children tend to encounter objects in specific contexts, for example, foods in the kitchen (Custode & Tamis-LeMonda, 2020). Do children use these contexts to ascribe meaning to novel words? Preschoolers observed novel object-label pairs either in kitchen or outdoor contexts. At test, children heard sentences in which one of the novel words was preceded by a verb that was either related to the context the object was pictured in (e.g., "eat" for a kitchen object) or neutral ("find"). We measured whether children's anticipatory eye movements (AEMs) to the target object after hearing the verb differed between neutral and context-related verb trials. This design introduced two competing pressures: increasing variability to maintain interest and decreasing variability to make the verb manipulation salient. In one version, the test sentences included variable carrier phrases ("Do you want to," "It's fun to") and the training and test trials were interleaved. In another version, there was one carrier phrase ("I like to") and training and test trials were blocked. With stimuli variability, preschoolers' (N=46) AEMs did not differ between neutral and context-related verb trials. When variability was reduced, preschoolers (N=38) made more AEMs in context-related verb trials than in neutral verb trials (Figure 1E). These data illustrate the impact of different experimental design choices and suggest that children may indeed be using the environmental context to ascribe meaning to words.

P3-149 - What influences infants' regulatory skills? Exploring the role of parental emotion reactivity and infants' resting EEG activity

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Details

Infants' early abilities to regulate their emotions is an important development, with links to later healthy social outcomes. What contributes to individual differences in development of these important regulatory skills? Existing research suggests the neural circuitry supporting emotion development specializes in the first year of life (Leppanen & Nelson, 2009), and that this specialization may be influenced by parents' own emotion reactivity (Xia et al., 2023; Morris et al., 2007). However, this possibility has not been directly tested. The present study examines whether parental emotion reactivity (assessed via self-report Emotion Reactivity Scale; Nock et al., 2008) is related to 4-month-old infants' brain activity and whether infants' brain activity further predicts infants' emotion regulation (assessed via Infant Behavior Question subscale) (N = 45). We focus on a neural signal in infants' EEG that has been linked to emotional development and regulation, and that undergoes change in infancy: resting-state EEG 6-9 Hz frontal power. Linear regressions reveal that increased parental emotion reactivity predicts increased relative infant frontal 6-9 Hz power ($b = 0.001$, $p = 0.05$) which separately predicts reduced infant regulation ($b = -0.03$, $p = 0.04$). A full mediation model will be tested with a larger sample (data collection on-going). Results provide preliminary support for a mechanistic model in which parental emotional reactivity shapes infants' regulatory abilities by influencing infants' resting-brain activity.

P3-151 - How youth think about wealth inequalities created through structural, individual, and random reasons

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Details

Developing cognition about wealth inequality is important to investigate given it may influence youths' support for equitable policies. No research that we know of has systematically investigated whether youth explain inequalities due to structural, individual, or random reasons, and their likelihood of rectifying such inequalities.

262 racially and economically diverse 9-14-year-olds evaluated wealth inequalities when the explanation was 1) hidden, 2) individual, 3) structural, and 4) random (1 = *really not okay*; 6 = *really okay*). Participants were also asked whether they would elect to redistribute the wealth equally among the characters (0 = *no*; 1 = *yes*).

A generalized linear mixed model revealed youth differentiated reasons, evaluating structural reasons more negatively than individual, random, or hidden reasons, and evaluated individual and random reasons more positively than hidden reasons, $ps < .001$ (Figure 1).

Logistic regressions showed adolescents redistributed wealth in response to structural reasons but not individual and random reasons, while children preferred redistribution for all reasons, $ps < .003$. Adolescents may thus coordinate their desires to rectify inequalities with the knowledge of whether the inequality's reason was fair or unfair. However, higher wealth youth were less likely than their lower wealth peers to redistribute wealth for a hidden inequality, $p = .049$, revealing nuances in preferences for equity based on youth's wealth background.

P3-152 - Interrupting the cultural transmission of idealized biological prototypes

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Details

Young children tend to hold narrow, idealized prototypes for animal and social categories, focusing on how categories *should* be and ignoring variability. The current studies ($N = 281$) tested whether interrupting the cultural transmission of essentialist and teleological biases limits children's development of idealized prototypes. In Study 1, 7- to 8-year-old children developed less idealized prototypes of novel animal categories when they heard a teacher correct a generic statement about a characteristic feature and highlight how varied features serve varied functions (Fig. 1). In Study 2, explanations about varied functions alone explained this effect for novel animals, with mixed effects for familiar animals; there was no additive effect of correcting generic language. Children in Study 2 also expected functionally ideal features to be more frequent (Fig. 2), suggesting that idealized prototypes reflect mistaken assumptions that category members homogeneously share ideal features. Children in Study 2 did *not* explicitly disapprove of nonconformity, suggesting that idealized prototypes do not reflect an inability to dissociate how things are from how they should be. Together, these results support the proposal that narrow, idealized prototypes are shaped by common conceptual biases that are perpetuated and reinforced by cultural input.

P3-153 - Children's and adults' reasoning about how expected wait time influences preferences and emotions

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Details

We are investigating children's (aged 4-10 years) and adults' (current $N=81$; anticipated $N=100$) reasoning about how preferences and emotions may change based on varying expected wait time. All participants wait three minutes to receive a treat (e.g., candy). Before the waiting period, half of the participants are asked to wait 5-6 minutes (low expectations; unexpected) and half are asked to wait 2-3 minutes (expected). After receiving the treat, participants report their affect about their wait-time and about imagining how they would have felt about their wait time if they had held alternative expectations (two 6-point scales from "dislike a lot/feel very bad" to "like a lot/feel very good." Preliminary results demonstrate that there were no differences within age group by condition for either question type. Of interest, when children in the expected condition imagined having low expectations instead, they judged that they would have felt worse than they reported currently feeling ($p<.001$), whereas adults reasoned that prior low expectations would lead to feeling better ($p=.002$). Both children and adults think that expectations about wait-time influence affect, but this does not map on to actual experience.

P3-154 - Pretense and persistence: disentangling the roles of psychological distancing and embodied competence in the "Batman Effect"

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Details

Children can display increased persistence, lower frustration, improved executive function, and greater ability to delay gratification when embodying competent characters. These effects have been attributed to psychological distancing, a process of thinking about one's self using an outsider's perspective, which enables adults to regulate their emotions and improve their performance on difficult tasks. However this effect may also be driven by children's embodiment of the characters' competence. Children delayed gratification when dressed as Batman but not when dressed as the superhero Dash, who was described as impulsive. This study seeks to decipher the mechanism by which pretense can improve young children's persistence and emotion regulation.

Children aged 4-6 were asked either to embody an animal described as hardworking (competent condition), embody the same animal with neutral descriptors (neutral condition), or not to embody a character (control condition). Children then attempted to open an impossible box for up to 10 minutes. In initial data ($N = 7$ of 90), children persisted for 1-7 minutes. We will test whether time spent, level of frustration, and ability to self-regulate following frustration differ among the three conditions. We

hypothesize that children in either the competent condition or both the competent and neutral conditions will outperform children in the control condition.

P3-155 - Literacy and spatial representations of time and number in preschoolers

Sahana Sridhar¹, Ariel Starr¹

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Details

In cultures all over the world, we use space to represent abstract concepts. In many Western cultures, adults instinctively use a left-to-right linear reference frame to think about time and number (i.e., the mental timeline and number line). The mental timeline develops gradually as children gain experience with left-to-right reading and writing direction. However, research on the effect of orthography on the construction of the mental number line is more sparse. The present research aims to answer two key questions: 1) do children spontaneously construct the mental timeline and number line along the same spatial axes? and 2) how do early literacy skills influence the development of the mental timeline and number line? Children (N = 15, 3.5-4 years, data collection is ongoing) were asked to physically arrange cards that represented either the sequence of events from a story or varying numerical magnitudes. They also completed a literacy assessment. Preschoolers most frequently made left-to-right lines when representing temporal order but most frequently arranged numerical information nonlinearly. Literacy skill was not correlated with the number of left-to-right lines produced in either domain. These results suggest that the mental timeline may form prior to mental number line, and neither may be directly influenced by early reading skill. These data provide new insights into how children spatialize abstract concepts.

P3-156 - Assessing infant affect-biased attention using steady-state visual evoked potentials

Alexa Monachino¹, Alexis Hernandez¹, Isaac Morales¹, Melanie Kwan¹, Santiago Morales¹

¹ University of Southern California

Details

Attention bias to threat may play a causal role in the development of anxiety. However, results are inconsistent partly because the literature relies on indirect and unreliable measures of attention. Steady-state visual evoked potentials (ssVEPs) are a neurophysiological response to stimuli flickering at a specific rate (e.g., 6 Hz), which can be captured by EEG providing a robust and direct measure of attention. The high signal-to-noise ratio of ssVEPs may be particularly useful in high-artifact populations (e.g., infants). We hypothesized that we would be able to use ssVEP's ability to capture infant attention to stimuli through increased SNR at the specified frequency (6 Hz). We further hypothesized that we could detect infant attentional bias via increased SNR to threat stimuli (fear and anger) over neutral stimuli.

Infants (N=50; MeanAge=9.87 months) were shown a series of faces with one of four affective expressions (neutral, happy, fear, and anger), flickering at a rate of 6 Hz. We pre-processed the data using HAPPE+ER and calculated the SNR to assess infant attention. Results indicate that ssVEPs can robustly capture infant attention to stimuli with high SNR. However, there were no significant differences in attention between affective conditions. Ultimately, we show that ssVEPs are a robust measure of attention in infancy, but further testing is needed to see whether they can capture attention bias and are related to risk factors for anxiety (e.g., temperament).

P3-157 - The pink lie: how children evaluate and understand lies told to seem similar to others

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¹ Southern Illinois University Carbondale, ² Southern Illinois University

Details

People often tell lies to be similar to others in order to initiate and/or maintain social relationships. Little research has been done on this specific lie, which we call a pink lie. The present study examined how children evaluate a pink lie and comprehend the motivation behind telling it. Children aged 4-9 heard two regular-lie and two pink-lie stories. In each story, two characters chose their preferred toy, and then a target appeared and chose one of those two toys. In the regular-lie story, one of the two characters breaks their toy and lies to the target; and in the pink lie story, one of the two characters lies to the target about the toy they chose to show similarity with the target. After each story, children were asked to rate how bad each lie was, and which characters would want to be friends with the target and vice versa. Preliminary results show that children distinguished between regular and pink lies and rated regular lies to be worse than pink lies. In both the pink-lie and regular-lie scenarios, more children stated that the truth-telling character who showed initial similarity wanted to play with the target more and would also be the target's preferred friend. This effect was greater in the regular-lie scenario. By exploring children's understanding of lying in social relationships, the current study contributes to literature on the development of lying.

P3-159 - Beyond the veil: examining underrepresented identities in children's literature about death

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¹ University of North Texas

Details

Research on children's books about death have analyzed the presentation of emotions and the sub-concepts of death (e.g., irreversibility); and have noted the lack of underrepresented identities but haven't sufficiently examined those themes (e.g., Arruda-Colli et al. 2017; Gutiérrez et al., 2014; Martínez-Caballero et al., 2023; Polling & Hupp, 2008). For children dealing with death, bibliotherapy can help reduce feelings of isolation by seeing a character experience death and is most powerful when a child feels reflected by the protagonist (McNair et al., 2021). This poster will present data on how books featuring characters with underrepresented identities compare to books that do not in the

presentation of age-appropriate concepts of death and how to cope with emotions. Books were coded for character features, character identities (e.g., BIPOC, disability, LGBTQIA+), concepts of death, educational resources, and coping strategies. 202 books were identified that met all 6 criteria (e.g., year, accessibility). Coding and analyses will be completed by February. Preliminary findings (n = 94) show 29% of books contain at least one character with an underrepresented identity and promoted more coping strategies but did not give more information about the biological concept of death (see Figure). They were not more likely to include educational resources ($X^2 = .218, p = .640$). Implications for the development of emotion understanding and death concepts will be discussed.

P3-160 - Understanding the relationship between fractions and algebra reasoning in younger and older students: a structural equation modeling approach

Victoria Jay^{1,2}, Percival Matthews¹, David Kaplan¹, Martha Alibali¹, Edward Hubbard¹

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Details

Algebra is a “gatekeeper” to more advanced courses and opportunities, and fractions knowledge has been called the “gatekeeper’s doorman”, because fractions proficiency uniquely predicts later algebra proficiency. However, which fractions subskills relate to which algebra subskills—and when in development—is not well-understood (Viegut, 2024). We measured fraction knowledge, fraction magnitude processing, relational reasoning, math fluency and spatial reasoning at Time 1 (younger cohort 3rd grade, N = 170; older cohort 6th grade, N = 139), and algebraic reasoning at Time 2 (4th and 7th grade). Fraction knowledge directly predicted algebraic reasoning in both cohorts (Tables 1 & 2). Critically, non-symbolic skills (spatial reasoning, nonsymbolic ratio magnitude processing) predicted algebraic reasoning in younger children (Table 1), while symbolic fractions skills (fraction arithmetic, symbolic fraction magnitude processing) predicted algebraic reasoning in older children (Tables 2-3). Understanding the developmental contributions of fractions and algebra subskills may inform interventions that leverage fraction knowledge to improve algebra proficiency.

P3-161 - Parents' descriptive input for different domains in a semi-naturalistic setting

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Details

Children show very different knowledge of different domains of words (Gelman, 1998; Djalal et al., 2017). In this study, we examine how the parental language input is structured in three domains (i.e., animals, foods, people) that may lead to differences in acquisition.

Participants were 33 children (age_M=55.09 mos) and their mothers. We selected the Individual Differences corpus (Gelman et al., 2014) in the CHILDES database (MacWhinney, 2000). Data were analyzed using t-tests corrected for multiple comparisons.

Parents' utterances about people were highly distinguishable from their utterances about animals and foods. Parents used a higher proportion of non-descriptive (fill-in-blank) questions than descriptive (yes/no) questions for people ($t(32)=3.621$, $p=0.001$), but not for the other two domains.

The features that parents talked about also differed by domain, with parents talked about a lower proportion of conceptual and taxonomic features for people, compared with animals (C: $t(32)=4.686$, $p<0.001$; T: $t(32)=3.263$, $p=0.003$) and foods (C: $t(32)=3.852$, $p<0.001$); T: $t(21)=5.192$, $p<0.001$). However, there were no differences between animals and foods.

One possibility is that children are more familiar with the food and animal words than the people words, but we found that the above results remained the same after controlling for children's average age of acquisition of different words. Another possibility, and subject of the discussion, is that people have a more malleable category structure and are more similar to each other than the referents within the other two domains.

Altogether, these differences in language input, as well as category structures, affect lexical pathways supporting language acquisition.

P3-162 - The effect of visual dominance on exploration and word learning in infants and adults

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Details

Infants hold objects close to their faces, making held objects appear larger in view (visually dominant; e.g., Smith & Pereira, 2011). Successful object name learning is correlated with named objects being visually dominant (Yu & Smith, 2012; Pereira et al., 2014). Visual dominance has been hypothesized to direct gaze to the visually larger object and away from visually smaller objects, helping learners associate heard names with the dominant referent. We tested this hypothesis by manipulating the visual size of 12 objects on a screen (Fig. 1A). We examined whether named objects (targets) that were larger in view than non-named distractors (Dominant condition) would result in better learning of targets' names compared to a condition in which objects were equally sized (Equal condition); participants within each condition either heard names for the target objects or not (Fig. 1B). Given the pragmatic considerations of testing infants, we first examined adults ($n = 72$) before testing infants ($n=36$ so far, M age=13 months). Participants viewed up to 160 trials as we tracked their gaze, followed by test trials (Fig. 1C) and a "pointing" test for adults (Fig. 1D). Preliminary data from both age groups indicate that visually dominant objects did not draw as much attention (Fig. 2) or support object-name learning (Fig. 3) as much as hypothesized. Planned future analyses will examine how looking behavior in each condition differs across trials and how it relates to word learning.

P3-164 - The development of contextual learning and inference

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Details

Both children and adults learn from noisy information extracted from their everyday environments. By integrating information across multiple episodes, individuals acquire associative knowledge from their first hand experiences. Prior work has shown that children struggle to extend first order associations to infer the latent structure of the world (Schlichting et al., 2017; Shing et al., 2019), leading to developmental differences in memory, decision making and reasoning. We examine potential developmental differences in learning both direct associations from different contexts as well as in extending this knowledge to infer latent causes in the absence of direct contextual cues. We adapt a prior adult study (Chan et al, 2016) to examine the development of contextual learning and inference behaviors. Participants first learn the likelihoods of observing 5 different friendly “monsters” in 3 different contexts and are then asked to infer the latent contexts given only a sequence of monsters and no other contextual cues. Both children and adults learn the direct associations successfully, though we observe significant developmental differences in the ability to extend this knowledge to perform inference, consistent with prior work showing that children struggle to go beyond their direct experiences to infer latent task structure.

P3-165 - What do we really learn about children from parents’ and teachers’ reports?

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Details

Children’s behavior can change depending on the environment or be interpreted differently by others. Research has consistently shown low to moderate coincidence between predictors of children's aggression (Baker & Jensen, 2023; Deng & Roosa, 2004), which may be an artifact of children’s changing behavior, or a methodological issue. We are interested in finding out if there is a difference between the responses of parents and teachers in children’s social behaviors, and if so, where the difference is attributed – children’s cognition (verbal, Theory of Mind), family demographics (father and mother education, poverty severity, economic strain), or previous behavior reports. Results from 106 children ($M_{age} = 52.78$ months), and their parent and teacher triads, indicate that parents’ reports – though impacted by their previous reports – were also predicted by children’s verbal skills and father’s education, and that teachers’ reports were predicted only by their previous reports, and were unrelated to child and family factors.

P4-1 - Stereotypes of brilliance: unpacking their links with gender presentation and gender identity

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Details

The gender brilliance stereotype associating high intelligence with men has been documented across development (Storage et al., 2020) and cultures (Shu et al., 2022). However, gender presentation exists on a spectrum that even young children recognize (Martin et al., 2017). The current work seeks to understand how both gender identity (identifying as a man or woman) and gender presentation (presenting as more masculine or feminine) contribute to beliefs about brilliance in early childhood. Ninety children (target $N = 96$) ages 5-10 completed two rank-choice tasks assessing brilliance beliefs. Specifically, children saw four targets that varied on gender identity and gender presentation: a masculine man, a feminine man, a masculine woman, and a feminine woman. With age, both boys and girls became more likely to choose the masculine targets as the most brilliant. In addition, both boys and girls with age were more likely to invite the masculine targets to join their team for a game requiring brilliance. Overall, our preliminary results indicate that children utilize gender presentation to a greater extent than gender identity when making inferences about brilliance. This expands on the growing literature on brilliance stereotypes, providing initial evidence for an early-emerging mental connection between perceived masculinity and intellectual talents.

P4-2 - Parents take over less when they think children are learning

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Details

Persisting through challenges is critical for children's academic and interpersonal success, but parents in the U.S. are increasingly taking over and solving problems for their children. What can help parents step back and allow children more autonomy? Across 3 pre-registered studies, we test the novel hypothesis that parents step back when they view tasks as learning opportunities. In correlational Study 1, parents of 4-5-year-olds ($N = 77$, recruited via CloudResearch) reported that they are more likely to take over (i.e., physically complete tasks) when they think their child has less to learn (Figure 1A). This was most often the case on non-academic tasks like getting dressed. In Experimental Study 2, we found that parents ($n = 60$) took over half as much on a novel dressing task (Figure 1B) when told that children could learn lifelong skills by dressing themselves vs. a carefully matched control message. In Study 3 ($n = 80$), we replicated this effect and found that, in contrast to self-report in Study 1, parents take over equally little when they think that their child has a little or a lot to learn (but significantly less than when learning is not mentioned at all) (Figure 1C). Taken together, our results suggest that reflecting on children's learning opportunities – whether big or small – leads parents to take over less and give children more autonomy.

P4-3 - Low-income preschoolers' reasoning about moral harm: a longitudinal person-centered study

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Details

Preschool children's reasoning about moral harm has yet to be tested using a person-centered approach over time, which may help to determine if specific developmental profiles or patterns of reasoning correspond with specific predictors or outcomes. Here, we longitudinally tested 106 urban, low-income preschoolers ($M_{T1age}=52.78$ months) judgments of severity of moral harm on a prototypic harm task (Killen et al., 2011) using a two-step cluster analysis. Three distinct profiles emerged (see Table 1 for model fit, and Table 2 for cluster descriptions). Cluster 1 (35.8%, $n=38$) at T1 judged based largely on psychological harm, but at T2 (six months later) judged based on physical harm. Cluster 2 (39.6%, $n=42$) at T1 judged at based on physical harm, but at T2 largely did not elaborate; Cluster 3 (24.5%, $n=26$) judged the moral harm event based on physical harm at both T1 and T2. Implication of relevant predictors will be discussed.

P4-4 - Using gaze-contingent active sampling to measure toddlers' preference for reliable speakers

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Details

Children not only need to learn the vocabulary and grammar of their language; they must also learn the social norms that govern language use. Previous work shows that children assess the reliability of speakers in their environment (Koenig & Woodward 2010). The current study investigates toddlers' information-seeking preferences for reliable speakers with a gaze-contingent eye tracking paradigm. Toddlers (22-24m) view videos of two speakers who take turns labeling highly familiar objects. One speaker provides correct labels and the other speaker provides incorrect labels. Toddlers then sample novel labels from either of the two speakers using a gaze contingent paradigm. Toddlers first see grey-scale images of the two speakers holding novel objects on the screen. When they direct their gaze towards an image of one of the speakers, the image lights up and that speaker provides a novel label ("Look a modi!"). If the infant then shifts their gaze to the other speaker, that speaker also provides a label ("That's a toma!"). Toddlers control the screen in this fashion for two 20 sec test trials. Initial data ($N=9$, 40 preregistered) suggests that participants prefer to sample first from the reliable speaker over the unreliable speaker (Fig 1a). However, there is little difference in the overall sampling time between the two speakers (Fig 1b). This method provides a promising new use of gaze-contingent active sampling to study infants' sampling preferences beyond objects and labels.

P4-5 - Relationships between parental taking over and demographics

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Details

Parents in the United States are increasingly taking over and solving challenging problems for their children, a behavior that is detrimental to children's cognitive development and motivation. However, little is known about the individual differences that underlie parents' tendencies to take over. Here, we explored the relationship between parental taking over and demographic variables including parent education, income, and gender, and child gender and age across two Study samples. Study 1 consisted of 79 parent-child dyads completing a block design task (ages 4-9, 24.1% white, median parental education = 13 years). Study 2 consisted of 140 parent-child dyads (ages 4-5, 52% white, median parental education = 16 years) where children put on novel hockey clothes with random assignment to 4 conditions. Taking over was operationalized as the number of actions parents physically completed for children. Across both studies, parents from lower-income backgrounds took over more (S1. $p = -0.31, p < .01$ controlling for age; S2. $b = -.00, p = .027$ controlling for age and condition). In Study 1, but not Study 2, parents with less education took over more. Parents also took over more for younger children in Study 1, and marginally more in Study 2. Future work will look at whether the consistent relationship between parent income and taking over is due to reputation threat while participating in lab studies, or other factors, like chronic stress.

P4-6 - Children's context-dependent probabilistic social decision-making based on affiliation and dominance

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Details

Choosing whom to interact with greatly influences our thoughts, emotions, and behaviors and is often biased toward particular social traits such as affiliation or power. In real-life, these characteristics are not static; they are probabilistic and vary by contexts and prior experiences. Moreover, they may be perceived differently, depending on whether the interaction involves the self. Using a computerized social decision-making task, we investigated how children ($n=54$, 4 to 9 years old), when given a choice between two characters with different probabilities in their social affiliation and dominance, decide with whom their own character interacts with. In the affiliation context, we found that children strongly favored the character with a higher probability of displaying positive interactive behavior. In contrast, children's preference in the dominance context varied: Despite their ability to identify the most dominant figure (in a series of post-test questions), children showed high individual differences in their choice between the character that was more or less powerful than their own character. This finding highlights the fact that while affiliation is a strong intrinsic reward in forming children's social preferences, dominance is a more complicated factor that may modulate how children learn to make decisions regarding their social interactions.

P4-7 - Young children's sociopolitical worldviews

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Details

The current study tests the emergence, strength, and consistency of Social Dominance Orientation (SDO) and Authoritarianism in young children. In a preliminary study, 4- to 11-year-old children (N=48) completed five tasks designed to capture early emerging SDO and Authoritarianism. The SDO measures probed children's endorsement of group-based inequality and beliefs in social mobility. The Authoritarianism measure assessed children's leadership preferences, prioritization of authority, and responses to group norm violations. Preliminary results suggest young children respond relatively systematically within and across our measures, indicating that they may hold their own distinct belief structures early in life. Moreover, our results provide initial evidence that children show relatively clear political leanings across responses. An ongoing preregistered study seeks to replicate and extend these findings with a sufficiently powered sample size (N=144) and the addition of analogous parent measures. This larger sample and addition of parent data will allow us to conduct more robust analyses, test the relation between children's and parents' views, and determine how children's worldviews may come to reflect demographic and environmental factors (e.g., age; local political homogeneity). This study will provide a comprehensive understanding of the development of sociopolitical worldviews, which have crucial personal, social, and political implications across the lifespan.

P4-8 - Student satisfaction and self-regulation during COVID-era online learning

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Details

The COVID-19 pandemic compelled a swift shift to virtual learning, challenging students, parents, and educators. Instruction delivery format can impact learner satisfaction, which is linked with student success (Martin & Bolliger, 2022). We investigate the extent to which student's self-reported learning satisfaction and their (parent-reported) self-regulation varied by instruction format (virtual, hybrid, or in-person) during the height of the pandemic. We explore the nature of these relationships for students who were in grades 4-10 (N = 574) in spring 2020. We also consider differences by grade-level and other student factors. Students and their parent(s) completed Qualtrics surveys in 2021 retrospectively as part of a larger longitudinal study. Learner satisfaction varied by instruction format but parent-reported self-regulation did not. Implications for developmental theory and instruction will be discussed.

P4-9 - Who's in charge? The emergence of children's ability to differentiate social power cues based on context

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Details

Children can use a variety of cues to make judgments about social power. By age 3, children infer that a person who is strong, wealthy, or prestigious is more likely to be in charge than a person who is weaker, less wealthy, or less prestigious (Charafeddine et al., 2015; Enright et al., 2020). However, it is unclear whether children's judgments of social power are influenced by context (e.g., reasoning that a stronger individual compared with a wealthy individual ought to be in charge in a context where strength is a critical factor). To investigate this, 3-8-year-old children (N = 484) were introduced to three novel characters, each depicting a unique social power cue (strength, wealth, and prestige). Children were also introduced to one of four activities in which the characters engaged (e.g., Strength context: tug-of-war with another group; Prestige context: science task; and Control contexts: puzzles or drawing) and were asked to pick who should be in charge. While younger children (3-4; N = 148) picked at random ($X^2(6, 148) = 5.07, p = .534$), older children (7-8; N = 163) selected the strong individual to lead the tug-of-war competition ($X^2(2, 40) = 23.45, p < .001$), and the prestigious individual to lead during the science ($X^2(2, 40) = 48.65, p < .001$) and puzzle tasks ($X^2(2, 40) = 35.45, p < .001$). The current study demonstrates children's emerging ability to use social power cues to predict who might be a good leader in different situations.

P4-10 - Codeswitching dynamics: exploring contextual influences on Spanish-English parent-child interactions

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Details

This study investigates how context (free play, bilingual book reading, and word learning) modulates children and caregivers' codeswitching, and how parents' observed behavior correlates with their self-reported codeswitching frequency.

42 Spanish-English bilingual parent-child dyads interacted across three contexts. Codeswitching rates were calculated as total number of codeswitches divided by total utterances. Parents also estimated their codeswitching frequency.

The relationship between context and codeswitching frequency was assessed by regressing rate of codeswitching on context, children's language ability (measured continuously), and their interaction. We analyzed child and parent data in separate models. Context was a significant predictor of codeswitching for both models. Comparisons indicated that children's codeswitching rates were highest in play, but rates in book reading were only marginally higher than in word learning. Parents codeswitched more during play and reading than learning, but rates in play and reading were similar; self-reported

codeswitching was positively related to observed codeswitching during free-play and book reading but not word learning.

These findings indicate that context modulates codeswitching in children and their parents, albeit somewhat differently. Moreover, parents seem to draw on certain contexts more than others when reporting codeswitching.

P4-11 - Exploring the depth of children's word knowledge and associations with socioeconomic status and literacy interest

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Details

Beyond traditional measures of vocabulary breadth, this study measured depth of vocabulary to reveal strengths of children's word knowledge. We examined (1) the types of information most common in word definitions and (2) whether depth is related socioeconomic status or literacy interest. Forty children aged four- to five-year-old defined sixteen words and the research team coded each response for seven definitional information units. Children's definitions were most likely to include perceptual qualities (e.g., "it's red"), functional information (e.g., "it carries stuff") and gestures especially when defining concrete nouns. Conversely, abstract nouns were defined using synonymous associations (e.g., "bliss means happy"). Notably, there were significantly more information units in concrete versus abstract definitions. Children from higher SES households and who demonstrated greater interest in literacy had higher depth scores. These findings have implications for how children learn words and the importance of measuring children's vocabulary depth versus breadth.

P4-12 - Parenting behaviors during math play: examining parent gender differences

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Details

This study examined parenting behaviors during math play and differences in these behaviors by parent gender. Participants were 28 parents (50% mothers, 68% White, 29% Black) and their 4-year-old children (61% boys, M= 4.56 years, SD= 0.39). Dyads participated in a 5-minute unguided play session in which they were provided numeral blocks and beads. Parent talk was coded by sentence type (question, statement, feedback, other) and various parent and child behaviors were given a rating on a 1-7 scale using the Parent-Child Interaction System (Deater-Deckard, 2000; Deater-Deckard, Pylas & Petrill, 1997). Parents mainly used questions (35% of parent talk) and statements (37% of parent talk), and there were no gender differences found in these frequencies. However, mothers provided significantly more feedback to their children (25% of mothers' talk; 19% of fathers' talk). Additionally, positive parenting behaviors and parent-child mutuality (shared responsiveness, reciprocity, and cooperation; Deater-

Deckard & O'Connor, 2000) were observed across the sample. However, mothers demonstrated significantly higher parent-child mutuality. These results suggest that, although mothers and fathers speak to and interact with their children in similar ways, mothers may be more likely to engage in some behaviors that promote learning. These results indicate there is a need for consideration of parent gender when implementing home math interventions.

P4-13 - Lack of variability in family structure in YouTube videos for 3-to-5-year-olds

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Details

The media targeted toward and consumed by children may have recurring themes of the types of family structures that are represented, such as the traditional family with a mother, father, and two offsprings rather than showing a more diverse structure, such as single parents. Here, we examined the prevalence of diversity in family structure represented in YouTube educational videos commonly watched by 3- to 5-year-olds and the relationship between these children's primary caregiver's education and children's exposure to family structure diversity. Through an online survey sent to 232 parents in the U.S, parents were asked to share three links of YouTube videos recently watched by their children (68 videos were preliminarily coded). Results suggest a lack in family structure diversity represented in the videos (e.g., 78% of the families had a mother and father). Additionally, there was no association between children's primary caregiver's education and exposure to family structure diversity, $p=.801$. Educational content creators need to incorporate more family structure diversity in their videos to reflect the diversity in family structures of their viewers.

P4-14 - Does goal-encoding facilitate young infants' preferences for helpful over unhelpful agents?

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Details

After viewing a puppet show in which a hill-climber is repeatedly helped (pushed up) and hindered (pushed down) by two other puppets, infants are more likely to choose a helpful puppet (via reaching or preferential looking) when the protagonist's goal was clear (e.g., gaze direction; Hamlin, 2015), and when the infant produced more anticipatory looks to the hilltop during the show (Tan & Hamlin, 2022). Combined, these studies suggest that inferring agents' goals might facilitate young infants' sociomoral choices. However, it remains unclear whether individual differences in infants' goal-encoding abilities inform their helper/hinderer preferences. Here, we assessed the relationship between six month old infants' ($M_{age}=6.17$; $n=83$) goal-encoding (as in Woodward, 1998) and their preferences (via reaching) for prosocial/antisocial puppets who helped/hindered a protagonist trying to retrieve a dropped ball.

Concurrent analyses indicate that young infants' goal-encoding abilities, when assessed independently, are not associated with their sociomoral preferences ($p=.21$).

P4-15 - Children's evaluations of a robot's characteristics are associated with socio-cognitive skills and robots' learning behaviours across a novel classification teaching task

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Details

Background: Social robots have been suggested as a tool to increase learning. However, the potential benefits may depend on children's social evaluations of the robots. There is a paucity of research examining how children's socio-cognitive skills relate to perceptions of robots, as well as whether associations differ by robot behaviour.

Method: 114 children (8-10 years old) completed a false belief task and empathy questionnaire before teaching a humanoid robot a novel classification system. Children were assigned to a robot who made **no errors**, one who made **logical errors** (incorrectly answering unknown information), or one who made **illogical errors** (incorrectly answering known information). Before and after teaching, children rated the robot on factors: Humanlike, Smart, Interested in Learning, Fast at Learning, Friendly, and Trustworthy.

Results: Interacting with the robot increased ratings across all characteristics. No errors robots were rated as smarter post-interaction than in both other robots, while the no errors and logical robots were both rated as faster at learning than the illogical robot. The logical robot was rated as friendlier than the no errors robot. Higher cognitive empathy was related to lower initial ratings of robot smartness and trustworthiness. For children working with an illogical robot, higher affective and prosocial empathy related to more positive ratings.

Discussion: Children's socio-cognitive characteristics, as well as the behaviour of the robot, relate to children's perceptions of a robot throughout a novel teaching task. Understanding social evaluation of social robots is essential to improving their functionality as a learning tool.

P4-16 - Children's abstract thinking about careers and relative prioritization of career-related factors

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Details

Children's early-life thinking about their future occupational lives offers a valuable but understudied lens into career-related decision-making, as well as into how occupational inequities are created and maintained. By elementary school, children begin thinking about—and are frequently asked—“what they want to be when they grow up.” Past research focuses on children's interests in specific careers. This project seeks to understand children's abstract thinking about career aspirations. We presented 192 5- to 10-year-old children with fictional job descriptions that manipulated the following features: independence vs. collaboration; degree of power; work-life balance; competition vs. cooperation; money vs. helping, and male vs. female-dominated. By age 7, children expressed preferences for certain job features, including collaborating with others, valuing hard-to-obtain jobs, seeking fulfillment at work, and helping others. Unlike older children, 5- to 6-year-old children preferred easy-to-obtain jobs. Across ages, participants showed an own-gender bias. In ongoing analyses, we are linking children's responses to analogous responses from parents and using pattern-centered approaches (i.e., cluster and factor analysis) to consider how individual children's responses relate across job contrasts.

P4-17 - Young children infer the relative competence of social groups by observing how they are addressed

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Details

Children develop stereotypes about the competence of different social groups from early in life. The present studies address one potential mechanism in the development of such stereotypes, asking whether children are sensitive to subtle differences in how group members are addressed. Children aged 5 to 9 and adults observed a character systematically address members of one novel social group with later-acquired and more infrequent words (Study 1) or more interesting facts (Study 2) than members of a second group. Adults and 8- to 9-year-olds—but not 5- to 6-year-olds—inferred that individuals who were addressed with more complex speech and facts were more competent. Study 3 suggested that 5- and 6-year-olds fail to make this inference despite being able to discriminate between the complexity of the facts addressed to the different groups. Together, our findings suggest that, from the early elementary school years, children can develop competence stereotypes by observing subtle variations in how members of different groups are addressed.

P4-18 - Developmental change of uncertain information preference among young children

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¹ Kyoto University

Details

Epistemic curiosity plays an important role in active learning and adoption. Previous studies indicate that information uncertainty promotes exploration to reduce ambiguity. However, there is limited understanding of how curiosity relates to developmental changes during young childhood. This study focuses on examining whether uncertain information preferences change among young children. We measured 39-74-month-old's information uncertainty preference. The children, all Japanese speakers, participated in an uncertain information search task consisting of seven trials. In this task, children had to choose an object by manipulating the degree of uncertainty of the object patterns. The data collected in this study will be analyzed with R and SPSS software. At first, our analysis will focus on the correlation between children's preference for information uncertainty and children's age in months. This study aims to provide new insights into the cognitive mechanisms of curiosity and establish a pathway for effective educational practices to promote children's curiosity.

P4-19 - Early gender differences in negotiation: examining children's negotiation behavior in a self- vs. an other-advocacy context

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Details

Gender differences in negotiation—men asking for more than women—are theorized to be due to a mismatch in gender roles: negotiations require agency, and men value agency more than women. Indeed, when adults negotiate on behalf of others, gender differences in negotiation are mitigated or even flipped. Gender differences in self-advocating negotiations emerge during the same developmental window when girls begin to value communality more and boys value agency more. Here, we address whether gender roles underlie the development of gender differences in negotiation by examining 8- and 9-year-olds' (1) negotiation behavior and (2) perceptions of negotiation in a pre-registered study (ongoing, $n = 52$ of 248). Participants are randomly assigned to one of two conditions: negotiating a bonus for themselves (self-advocacy) or another child (other-advocacy). We hypothesize that in the self-advocacy condition, boys will ask for a larger bonus than girls, but that this difference will be moderated in the other-advocacy condition. To further probe children's gender norms of negotiations, we additionally measured children's descriptive norms regarding negotiation (e.g., what they think other girls and boys do) and anticipated backlash (e.g., whether they expect negative or positive reactions to negotiating). Overall, the present research examines children's responses to negotiating for themselves and others in order to shed light on where gender differences in negotiation stem from.

P4-20 - Learning to extend shape and number patterns: do lessons focused on the pattern unit help?

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Details

Childhood patterning skills are associated with numerical skills, which predict future academic and career success. We investigated whether a lesson focusing on pattern units would help children learn to extend and abstract growing patterns. Children received either (1) a Pattern Unit lesson with simple visuals, (2) a Pattern Unit plus Perceptual Support lesson with enhanced visuals that highlighted the pattern unit, or (3) a Control lesson about mental rotation (Fig. 1). On pre- and posttest, participants extended patterns and identified similar patterns with different materials. We examined accuracy and mentions of the pattern unit in explanations (e.g., "it kept going up by 2"). Gains in accuracy did not differ across conditions, but children in the two lesson conditions increased their mentions of the pattern unit from pretest to posttest more than children in the Control condition ($t(82) = 2.20, p = .031$; Fig. 2). Strategy analyses are ongoing.

P4-21 - Face recognition and racial biases: the role of social experiences

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Details

Both children and adults exhibit other-race effects, in which they are better at recognizing own-race than other-race faces. Such perceptual biases may be related to social perceptions, including in-group and out-group bias (Lee et. al, 2017). The present study sought to examine how social experiences, particularly the diversity of one's social groups in childhood and adulthood, is related to both face recognition and racial bias. A preliminary sample of children aged 6-9 ($n = 35$) and adults ($n = 63$, aged 18-41) completed an intergroup contact measure and provided information about their social experiences. Participants then completed a series of four recognition tasks over a period of 9 -11 days that included familiar and unfamiliar race faces. They also completed an explicit bias pre- and post-test. For children, greater intergroup contact was correlated with decreased negative bias toward an unfamiliar race ($r = -.389, p < .05$). Additionally, greater improvement on the recognition tasks was related to decreased negative bias toward an unfamiliar race ($r = -.385, p < .05$). For adults, greater improvement on the recognition tasks was correlated with increased positive bias scores toward an unfamiliar race ($r = .299, p < .05$). These results suggest that increased perceptual experience with unfamiliar race faces may be related to changes in bias toward unfamiliar races. We will present models to predict differences in recognition scores based on intergroup contact and racial biases.

P4-22 - The limits of generosity in childhood

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Details

Generosity strengthens social relationships and has positive effects on givers. However, the study of generosity in childhood contends with conflicting definitions. In this meta-analytic review, we focus on children's generosity in distribution tasks when they are encouraged to give.

We reviewed 24 older papers (27 experiments, $N = 2,678$; age range: 3 to 12 years) on imitative altruism (1967 to 1990). In each, a person either modeled or verbally encouraged a generous donation to a peer. Generosity meant giving < 50% (5 experiments), 50% (14) or > 50% (8). Children gave more than controls in 24 experiments but gave > 50% in only three. In 12 more recent studies ($N=5,611$; age range: 3 to 12 years), generosity meant giving > 50% and children gave > 50% in four.

Overall, giving over half occurred with older children and was country dependent. Generosity may thus require overcoming a cognitive barrier of equality.

P4-23 - Curious collectors: what do children collect?

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Details

Children enjoy collecting. William James noted that the drive to collect emerges early in childhood and often becomes the focus of intense interest and time investment (James, 1890). However, there have been few attempts to empirically investigate what children collect, and why. In the current study, we asked what kinds of objects children collect, how collecting changes with age, and what patterns emerge in collecting habits. Parents ($N=211$) reported information about what their children ($M=6.9$ years, range: 2-15) collect and their general collecting behavior in an online survey. Collecting was widespread: 93.8% of parents reported that their child collects something. On average, children had 3 distinct collections ($SD = 1.61$) and added more collections with age ($b=0.09$, $t(208)=2.15$, $p = .03$; Fig 1). Children's collections were highly variable (Table 1), but revealed distinctive structure in collecting tendencies (Fig 2). In our presentation, we will also share ongoing work (a) studying the longitudinal progression of collecting and its relation to individual differences in temperament and curiosity ($N=175$, i.e. 80.6% retention of original families) and (b) validating the parent-report results in in-depth, structured interviews with children ($N=54$). Collecting behaviors provide a window into children's active curiosity about their environments. This descriptive work sets the stage for studying how collecting behavior shapes children's early learning.

P4-24 - The emergence of religious parochialism across diverse societies

**Abby McLaughlin¹, Anton Gollwitzer², Sophie Riddick¹, Patrick Tusiime³, Samantha Bangayan⁴,
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Details

Religion provides a source of community and meaning for individuals throughout the world, but simultaneously can contribute to intergroup conflict, bias, and even violence. Exploring the emergence of religious parochialism in childhood can provide insight into the cognitive mechanisms and forms of learning that contribute to bias. The current studies investigate parochialism in childhood and how perspective-taking may mitigate bias.

In two studies, we presented children (aged 5 to 12) in Peru ($n=245$) and Uganda ($n=300$) with a modified Dictator Game. In Study 1, participants shared resources between religious in-group and out-group members from their own perspective and then from God's or an adult's perspective. Results showed that children were biased towards religious in-group members and viewed God, but not adults, to be equally biased.

In Study 2, participants were assigned to a religious, national, or minimal group condition, and then shared between in-group and out-group members from their own, God's, and an adult's perspective. Results showed that children were more biased in the religious and national group conditions compared to the minimal group condition, and viewed God as more biased toward religious than minimal in-group members, although there were no main effects of perspective. In sum, these findings suggest that children exhibit bias in their resource distribution, including in religious group contexts, and view God as similarly biased to themselves.

P4-25 - Congenitally blind and sighted speakers use similar intuitive theories of vision to assign generic color labels

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Details

How do sensory experience and language contribute to intuitive theories? We compared intuitive theories of vision across sighted ($n=48$) and congenitally blind ($n=48$) adults using a generic labeling task. Generic language signals conceptual and causal centrality of object features (e.g., birds lay eggs) (Cimpian et al., 2010; Gelman & Roberts, 2017). Speakers treat objects as having generic colors e.g., 'bananas are yellow,' though they are green when unripe, gray at night and white on the inside. We hypothesized that for blind and sighted speakers generic color labels signal ideal viewing conditions and causal relevance. To separate these from color frequency, participants chose generic color labels for novel objects in an 'island explorer' scenario. As predicted, both blind and sighted adults preferred

outside over inside, and daytime over nighttime colors (blind: $p < .0001$; sighted: $p < .0001$) (Exp1), even when controlling for seeing frequency (Exp2). Preference flipped to nighttime colors when objects had nighttime-related causal histories (e.g., nocturnal animals, nighttime tools) (blind: $p < .0001$; sighted: $p < .0001$). For sighted participants ($n=30$), the same preferences were elicited nonverbally (i.e., choosing color patches), suggesting conceptual/pragmatic rather than purely linguistic biases (Exp3). Shared intuitive theories of sensory phenomena develop without first-person sensory experience, highlighting the importance of language for transmitting intuitive theories.

P4-26 - Eliciting curiosity to impact early science learning

Hannah Puttre¹, Kathleen Shepardson¹, Kathleen Corriveau¹

¹ Boston University

Details

Curiosity is an integral feature of early childhood as children ask questions, explore, and experiment to learn about their environment (e.g., Bonawitz et al., 2012; Butler et al., 2020; Ronfard et al., 2018). Loewenstein's (1994) information-gap theory says curiosity from perceiving a gap in knowledge and has become popular for research on curiosity in early childhood (e.g., Jirout, 2011; Jirout & Klahr, 2020). The current study utilizes the information-gap theory to elicit curiosity and explore the relation between curiosity and science learning.

In the current study, 4- and 5-year-old children ($N = 60$, $M_{age} = 60.86$ months, female = 32) participate in one of two conditions: *curiosity* ($n = 34$, $m_{age} = 59.39$ months; storybook about designed with flaps to elicit curiosity); *control* ($n = 26$, $m_{age} = 62.79$ months; same book without flaps). They then participate in a *transfer* task to measure learning. Children were shown two photos of circuits, one complete circuit and one incomplete circuit, and asked for all images if the mechanism will work. Children were asked if the mechanism would work and received a score of 0 to 2 (neither to both correct).

More children in the *curiosity* (38.24%) responded correctly than in the *control* (11.54%; $z = 2.32$, $p = 0.02$). Thus, children in the *curiosity* condition seemed to learn more from the storybook.

The current study demonstrates a simple storybook manipulation for increasing science learning and curiosity. Educators may be able to use storybooks to boost children's interest and early learning around science.

P4-27 - Gender differences in children's response to ineffective teaching across contexts

Mia Radovanovic¹, Aafiya Somani¹, Miguel Alzona¹, Annabelle Persaud¹, Jessica Sommerville¹

¹ University of Toronto

Details

Concerns about misinformation in education are intensifying. Consequently, children must increasingly evaluate the teaching accuracy and explore alternatives. However, because girls are socialized into greater people-pleasing than boys, they may feel more pressure to persist in taught solutions. We evaluated 7-10-year-olds' reactions to ineffective teaching, varying puzzle gender typicality using a videogame in Experiment 1 ($n = 150$, $M_{AGE} = 9.02$ years) and a dollhouse in Experiment 2 ($n = 100$, $M_{AGE} = 8.94$ years). Children were instructed on a solution that seemingly worked; thus, children had to rely on their own experiences of the solution failing to deduce its ineffectiveness. Gender differences emerged: girls persisted more in the taught solution than boys (both $ps \leq .02$), contributing to decreased solving (both $ps \leq .02$) and learning (both $ps \leq .02$). Importantly, analyses controlled for task experience and girls reported greater concern for what others think than boys ($p = .04$), suggesting people-pleasing socialization, rather than ability, critically shaped gender disparities in the context of ineffective teaching.

P4-28 - Show me a "Mommy": infants' associations between parental labels and unfamiliar white and black faces

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Details

Often the first coherent words produced, parental labels embody a unique, critical social importance to infants. Although there is evidence that infants at 6 months do not generalize parental labels to other adults, it remains unclear whether these labels become generalized later in development. Given perceptual narrowing of familiar and unfamiliar race faces that occurs at 9 months, we expect to observe differences in an infant's endorsement of parental labels when faces correspond to the race of their parents. The present study examined the extent to which age and parental race influence infants' preliminary concept of two major parental labels: "mommy" and "daddy". U.S. infants 11-24 months ($N = 56$) were shown a series of unfamiliar Black and White women face pairs and men face pairs while an experimenter asked "Can you show me a *mommy* or *daddy*." Caregiver race and infant age were assessed in prediction of infants' face selections. No significant differences in face selection were found for infants with Parents of Color and White parents. Infant age was a significant predictor in endorsing either Black or White faces as a mommy or daddy. Infants were 6.7% (95% CI [0.04, 0.09]) more likely to choose the face that matched the race of their parents with every one month increase in age. The findings may indicate that with age, infants' concept of parental labels incorporate salient social markers like race into conceptually rich associations of in-group membership. *Keywords:* parental labels, familiar-race generalization, perceptual narrowing

P4-29 - Conceptual, social, and practical life skills in young children's educational YouTube videos: associations with parental education

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¹ California State University, Los Angeles, ² Ohio State University

Details

Concerns grow as a quarter of U.S. preschoolers spend over 4 hours daily on screens, diverting time from the development of essential adaptive skills (e.g., conceptual, social, and practical skills) that shape a child's daily competence (AAIDD, 2023). Here, we examined the prevalence of teaching these adaptive skills in young children's educational YouTube videos and if videos with these skills were watched more by children with higher-educated parents. An online survey was distributed to parents in the U.S. (N=232) asking for the three latest YouTube videos their children watched (60 of these educational videos were preliminarily coded). Results revealed that 81% of the videos demonstrated conceptual skills; 86% demonstrated social adaptive skills; and 93% demonstrated practical adaptive skills. Moreover, there was no correlation between parental education and the prevalence of these skills in video consumption. Findings contribute to understanding of the prevalence of adaptive skills in young children's educational videos and parental education's nuanced relationship with preschoolers' media habits.

P4-31 - Getting organized: the relationship between conceptual organization and word-learning

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Details

The words children add to their vocabularies have a tendency to be related to other known words, creating a lexicon that becomes more semantically structured over time. One explanation for this could be that kids who already have a dense, interconnected network of words can use their semantic knowledge to map many properties of similar existing concepts onto new words immediately. In contrast with prior research that used indirect measures of semantic organization, the current study directly tests the extent to which the semantic structure of concepts in a category can be leveraged for learning new concepts within that category. 5-year-old children first completed a test of their semantic organization where they rated the relatedness of pairs of items sampled within and across 3 familiar categories (animals, clothes, and vehicles). They were then tested on their ability to learn new words for unfamiliar concepts in the 3 categories. Results showed that children who judged concepts in the same category as more related had overall higher word-learning accuracy. However, the connectedness of concepts in a specific category did not relate to word-learning accuracy within that category. We did not find that dense semantic structure facilitates word-learning, which contrasts with prior research using indirect measures of semantic organization.

P4-33 - Neural foundations of infant empathy

Nico Navarro¹, Lindsey Powell¹, Meghan Pierce¹, Seaera Juarez¹, Charleen Necor¹, Khanh Nguyen¹, Cayla Regas¹, Yuxuan Yue¹

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Details

Helping behavior and expressions of empathy emerge in late infancy. In adults two brain networks support empathic responding. One, referred to as the mentalizing network, supports thinking about others' thoughts and emotions whereas the other, the pain network, is made of areas responsive to sensory, motor, and affective significance. We tested the role of these networks in infants' responses to others' struggle or suffering. In one phase of the study, 14- to 20- month-old infants (current N = 37, target N = 45) wore a functional near-infrared spectroscopy (fNIRS) cap covering portions of the mentalizing network (medial prefrontal cortex, temporoparietal junction) and the pain network (premotor cortex, somatosensory cortex). While wearing this cap, infants watched videos of actors struggling (e.g. failing to open a box, or pinching their finger) or engaged in similar activities without struggle. The other phase of the study, the experimenter created several situations in which the participant could help the experimenter solve a problem (e.g. pick up some dropped blocks). Initial results show that, across the sample, right and left temporoparietal junction respond more to struggle videos than non-struggle videos. However, differential responses to struggle vs. non-struggle videos in right somatomotor cortex and left medial prefrontal cortex significantly correlated with composite helping scores across tasks. These results suggest a role for both networks in early empathy.

P4-34 - The relation between spatial language comprehension and mental transformation during early childhood.

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Details

Mental transformation is the ability to visualize and represent two- and three-dimensional objects. Two common types of mental transformations are rotations and translations. Spatial language knowledge has been positively associated with mental transformation aptitude during early childhood. However, many previous examinations of this relation focus exclusively on the *production* of spatial language; the present study adds to the existing literature by measuring *comprehension*. One hundred typically developing 4- to 6-year-old (46 girls) completed age-appropriate general spatial-relational language comprehension and mental transformation measures. After controlling for age, gender, and parent education, multiple regression analyses found that children with greater spatial-relational language comprehension were more accurate on translation items ($b = 0.42$, 95% CI [0.09, 0.69], $p < .001$) but not rotation items ($b = 0.25$, 95% CI [-.046, 0.55], $p = .972$). No sex differences were observed in any measure. These findings suggest that children's comprehension of spatial-relational language relates to certain spatial abilities.

P4-35 - English monolingual and English-Polish bilingual children's use of word formation strategies

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Details

Successful use of word formation strategies is key for children's language development and vocabulary growth (Clark, 2009). English-speaking children tend to use *compounding*, the joining of two free morphemes to create a new word (e.g., backpack; Clark 2023). In languages such as Polish, children rely more on *derivation*, the addition of an affix/bound morpheme to a root to form a new word (Haman et al., 2009). What remains to be explored is how *bilingual* children apply word formation strategies. Thus, 62 children ($M_{age} = 7.49$ years; 21 English-Polish bilingual; 41 English monolingual) from Chicago, IL completed a word formation elicitation task. The task included 20 pictures of novel objects designed to elicit compounding and 20 pictures of novel objects designed to elicit derivation. Bilingual children were either tested in English ($n = 10$) or Polish ($n = 11$). Children's responses were analyzed using repeated-measures ANOVAs. A significant Language Group x Type of Device interaction was found, $F(2, 59) = 37.05, p < .001, \eta_p^2 = .557$. Follow up testing showed that bilingual children tested in Polish used significantly more derivatives ($p's < .001$) and fewer compounds ($p's < .01$) than English monolingual and bilingual children tested in English, who had similar frequencies of compounding and derivation. Overall, study findings suggest that bilingual children's input and testing languages influence their use of word formation strategies.

P4-36 - Good friendship quality makes adolescents happy and gritty: a longitudinal study

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Details

It is well-known that friendship quality is crucial to adolescents' positive outcomes as the impacts of peers are salient in adolescence. Recent studies found that friendship quality is associated with grit, an unflinching dedication toward a long-term goal, which is related to success in various domains (e.g., academic performance). However, the underlying process of how good friendship quality leads to higher grit in adolescence is currently under-investigated. Taking the perspective of broaden and build theory, we explored whether subjective well-being could mediate the relationship between friendship quality and grit. To test our hypothesis, we used four-wave panel data (2018~2021) consisting of a sample of Korean middle-school students ($N = 2,590$). Data was analyzed by using a random intercept cross-lagged panel model (RI-CLPM) to examine within-level changes of variables. Results from our RI-CLPM suggested that friendship quality improves adolescents' subjective well-being one year later thereby increasing grit two years later. In addition, our results showed that a between-level increase in friendship quality is associated with adolescents' between-level increase of sustained interests and efforts as well as an increase in positive experiences in their own lives. Our findings indicate the

importance of fostering adolescent friendships with researchers, practitioners, educators, and policymakers.

P4-37 - Children in Kenya and the US respond negatively to inequity of belief

Colin Jacobs¹, Henriette Zeidler^{2,3}, Oded Ritov¹, Nancy Njogu³, Mahesh Srinivasan¹, Jan Engelmann¹

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Details

Across many societies and cultures, research has shown that children respond negatively to material inequity – they object to receiving less of a reward than another person. Yet, as adults, we recognize that fairness is not limited to the distribution of tangible goods. Instead, fairness seems to apply to a broad range of social contexts wherein two parties are shown different levels of consideration or respect. Inspired by Miranda Fricker’s framework of epistemic injustice, this study investigates children’s understanding of fairness in epistemic contexts. Specifically, we evaluate how four- to- ten-year-old dyads in Kenya and the United States respond when one participant is consistently believed over another (N = 192). Our results show that, as young as four-years-old, children in both societies evaluate unjustified inequity of belief as unfair. Importantly, we find that children’s fairness judgments are not motivated by being disbelieved in general. Rather, they are motivated by the inequity of belief between two parties. These findings suggest that an aversion to unfairness in epistemic decisions is deeply rooted in children’s sense of fairness. This finding emphasizes the richness of early fairness concepts, and underscores a need for more research into the ontogeny of fairness beyond reward distributions.

P4-38 - Learning words through repetitions across contexts

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Details

People often address infants in a unique way characterized by higher rates of repetition than speech addressed to adults. IDS draws infants’ attention, but it is not well understood how repetition in IDS bolsters infant word recognition. To investigate the benefit of repetition, thirty-three 11- to 13-month-olds engaged in book reading and toy-play activities with their caregivers. Subsequently, infants participated in a looking-while-listening word recognition task for items with four levels of familiarity: appeared in both books and toys, book-only, toy-only, and no-exposure. Performing t-tests on a preliminary data set (n=18), infants showed significantly higher accuracy in word recognition for items they had seen from books and toys than from book-only or toy-only, $t(17) = 2, p = 0.04$, or items with no prior exposure, $t(17) = 2, p = 0.04$. The findings suggest that infants benefit from the high rates of repetition in IDS as it improves lexical processing.

P4-39 - Children's understanding of a goal of autonomy

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Details

Typically, we see one person helping another as prosocial, such as when a parent dresses their child, an act often perceived as caregiving. Yet, if the child intends to achieve the goal autonomously, intervening becomes less helpful. In two experiments with children ages 4 to 8 in South Korea, we explored children's understanding of autonomy as a goal. If children understand goals of autonomy, then their predictions about others' outcome-based emotions should take into account those others' role in any success. In Study 1 (N = 40), children predicted that a protagonist pursuing an autonomous goal (e.g., opening a box of markers on their own) would be less happy when a parent achieved the outcome, compared to a protagonist who desired the outcome only (e.g., having the markers out of the box) with no concern for autonomy. In Study 2 (N = 40), children rated a protagonist with an autonomous goal as less happy when the parent helped, compared to when the protagonist succeeded alone. These findings suggest that South Korean children, as young as age 4, understand a goal of autonomy.

P4-40 - Generating children's category exemplars with Markov Chain Monte Carlo with people

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Details

The extent to which a child learns about category variability and its central category exemplars directly affects how they can use the category. However, previous work has shown that children and adults can underestimate within-species variability and instead treat species as more homogenous groups with an underlying shared essence. Importantly, these biases can be amplified by learning and development, particularly with children endorsing less variability when traits are introduced as aiding a species' survival. Despite considerable research, there is an ongoing debate about how children develop these category representations. Answering these questions requires methods that can directly measure individual children's categorical organization, which is a challenging experimental task. This study uses a novel developmental experimental paradigm (Markov Chain Monte Carlo with People, MCMCp) to directly assess children's (data-collection ongoing, N = 18, Mean age = 9) and adults' (N = 50) notions of biological variability, specifically variability of ladybeetle traits such as color, spot patterns, and size. Moreover, we assess how knowledge about traits being beneficial for species survival influences variability. Our preliminary results suggest that children and adults produced comparable categories, but children produced less defined distributions than adults, suggesting that categories are still less defined, especially at their boundaries

P4-41 - A qualitative analysis of gender stereotypes and children's implicit theories of ability in the arts and sciences

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Details

Growth mindset develops in part through socialization by parents and teachers and through school and classroom cultures. Individuals possess ability beliefs (implicit theories of ability) that reflect gender stereotypes and expectations (e.g., boys are good at math, girls are good at art). The present qualitative study investigates the beliefs that elementary-aged children possess about the nature of ability in different subject areas and how these beliefs relate to gender. Twenty-three children ($M_{\text{age}} = 7.7$, aged 5 to 11) were recruited from a preschool and community summer program in the Southeastern U.S. Participants viewed vignettes about gender-neutral characters encountering challenges in different activities in two subject areas—math/science and writing/arts—and were then interviewed to ascertain their beliefs about ability and gender. Qualitative coding and analyses of open-ended responses revealed that the majority of children (regardless of gender) possessed growth mindsets for both STEM and the arts. Younger children were more likely to provide superficial explanations for their gendered beliefs whereas older children were more likely to draw connections from their personal histories and identities, reflecting their greater cognitive maturity. In summary, children's gendered beliefs about ability differ by age and learning domain which should be further explored in future research, with implications for enhancing equitable instructional and childrearing practices.

P4-42 - Growth mindset & bilingualism: investigating perceptions towards dual language learning in early childhood

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Details

Over the past few decades, dual language learners (DLLs) have emerged as one of the fastest growing populations in the United States. Research suggests that Growth Mindset (GM) may be especially valuable in helping children overcome academic challenges and perhaps language learning; however GM research among bilingual populations is scarce. Additionally, few studies have researched children's perceptions and motivations in dual language learning settings. In the present study, participants (N=42, ages 6-12) completed survey assessments and open-ended interviews measuring GM, overall cognitive flexibility and perceptions towards language learning. Results suggest a positive relationship between high GM and positive perceptions of bilingualism, suggesting DLLs may be uniquely receptive to GM intervention because they possess enhanced cognitive flexibility. Conclusions from this study have important theoretical and practical implications and may increase our understanding of the malleability of GM as a potential new cognitive mechanism to consider among bilingual populations.

P4-43 - Echoes of understanding: evaluating metalinguistic awareness in monolingual and bilingual children and their caregivers

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Details

Research consistently shows a positive relationship between metalinguistic awareness and general language abilities in both monolingual and bilingual children. Bilingual children, specifically, exhibit enhanced metalinguistic awareness, which might be due to their need to focus on multiple languages' properties. Given their validity in estimating language abilities, self-ratings and caregiver reports are common ways of measuring metalinguistic awareness. However, it is unclear which of these measures more closely correlates with scores from standardized assessments of language abilities. Furthermore, bilingualism's impact on the accuracy of caregivers' understanding of their children's language abilities is unknown.

To address these gaps, 30 caregiver-child dyads (14 monolingual English, 16 bilingual) completed questionnaires in which both individuals answered questions about the child's language abilities. The 9- to 12-year-old children ($M = 11;0$, $SD = 1;2$), who were either neurotypical ($n = 24$) or language impaired ($n = 6$), also completed a standardized omnibus language assessment, the Clinical Evaluation of Language Fundamentals (CELF-4).

Analyses revealed that questionnaire scores accurately predicted CELF-4 scores ($\beta = 5.48$, $SE = 1.87$, $p = .005$), but bilingualism and who completed the questionnaire did not have any significant impact. Thus, both monolingual and bilingual children and their caregivers have similarly accurate levels of the child's metalinguistic awareness.

P4-44 - 'Your French makes you sound nice!': Children's attitudes towards French speakers in a diverse community

Marianne Turgeon¹, Tracie Pospisil¹, Anne-Lois Kouassi-Djan¹, Jacqueline Perich¹, Asma Noomani¹, Isabel Wynn¹, Ruth Kircher², Andrea Macleod¹, Anne-José Villeneuve¹, Kristan Marchak¹

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Details

Background. Regional varieties of a language (i.e., dialects) play a central role in children's attitudes towards speakers (Arredondo & Gelman, 2019; Dejesus et al., 2017; Spence et al., 2021). Yet, the study of language attitudes is complex, because linguistic communities are often made up of individuals who belong to intersecting social groups. We explored the attitudes of French-speaking children in Alberta, because this official language minority community in Canada is composed of people who belong to multiple groups (e.g., speakers of sub-Saharan African French dialects who are also Black).

Methods. In a pre-registered study, we presented 7- to 12-year-olds ($n = 29$ out of a planned sample of 96) with pairs of audio clips of French speakers from six different regions: Western Canada, Quebec, Eastern Canada, Europe, Maghreb, and Sub-Saharan Africa. Participants were asked to attribute status (e.g., intelligence) and solidarity (e.g., kindness) traits to one of the two speakers.

Results. Preliminary results show that children attribute positive traits more often to speakers of Canadian than international dialects, regardless of whether the speakers are of the same/different races. Additional analyses will compare participants' responses across age groups.

Conclusion. Our results replicate studies from prior research in a diverse community, allowing us to explore the impact of multiple minority identification on inclusion in linguistic minority communities.

P4-45 - Children's beliefs about the emotional consequences of norm adherence and violation

Annie Riggs¹, Anne Fast^{1,2}

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Details

What behaviors make people happy? In the current studies, we investigated 4- to 7-year-old children's ($N = 148$) emotion attributions for people who follow or violate a conventional norm in the presence of other psychological motivators. In Study 1, we tested whether children believe people are happier when they desire (vs not desire) adhering to (vs violating) a norm. In Study 2, we tested whether children believe people are happier when choosing (vs not choosing) to adhere to (vs violate) a norm. In both studies, we found that children predicted the highest happiness levels for people who followed norms, even when doing so conflicted with other psychological motivators (e.g., wanting or choosing to do something). Children also explained their emotion attributions by making reference to norms more often than desire or choice. These results may reflect children's early socialization and have implications for their own norm adherence.

P4-46 - Investigating the mechanisms underlying unsuccessful replications: Three replication attempts of Hamlin et al. (2007)

Francis Yuen¹, J. Kiley Hamlin¹

¹ University of British Columbia

Details

A large body of work suggests that infants positively evaluate, and socially prefer, agents who help versus agents who hinder others (e.g., Hamlin et al., 2007; see Margoni & Surian, 2018 for meta-analysis; see Woo et al., 2022 for review). However, there have been notable failures to replicate seminal findings (e.g. Schlingoff et al., 2020), and the reasons underlying these failed replications remain unclear. To shed light on this issue, we tested 6-12-month-olds online over Zoom (Exp.1 and 2) and in-person (Exp.3). Infants watched video versions of the Hill Show that maximally matched the original

Hamlin et al. (2007) puppet show (but are faster than past video versions, e.g. Tan & Hamlin, 2021), in which a climber attempts to ascend a hill, and is alternately helped or hindered by another puppet. Infants' social preference was measured via proportion looking at still images of the helper and hinderer side by side. Across all three experiments, infants showed no visual preference for the helper (Exp.1: $t(31) = .36, p = .72$; Exp.2: $t(31) = 0.95, p = .35$; Exp.3: $t(33) = 1.10, p = .28$). Analysis of infants' eye-movement in Exp.3 showed almost no anticipatory looking to the top of the hill, an index of goal understanding that is a required precursor for showing helper preference (Tan & Hamlin, 2021). Together, these findings suggest that differences in stimuli affect infants' ability to encode the character's unfulfilled goal, and consequently impact their social preference.

P4-47 - "A cat is alive because it has inner stuff..": Children's understanding of biology and its relation to executive functioning.

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Details

Young children often engage in the folk theory of vitalist biology that focuses on understanding how internal organs work (Hatano & Inagaki, 1994). Executive functioning may have an important role in the development of vitalist theories (Bascandziev et al., 2018; Grenell & Carlson, 2021; Tardiff et al., 2020). This is because of the cognitive processes that are required to build a new foundation of knowledge to allow vitalist theories to be adopted (i.e., conceptual change).

Ninety-three 6- to-12-year-olds were given a vitalist biology questionnaire along with battery of executive functioning tasks including a cued task switch paradigm and trail making task (cognitive flexibility), a backward digit span task (working memory), and a go-no-go task (inhibitory control). For children aged 9 and older, there were no effects of any of the EF measures. However, for the 6- to 8-year-olds, multiple regression indicated that cognitive flexibility, $B = .432, t(31) = 2.67, p = .012$, and inhibitory control, $B = -.311, t(31) = -2.08, p = .046$ predicted vitalist biology but working memory did not, $B = .120, t(31) = .753, p = .458$. A follow up comparison of the beta values was conducted (Cumming, 2009) revealing that the cognitive flexibility slope was significantly larger than the other two EF slopes. Cognitive flexibility may be the most influential component, perhaps because of the role it plays in conceptual change which is needed to enter, and eventually exit, the vitalist biology stage.

P4-48 - Do early counters recognize counting as a signal for fairness?

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Details

Counting is a skill that undergoes rapid changes in early childhood and recent research has highlighted the importance of counting for related skills, such as sharing. We explored whether 3–5-year-old children recognize counting as a means to ensure equality, particularly in the context of sharing, and whether this recognition varies as a function of the child's counting abilities. In this study, we investigated how children's own numerical competence (as measured by the Give-N task) relates to their evaluations of individuals who count versus individuals who do not count when distributing resources (either evenly, or unevenly distributed). Preliminary results from a binomial test indicate that children who have mastered the count procedure (Cardinal Principle Knowers) to judge the agent who counted as a better sharer than the agent who did not count, $p < .05$. Yet, children who are still learning to count viewed the agents equally. These results suggest that as children become more proficient counters they become more aware of the importance of the counting procedure. Future analyses will further tease apart this relationship between CP-knowers and subset-knowers.

P4-49 - The role of different types of anthropomorphism in children's biology learning from stories

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Details

Unrealistic elements like anthropomorphism are ubiquitous in children's educational media. It is thus crucial to determine how these unrealistic depictions affect children's learning. The current study challenges the consensus that anthropomorphism interferes with children's learning. Instead, we aim to show that anthropomorphism can help children to learn new scientific concepts. We present preschoolers with an educational story designed to teach about biological inheritance: Offspring resemble their mothers with respect to inborn traits, like fur color, but not with respect to acquired traits, like injuries (based on Hopkins & Weisberg, 2021). Children hear one of four versions of the story, which vary in (1) the depictions of the story's narrators who present the educational information (anthropomorphic kangaroos or humans) and (2) the depictions of the animals used to illustrate the target biological principle (anthropomorphic or realistic). Children's understanding of biological inheritance is measured before and after they hear the story. Current results ($N=71$ out of a planned 128) indicate no improvement between pre-test ($M=2.87$, $SD=1.26$) and post-test ($M=2.85$, $SD=1.44$), $t(70) = 0.19$, $p = .85$. While there are currently no differences in learning scores (post-test minus pre-test) across conditions ($F(1, 67) = 0.09$, $p = .76$), these scores are negative only in the most realistic condition (realistic animals / human narrators).

P4-50 - Predictors and barriers to caregiver/child play

Mikka Hoffman¹, Allie Tung¹, Dominic Gibson¹

¹ foundry10

Details

Caregivers serve an important role in children's early play experiences, supporting a range of playful activities from free play to direct instruction (Zosh et al., 2017). In this study, we investigated caregivers' perspectives about different types of caregiver/child play. Caregivers of preschool-aged children (n = 177) completed an online survey about their behaviors and attitudes related to playing with their child, focusing on different types of activities such as free play, guided play, games, and direct instruction. Results indicate frequent participation in all play types, especially free play. Caregivers' reported play frequency is related to their beliefs in the child-centered benefits (i.e., promoting learning) and adult-centered benefits (i.e., aiding household tasks) of these activities. Significant interactions reveal that the perceived benefit for children's learning strongly predicts guided play frequency, while free play remains high irrespective of its perceived benefits. Additionally, caregivers' other responsibilities emerge as a prominent barrier to engaging in various play types. These findings deepen our understanding of motivating factors and limitations in caregiver-child play, shedding light on variations across the play spectrum.

P4-51 - Parents' perceptions of their own children's number knowledge

Allie Tung¹, Mikka Hoffman¹, Dominic Gibson¹

¹ foundry10

Details

Past research suggests that child-directed number input from parents may be most effective when it aligns with children's current level of number knowledge (Gibson, Gunderson, Levine, 2020; Silver et al., 2023). Therefore we explored caregivers' perceptions of their own children's early numeracy through a survey of 177 caregivers of preschool-aged children, including caregivers' estimates of the highest number their child could count to and their estimates of the highest number their child could give accurately on a Give-N task. Give-N is often contrasted with children's counting in order to emphasize that the latter could mislead caregivers into believing their child possesses greater number knowledge than they do in reality. Indeed, comparisons between caregivers' estimates of the highest number their child could accurately give when asked for a certain number of objects and previously lab-collected Give-N data suggest that parents' may overestimate their children's number knowledge (i.e., knowledge level). Nevertheless, caregivers' estimate of the highest number their child could succeed on a Give-N task tended to be lower than their estimates of children's counting abilities, suggesting that caregivers largely recognize the distinction between these skills without being told. These findings provide insight into how researchers can effectively promote caregiver number talk.

P4-52 - Do children care about causal stability?

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Details

Adults have been shown to favor stable causal relationships – those that hold robustly across background contexts – in their actions and causal/explanatory generalizations (Vasilyeva et al, 2018). Here we explore how this preference develops. We present results from two developmental studies with 188 4-7-year-olds investigating whether children pay attention to causal stability when they explain observations and design interventions in novel contexts. We report developmental shifts in reliance on causal stability in a range of inferential tasks (action choice, inference to the best explanation), highlight the important role of perceived average causal strength in determining children’s causal preferences, and discuss the implications of our findings for theories of early causal learning.

P4-53 - The role of school math proficiency in the math anxiety-math achievement link

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Details

Students with lower math achievement generally experience higher math anxiety (Dowker et al., 2016; Ramirez et al., 2013). We examine whether this negative relation holds for students in “low performing” schools where few students meet state math proficiency standards. We investigated this question in a study of 86 2nd grade students, mainly from under-represented minority groups. As expected, students at very low proficiency schools (0% of students proficient) had lower math achievement than students at somewhat higher proficiency schools (17-36% proficient) but math anxiety did not differ by school context (Table 1). In a mixed-effects model, School Math Proficiency and Math Anxiety x School Math Proficiency significantly predicted students’ math achievement (Woodcock-Johnson Applied Problems; Table 2). The interaction reflected a nonsignificant relation for students in the moderately low proficiency schools and a marginal positive relation for students in the very low proficiency schools (Figure 1). These findings suggest that the math anxiety-math achievement link differs in different school contexts, possibly due to higher achieving students in low performing schools experiencing greater achievement pressure compared to their lower achieving peers, the reverse of what may exist in higher performing schools.

P4-54 - Perceptual learning in infants across domains

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Details

By one year of age, infants become expert processors of familiar social stimuli such as familiar race faces, musical rhythms, and native speech. Around this time, their sensitivity to unfamiliar faces, speech, and rhythms diminishes, an adaptation known as perceptual narrowing. Despite much evidence demonstrating perceptual narrowing in infancy, there is little agreement about the mechanisms driving these developmental shifts. Our goal is to investigate whether perceptual narrowing is primarily driven by domain-specific experiences or by domain-general factors such as changes in cognitive skills. In our longitudinal study, we employed a looking time paradigm measuring infants' discrimination accuracy of familiar and unfamiliar face types, speech sounds, and rhythm at the ages of 5, 7, 11, and 13 months. On a given trial, familiar or unfamiliar stimuli presented earlier in the trial predicted where an object would later emerge from behind an occluder. Per trial, we measured accuracy of infants' anticipatory looks and their looking time latency toward targets. With age, we expect a greater increase in infants' look accuracy and decrease in looking time latency for stimuli in the familiar condition compared to stimuli in the unfamiliar condition. This result would indicate a perceptual narrowing effect. We will present developmental trajectories for an initial subset of infants and describe discrimination patterns across domains.

P4-55 - Children's engagement during a museum visit to a mammoth fossil exhibit

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Details

This study investigated links between children's participation in an inquiry activity with a "Mystery Object" and their patterns of engagement while visiting museum exhibits. Attisano et al. (2021) found that the experience of being primed by a conceptually related prompt positively correlated with children's learning from their subsequent visit to an exhibit. We observed 86 children ranging from 3- to 11- years old and their families during visits to the *Mammoth Discovery!* exhibition at Children's Discovery Museum of San Jose. Families represented a range of backgrounds, with 37% identifying as white, 25% as Asian American, 13% as South Asian American (or Indian), 15% as Latine, and 9% as mixed heritage. Participation was counterbalanced; half of the families visited the exhibit first and half visited the "Mystery Object" first. Using an expanded definition of engagement, we looked at children's verbal and nonverbal behavior grouped into three categories: active engagement, quiet engagement, and unengaged. Analyses showed that younger children who participated in the inquiry activity first showed more quiet engagement than those who visited the exhibits first. Younger children's initial and overall patterns of engagement were both related to their participation in the priming activity. Older children's engagement did not vary by condition. These findings may inform conceptualizations of engagement in learning, and future design of exhibits and activities for families.

P4-56 - Development of Theta oscillations in auditory and written sentence processing: a comparative study between adults and school-aged children

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Details

During school ages, children are exposed to language in both written and auditory, however around 4th grade, written language processing becomes more dominant for children's vocabulary growth and academic achievement (Schneider et al. 2018). Recent work using EEG has revealed important developmental changes in neural activity during these critical grade school years, but the focus has been primarily on written modalities. In these studies, theta activity (4-8Hz), which often corresponds to semantic retrieval and processing (Lam et al. 2016), decreases in power and becomes more localized with age (Schneider et al. 2018). The goal of this project is to compare the developmental trajectory of theta in both auditory and written sentence processing. This is important because existing research mainly focuses on written language processing. Methods: 18 adults and 14 children, ages 8-26 completed an EEG task that required auditory and written sentence comprehension. We then used between-subject analysis of variance (ANOVA) to statistically compare the theta activity to identify modality and age-related differences. Our findings in the auditory domain support previous work on written modality, revealing a burst of theta after each word that is larger and more widespread for children than adults. However, auditory processing has smaller differences in theta activity between age groups. This may indicate that reading makes semantic retrieval more challenging for children.

P4-57 - How access to solutions influences children's persistence

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Details

We explore how providing children with solutions affects persistence. In Experiment 1, 60 4- and 5-year-olds attempted to activate a novel toy. The experimenter either told children they would be presented with the solutions afterwards, or that they would not receive the solution. Results demonstrate that children gave up faster when they expected a solution was coming ($M = 56.4s$) than when they did not ($M = 93.8s$). In Experiment 2, we remove the potential for social inferences by providing solutions during an iPad game and removing all experimenter interaction. Children complete three iSpy puzzles on an iPad and either get to see the answers after each, or are not provided answers. While the study is ongoing (N=35 of 74), we find that taking the task out of a social context reverses the pattern of results, with children spending more time on puzzles when expecting to receive answers.

P4-58 - Cultural scripts of emotion: exploring cross-cultural variations in children's emotion knowledge and parental socialization practices

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Details

Culture shapes shared emotional understanding (Dzokoto et al., 2016), known as cultural scripts, constructed through caregiver experiences. This impacts children's emotion knowledge (Ip et al., 2023). Despite cultural variations in emotion socialization, few studies explore cross-cultural differences in children's emotion knowledge. **Objectives.** We examined (1) cultural variations in emotion knowledge among 199 4-5-year-olds in the US, China, and Japan by using the Affect Knowledge Task (Denham, 1986) and (2) its association with maternal alexithymia (Toronto Alexithymia Scale; Bagby et al., 1994) and emotion socialization (Socialization of Moral Affect Questionnaire; Rosenberg et al., 1994). **Results.** US preschoolers exhibited higher levels of facial emotion recognition than their Chinese and Japanese counterparts ($F(2,175)=13.41, p<.001$), whereas Chinese preschoolers exhibited higher levels of situation-based emotion understanding than their US and Japanese counterparts ($F(2,174)=6.78, p<.001$) (Table 1). Chinese mothers reported higher alexithymia in identifying emotions than the US and Japanese mothers ($F(2,171)=17.66, p<.001$). Maternal alexithymia in identifying emotions mediated cultural differences in children's facial emotion recognition (Figure 1). Psychological control negatively predicted children's situation-based emotion understanding across cultures ($B=-2.27, p=.016$; Table 2). **Conclusions.** Findings suggest that Chinese children rely more on situational cues for understanding others' emotions, possibly influenced by their mothers' reduced emphasis on mental state language in the socialization process. This highlights the importance of cultural variations in socialization processes when studying emotion knowledge development.

P4-59 - Where should I look next? Using a storybook intervention to promote children's strategic exploration in a virtual search task across cultures

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Details

Despite the vital role of curiosity-driven exploration in learning, research on the malleability of children's exploration is limited. We tested whether hearing a story with curiosity-promoting themes (e.g., approaching uncertainty, adapting to new information) vs. a control story with traditional pedagogical themes (e.g., following rules, learning from others) would alter children's exploration. Three- to 6-year-olds from the U.S. (N=138) and Turkey (N=88) were randomly assigned to hear the curiosity or control story over Zoom, before playing a game in which they searched for sea creatures across 5 tanks; some tanks had creatures in 25% of hiding spots, others in 75% (Fig 1A). Time was limited and children could not return to prior tanks, pushing them to allocate search effort strategically. Children in the curiosity

(vs. control) condition moved through tanks more rapidly; they spent more time searching later than earlier tanks (trend reversed in the control group; $B=0.17$, $p=.01$; Fig 1B) and were more likely to explore all tanks ($B=0.61$, $p=.027$). These patterns were broadly consistent across countries. Children in the U.S. in the curiosity (vs. control) condition also showed more strategic search, tolerating longer stretches of unsuccessful search in high-reward tanks (where staying yielded more rewards) and shorter stretches in low-reward tanks ($B=0.36$, $p=.01$). Storybooks appear to be a promising method for shaping children's exploration and promoting problem-solving.

P4-60 - Influence of attention on topological properties and surface features in toddlers' working memory

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Details

Deployment of selective attention and its interaction with the encoding of different object properties are central to the efficient maintenance of information in working memory (WM). Although previous research with infants and children in late childhood shows that both attentional deployment and WM performance improve with age, there is a significant gap in our understanding of toddlers' representation of different object properties in WM and whether these representations interact with attentional mechanisms. In this study, we recruited 41 21-40-month-old toddlers and presented them with two objects that differed either in surface features (color) or in topological properties (object with or without hole) which were then occluded. We manipulated attention in another block by presenting pre-cues before the objects appeared. We found that toddlers significantly performed above chance in both color (no-cue: mean = 62%, $t(20) = 2.75$, $p = .012$, Cohen's $d = .60$; cue: mean = 65%, $t(20) = 3.19$, $p = .005$, Cohen's $d = .7$) and topology conditions (no-cue: mean = 59%, $t(19) = 2.146$, $p = .045$, Cohen's $d = .48$; cue: mean = 65%, $t(19) = 4.42$, $p < .001$, Cohen's $d = .99$; cue: mean = 65%, $t(19) = 4.42$, $p < .001$, Cohen's $d = .99$). Toddlers' WM performance was not different between color and topology conditions ($F(1,36) = .028$, $p = .868$, $\eta^2 = .003$). We did not observe an effect of the pre-cues on either color or topology representations ($F(1,36) = .41$, $p = .53$, $\eta^2 = .011$). Our research shows that toddlers' WM might be limited by the number of objects rather than the nature of object properties. Future studies should investigate whether and when in development the nature of object properties becomes central to WM.

P4-61 - Environmental adaptation in children's social learning strategies

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¹

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Details

Children learn by exploring alone and by seeking help, but receiving help when needed is not a given. Teachers might promise help but fail to deliver, or parents may be unavailable or even unresponsive. Yet little is known about how children navigate learning in environments that vary in the likelihood of receiving help. The current project tests (1) whether children adapt their learning decisions based on the past reliability of help, and, if so, (2) whether such developmental adaptations contribute to differences in learning outcomes.

In Study 1 (N=60 US children, Age=4.0-5.9), a researcher either responded to children's bids for help during an art task and offered effective help (Reliable) or did not respond (Unreliable). Then, children were given a choice between a difficult puzzle with a high reward and an easy puzzle with a low reward. Children in the Reliable Condition were more likely to choose the difficult puzzle than those in the Unreliable Condition (OR = 3.45; 95% CI: 1.19 to 10.04; $p = 0.02$). Importantly, children in both conditions made adaptive choices. Choosing the difficult puzzle maximizes the potential reward if help is readily available, but it may be better to try an easy task for a smaller reward if bids for help are likely to go unanswered again. Together, this project aims to understand how children from diverse social backgrounds—including those without access to reliable help—adapt to learn, and, in turn, inform efforts to support education for all.

P4-62 - Brain break preferences among children

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Details

Brain breaks are often used during lessons to replenish children's attention. However, every child may respond differently to a single type of brain break. Therefore, this study aims to identify the types of brain breaks that are most preferred by children, the instantiations they prefer within each break type, and the breaks children believe will help them focus. The task consisted of a forced choice between two instantiations of six different break types: cognitive engagement, mindfulness exercises, physical activity, nature videos, coloring, and mind wandering. For each break type, elementary and middle school children were asked to select their preferred instantiation and the instantiation they believed would help them focus. Then, children ranked the breaks they selected from most to least preferred and from most to least beneficial for focusing. Data collection is ongoing ($N = 16$). Initial analysis of children's break type preference revealed that cognitive engagement breaks were more likely to be ranked first than other break types, $\chi^2(4, N = 16) = 18.37, p = .001$. Comparing children's preferred break

instantiation suggested that children preferred mazes vs. pattern blocks as their cognitive engagement break, $\chi^2(1, N = 16) = 4.00, p = .046$. Mindfulness exercise breaks were ranked last more often than other break types, $\chi^2(3, N = 16) = 12.50, p = .006$. Interestingly, there were no significant differences in children's preference rankings when asked to rank breaks from most to least beneficial for their ability to focus.

P4-63 - Variations in violations: evaluating the impact of the degree of expectation-violation and violation-type on children's memory for storybook details

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Details

Expectations play a critical role in children's learning. Prior studies suggest that children selectively focus on and better remember details of expectation-violating events (Stahl & Feigenson, 2017; 2019). Yet, it remains unclear whether this enhanced memory persists across varying degrees (e.g., somewhat vs. very surprising) and types of expectation violations (core-knowledge vs. schema-based violations). Adapting a surprise storybook paradigm from Foster and Keane (2019), we measure children's (5-8 years; N=20) surprise and recognition memory for six stories that span different expectation-related domains and contain outcomes that are expectation-congruent, somewhat expectation-violating, or completely violating. While preliminary data revealed no significant difference in recognition accuracy by level of surprise, a trend towards better memory for violations of well-entrenched versus schema-based expectations was observed. This preliminary work points to potential differences in how varying types of expectations influence memory in young children and has important implications for learning.

P4-64 - Understanding possibility vocabulary predicts performance on behavioral measures of possibility concepts

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Details

Possibility words like 'can' and 'maybe' allow us to coherently describe incompatible possibilities. It's incoherent to say 'Jon is in Berlin and Jon is in Paris,' but 'Maybe Jon is in Berlin and maybe Jon is in Paris' is fine. Thought also deploys elements—*possibility concepts*—that enable the parallel consideration of incompatible possibilities. How do possibility concepts develop?

Most children use possibility words by 24 or 30 months of age. Yet many struggle with behavioral measures of possibility concepts after 48 months. Why this difference? Two hypotheses are: **A.** Possibility talk reveals possibility concepts; task demands mask competence on behavioral measures; **B.** Possibility talk begins before possibility concepts develop, as revealed by behavioral measures.

We tested these hypotheses. We developed (1) a language comprehension test to check whether children who produce possibility vocabulary fully understand the words 'can' and 'have to', and (2) a behavioral task that measures possibility concepts in the same children. If children comprehend possibility vocabulary before they solve the behavioral task, we have evidence for hypothesis A. If success on the comprehension and behavioral tasks are correlated, we have evidence for hypothesis B.

We tested 47 4-year-olds. Half failed our language comprehension task. These children showed a peculiar pattern of failures on the behavioral measure that has previously been observed in 2.5-year-olds and chimpanzees. The other half showed comprehension of both 'can' and 'have to'; these children performed significantly better on the behavioral measure; the peculiar pattern of failures was not observed.

These results speak in favor of hypothesis B.

P4-65 - Exploring the opportunities and limitations of large language models in understanding emotional dynamics in parent-child communication

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Details

The advent of Large Language Models (LLMs) exemplified through ChatGPT 4 enables unprecedented opportunities for researchers in psychological science to delve into the intricacies of the human mind and behavior. This study leverages the potential of LLMs to enhance our understanding of parent-child communication dynamics, a critical factor in child development. Our research focused on harnessing ChatGPT 4 in analyzing the emotional dynamics within parent-child interactions to process transcripts from the CHILDES English - North American database. A preliminary analysis through different prompts was conducted on the Gleason corpus, comprising 48 diverse transcripts, including mother-child, father-child, and family dinner conversations, revealing three distinct clusters of interaction dynamics: guidance, independence, and curiosity. These initial findings underscore the feasibility of LLMs like ChatGPT 4 in dissecting and understanding the complex emotional layers and to gain deeper insights into familial communication patterns. More insight into the opportunities and limitations of LLMs will be presented at the conference based on the analysis of the rest of the corpus.

P4-66 - Enjoyment or effort: math learning goals and decision making in two cultures

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Details

Do cultures differ in beliefs about learning? We asked how Chinese and U.S. parents and their K-2nd graders ($N=252$) prioritized *effort* vs. *enjoyment* in math learning. Participants selected who would be better in earning good math grades or obtaining math-related jobs: a character who thinks math is no fun but always does extra math problems (Effort) or a character who thinks math is fun but never does extra math problems (Enjoyment). In contrast to the stereotype that Americans and Chinese have different learning attitudes, results showed that overall, parents from both cultures valued enjoyment over effort (64% for good math grades, 89% for math-related jobs). In fact, Chinese parents prioritized enjoyment more than U.S. parents for good grades ($\chi^2(1, N = 252) = 7.10, p = .008$). No significant cultural difference emerged in predicting math-related jobs ($p = .41$). Interestingly, children across both cultures showed the opposite pattern from parents, prioritizing effort over enjoyment (67% prioritized effort for good math grades and 53% prioritized effort for math-related jobs). No significant difference was observed between Chinese and U.S. children regarding the perceived importance of effort and enjoyment for grades ($p = .86$) or math-related jobs ($p = .25$). Our results highlight the importance of investigating cultural beliefs and attitudes within the framework of evolving cultural dynamics, emphasizing the need to move beyond static stereotypes.

P4-67 - The effect of future imagination on prosocial sharing in preschoolers

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Details

Building on prior work revealing positive effects of future imagination on self-control in preschoolers (Zhang et al., 2023), we expanded the outcome to prosocial sharing, a behavior also requiring self-restraint. Typically developing 4-year-olds in the midwestern US participated ($N = 79$; 44.3% female; $Age = 54.4$ months, $SD = 4.3$; 86% White). Children were invited to play a marble game where they could allocate marbles (out of 5) to two peers (one White and one Black) they were told would be coming to the lab later that day. Before playing the game, children were randomly assigned to one of three conditions where they would simulate a future decision and its emotional consequences (sharing and feeling positively vs. not sharing and feeling negatively) or a bedtime routine (control) using a storyboard. Consistent with prior research, children shared more marbles with a White than a Black peer, $F(1, 75) = 4.63, p = .035, \eta^2 = .057$. Preliminary results suggest that for the White peer, positive future simulation improved the odds of sharing compared to the control, $p = .09, B = 2.63$. For the Black peer, preliminary results suggest that positive future simulation increased sharing compared to negative simulation, $p = .05, B = 3.33$ (Fig. 1). This research indicates that simulating future emotions

may represent a promising new direction to improve prosocial behavior in intergroup contexts, starting in early childhood.

P4-68 - Prevalence of math language in YouTube videos watched by 3-to-5-year-olds: are there differences by child gender and parent education?

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Details

Language, especially math language (e.g., *many, few*), is an integral part of the acquisition of early math skills. Given most children watch television or videos every day, are these videos educational and if so, how much educational language is there? Here, we examine the quality of math language in videos watched by 3- to 5-year-olds. An online survey was distributed to parents asking them to list their children's three recently watched YouTube videos. Math language was then coded for in these videos. Given the prevalence of gender and parent education differences in children's math language, we hypothesized that videos watched by boys and highly educated parents would have more math language. Overall, we found that 2% of the language in educational videos was math-related (SD=4%). Contrary to our hypothesis, we found no significant differences in prevalence of math language by child gender ($p=.945$) nor parent education ($p=.425$). Thus, educational content creators should consider incorporating more math language in their videos.

P4-69 - Collaborative versus independent learning in YouTube videos watched by young children

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Details

Collaborative learning, such as working with peers toward a common learning goal, can be more beneficial for deeper learning than independent learning (Gokhale, 1995). Given that many children watch YouTube videos, we ask here how prevalent collaborative learning is in educational videos that 3-to-5-year-olds watch. Moreover, of the videos that involve collaborative learning, we predict that they will involve more goal-oriented problem-solving than videos with independent learning. An online survey was distributed to parents in the U.S. (N=232) asking for the three latest YouTube videos their children watched (58 of these videos were preliminarily coded). Results suggest that 79% of educational videos involved collaborative learning and of these collaborative videos, 72% involved a problem-solving scenario. Whereas for the 21% of videos that involved independent learning, only 8% of the videos involved problem-solving. Thus, collaborative learning videos are a good choice for encouraging problem-solving skills.

P4-70 - Impact of hand cues on infant object encoding

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Details

Infants rely on a variety of social cues to direct their attention towards objects in their environment. Recent work has shown that gaze improved infants' encoding of objects in 9 to 12-month-old infants (Thiele et al., 2021). However, we know from research on naturalistic environments that infants as young as 9 months begin to focus less on faces and more on hands and objects during play, highlighting the importance of hand cues in directing attention (Francheck et al., 2011). The current study aims to investigate the effectiveness of hands in directing infant attention and subsequent object encoding. We show 9 to 12-month-old infants (target N = 75, data collection in progress) videos featuring human agents using a point to direct their attention toward an object compared to an uninformative hand gesture. Following these videos, infants are shown the same object paired with a novel object. We code infant looking and calculate their novelty preference — looking time to the novel object over total looking to both objects — as a measure of object encoding. We will use linear mixed effects models to estimate the effect of pointing versus an uninformative hand gesture on learning. We will also compare the effects of these hand cues to the effect of a social partner's gaze on infant encoding in an already collected sample of 75 infants. These findings will provide insight into how a wider range of social cues impact infant learning.

P4-71 - Children's predictions of gender preferences for block play: gender stereotypes and implications for childhood engagement of spatial skills

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Details

Block play is one of children's earliest experiences enacting spatial skills important for STEM fields. Prior work assessing potential stereotyped perspectives on block play using force-choice tasks that involve making a selection between two genders suggests blocks are typically designated as a more suitable toy for boys compared to girls. The current study sought to examine children's ideas about gender preferences for a block game using an open-ended response format with a sliding scale (0 to 100). A total of 194 children (girls=105; *Age* = 6.18 years, *sd* = 2.44) participated in the study. Results indicate that both boys and girls showed an in-group bias, with each group responding that their respective gender would like the block game more than the other gender ($F(1, 192) = 16.95, p < .001$). Moreover, this in-group bias effect was more pronounced in younger compared to older children ($F(1, 190) = 5.79, p = .017$). These findings suggest that in the absence of a forced-choice format, neither younger nor older children display a gender-based stereotyped perspective regarding block play. Instead, there was support for in-group bias among younger children and more flexible thinking for older children. Collectively these patterns suggest the potential for a more nuanced view of children's perspectives of engagement with, and enjoyment of, tasks that engage spatial skills and inform future approaches to enhancing spatial skill development.

P4-72 - Learning through errors: tapping into teachers' knowledge of early math development

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Details

One critical aspect that influences the quality of a preschool education is teachers and their knowledge of early math development—that is, their ability to recognize concepts that are considered developmentally-appropriate milestones of math learning. Pre- and in-service preschool teachers ($N = 83$) were asked to judge whether particular early math skills can be observed in typically-developing four-year-olds in the United States; domains of numeracy, patterning, and geometry were explored. On average, teachers were significantly less accurate when asked to identify developmental milestones from vignettes (30%) versus from a given list (70%). Further analysis of the vignettes revealed four plausible patterns of errors: Underestimation, Overestimation, Overgeneralization, and Insufficient Knowledge. The frequency of errors significantly varied by domain (i.e., underestimation was most prevalent for numeracy and patterning, whereas overgeneralization was most common for geometry). Finally, analysis of teaching characteristics provided insight into how teachers calibrate their knowledge and instruction within the context of their students' learning.

P4-73 - Anticipating the future: children's and adult's reasoning about the emotional benefits of varying expectation management strategies

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Details

Children develop some awareness of the influence of prior expectations on future emotions as early as age 6, especially for negative outcomes (Lara et al., 2019). In two studies, we tested 6- to 10-year-olds' ($N=73$; target=100) and adults' beliefs ($N=90$; target=100) about the emotional effects of four expectation management strategies while anticipating an uncontrollable event (e.g., a raffle): *Consistent-High* (high expectations at two time points), *Consistent-Low* (low expectations at two time points), *Bracing* (shifting from high to low), and *Elevating* (shifting from low to high). Participants predicted and explained characters' emotions after positive, negative, and attenuated outcomes (outcomes between the high and low expectation). Preliminary analyses showed that 8- to 10-year-olds and adults judged that consistent-low and bracing strategies conferred a stronger emotional boost after negative outcomes compared to consistent-high or augmenting plans, with only adults also following this pattern for attenuated outcomes. Prior expectations did not affect emotion ratings after positive outcomes for these two age groups. Further analyses of emotion ratings and qualitative data from explanations will investigate the development of this reasoning from the ages of 6 and 10 and between childhood and adulthood. We will discuss results in relation to the development of children's reasoning about mind-emotion connections, with implications for emotion regulation and mental health.

P4-74 - Unveiling the complexity of gendered speech in early childhood: efficient rater sampling for precise ratings on 5-year-olds' gender

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Details

Understanding early gendered speech acquisition is crucial for unraveling gender development. This study surpasses binary 'boy' and 'girl' labels, recognizing the nuanced gender spectrum through continuous ratings on children's perceived gender in speech. Past research found no singular cue for gender in adult speech, creating gaps between existing rating measures in speech science (e.g., speech sound accuracy) and measures on gender-associated speech patterns. Our study explores the minimum unique raters needed for reliable mean ratings obtained from an 80-rater panel, with each child ($N = 108$)'s gender rated by a subset of 20 raters. Re-analyzing Munson et al.'s (2022) dataset, we seek an optimal balance between accuracy and economy. We compare mean ratings from different-sized rater subsets against 20-rater means (80% agreement threshold). The refined measure has implications for resource-efficient research on gendered speech development and for introducing a reliable speech measure on gender typicality in developmental psychology.

P4-75 - Context vs. process: understanding the role of household chaos and parents' emotions during homework help in children's math achievement

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Details

Parent-child mathematical interactions at home are related to children's math performance (Skwarchuk et al., 2014). However, additional exploration is necessary to better understand the role these interactions play on children's early math skills as a function of contextual and developmental factors (Hornburg et al., 2021). As part of a longitudinal study, 143 elementary-school students (K-3; 48% female, 79% Caucasian, 20% students of color) completed grade- and season-specific versions of the Elementary Mathematics Student Assessment (Schoen et al., 2021). Caregivers completed a survey that included questions about the degree of chaos in the home, how much time their child spends on homework, and their emotional experiences while helping their child with math homework (DiStefano et al., 2020). Preliminary findings show a negative relation between chaotic home atmosphere and parents' positive emotions during homework help ($B = -.26, p = .02$). Moreover, a positive relation was found between parents' positive emotionality during homework help and children's math achievement for second- and third-graders ($B = .23, p = .01$) but not for kindergarteners and first-graders ($B = .12, p = .12$), suggesting that homework help interactions become increasingly relevant as children progress through elementary school. These and other findings exploring the interplay between home context and parent-child processes with regard to children's math achievement will be presented.

P4-76 - Exploring the factors that impact performance on a commercial shape sorter toy during infancy and early childhood

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Details

Young children's ability to fit shapes into the appropriate opening of a shape sorter is related to their spatial skills such as mental rotation (Pedrett et al., 2020). With increasing age, children improve in their object fitting and have greater ease inserting rotationally symmetrical (e.g., circle, hexagon) than asymmetrical solids (e.g., semicircle, trapezoid) (Bambha et al., 2020). We examined whether young children's frequency of spatial play at home related to their object-fitting success. Parents of children between 12 and 36 months ($N = 36$, $M_{age} = 28.79$ months, $SD = 6.98$ months) reported the frequency of their child's play with puzzles and building toys (e.g., wooden blocks) at home. We observed children's insertion of three symmetrical solids (circle, square, and hexagon) and three asymmetrical solids (triangle, trapezoid, and semicircle) into a shape sorter. The probability of success for each insertion attempt was higher for older than younger children, $B = 0.47$, $SE = 0.22$, $z = 2.15$, $p = .031$, and higher for rotationally symmetrical than asymmetrical solids, $B = 2.38$, $SE = 0.32$, $z = 7.35$, $p < .001$, but was not related to children's reported frequency with building toys and puzzles at home. These findings provide further evidence of stronger object-fitting performance with age and symmetrical shapes, but did not find a link with children's reported experience with puzzles or building toys at home.

P4-77 - How do children's attempts to insert pieces into their correct openings vary with different spatial toys and age?

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Details

Children recruit a range of cognitive skills that support their learning and development during spatial play, but few studies have compared children's behavior while they engage with different types of spatial toys. In the present study, we compared 18- to 36-month-old children's ($N = 28$, $M_{age} = 27.17$ months, $SD_{age} = 7.66$ months) accuracy inserting pieces into a wooden shape sorter and a wooden slot puzzle that varied in terms of the size, geometric shape, and number of pieces and openings. We coded each instance in which children transported a specific piece (e.g., a cube for the shape sorter or a triangular prism for the slot puzzle) towards the toy with the intention of inserting the piece into an opening. On average, children inserted 4.38 unique pieces ($SD = 2.02$) into the correct opening for the slot puzzle and 3.18 unique pieces ($SD = 1.50$) for the shape sorter, indicating that, as a group, children were able to accurately insert pieces while engaging with both toys. The probability that each insertion attempt was successful was higher for older children than younger children, $B = 0.15$, $SE = 0.03$, $z = 4.96$, $p < .001$, but this effect was stronger for the slot puzzle than the shape sorter, $B = -.11$, $SE = 0.04$, $z =$

= -2.96, $p = .003$. These results highlight the importance of examining children's engagement with distinct spatial toys when considering how spatial play may relate to their spatial development.

P4-78 - Children's intuitive reasoning about incentives

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Details

In daily life, parents and educators across diverse cultures utilize incentives to motivate children to achieve specific goals, such as offering them money for completing chores or earning good grades. Despite the prevalence of this practice, little empirical research has examined how children make inferences about incentives. In the current study, we recruited a group of 5- to 12-year-old children in Southern California (N = 88, Mean age = 8.99, 57% girls). Participants heard two stories. In one, a character had the opportunity to receive two dollars by eating one novel food, and in the other, a character had to pay two dollars to eat another novel food. Then, participants rated a series of traits of the food. Results showed that children perceived the food the character would have to pay to eat as more sugary, less healthy, more popular, and less yucky than the food the character would be paid to eat (all $ps < .001$). These results highlight that children can make sophisticated social inferences based on incentives. More broadly, the current study advances our understanding of children's economic cognition.

P4-79 - Cognitive and conceptual influences on flexibility development

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Details

Executive functioning (EF) refers to the cognitive skills that support goal-oriented, task-appropriate behaviours. EF skills develop rapidly in the preschool years, though, the reasons underpinning these developments are unclear. Previous work found that an intervention targeting 3-year-olds conceptual understanding of the multidimensional nature of objects improved children's probability of passing the Dimensional Change Card Sort task (DCCS), a measure of EF in preschool children (Bardikoff & Sabbagh, 2021). We investigated the impact of a similar intervention on older children's performance on an advanced version of the same task. Children (n = 56, 27 girls and 29 boys) aged 62-71 months (M = 66.60, SD = 3.1) from a predominantly white (90.8%) community participated. Children were assigned to one of two interventions before completing the advanced DCCS. In the "multidimensionality-only" version, children constructed or decomposed test cards based on colour, shape, and presence of an external cue on the card. In the "multidimensionality + rules" version, participants decomposed test cards differently depending on the presence of an external cue outside the object on the card. Results showed that those in the "multidimensionality + rules" intervention were three times more likely to pass

the advanced DCCS. Although multidimensional understandings may be critical in children's emerging EF skills, practice reasoning about recursive rules may also be important for development.

P4-80 - Leveraging common mathematical errors to support understandings of equivalence and operations

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Details

In a within-subjects study, fourth through sixth graders ($N = 24$) participated in a series of one-on-one trainings (see Fig. 1) in which they reflected on errorful learning tasks that addressed common misconceptions about equivalence and operations. The majority of students had mathematics and reading disabilities. Students showed moderate to large improvements in their problem-solving on equivalence and operations posttest including reduced error rates (Table 1). Notably, students in 5th and 6th grades exhibited large improvements in understanding equivalence ($g = 0.78$), while 4th-grade students showed moderate improvements ($g = 0.42$). In operations, moderate improvements were observed in 4th grade ($g = 0.63$) and 6th grade ($g = 0.53$), with smaller improvements for 5th grade ($g = 0.23$). The error rate in the equivalence category significantly decreased ($p < .001$; $g = -0.55$), indicating substantial improvement. These findings suggest that errorful learning has specific benefits for students who struggle with mathematics.

P4-81 - Consistent individual differences in infants' responses to expectancy violations across the physical and social domains

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Details

The violation of expectation (VOE) paradigm has long been used to show that infants hold expectations about the objects and people around them, looking longer at surprising than expected events (Spelke & Kinzler, 2007). Perez and Feigenson (2022) found that infants who showed greater surprise at an object violating solidity expectations also showed greater surprise at an object violating gravity expectations. Here we asked whether these individual differences reflect aspects of domain-specific (expectations about objects) or domain-general processing. Infants (15-27 months; $n = 62$) saw eight video pairs depicting physical and social events. Surprise responses (i.e., looking to surprising outcomes minus expected outcomes) were correlated both within and across the physical and social events, and this domain-general predictability increased with age. General interest (looking regardless of whether outcomes were expected or surprising) showed no developmental trend. These results implicated individual differences in domain-general predictive processing that increase with development.

P4-82 - How does maternal postpartum depression influence infant brain activity: the role of the family home environment

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Details

Maternal postpartum depression (PPD) is associated with infants' altered socioemotional development and brain activity. However, the underlying mechanisms linking PPD to infants' brain function and socioemotional development are unclear. Depression may influence infants' home environment, which may in turn influence infants' development. Yet, this type of mechanistic model remains unexplored. To date, no study has tested whether infants' home environment mediates the link between PPD and infant brain activity. Such investigations are critical to identify a point of possible intervention to buffer the risk for maladaptive child outcomes conferred by PPD.

The present study tests this mechanistic model in a community sample of typically-developing 4-month-old infants and their mothers (current N = 35; data collection on-going). We focus on infant neural signals in the resting EEG that have been associated with socioemotional behavior—namely, frontal, central, and temporoparietal 6 to 9 Hz power. Mothers' PPD was assessed concurrently via the Edinburgh Postnatal Depression Scale and infants' home environment was assessed via the CHAOS scale, which measures disorder and commotion in the home. We included covariates of maternal education, infant age, and duration of infants' contributed EEG.

Preliminary results show that maternal PPD predicted increased home chaos ($b = .25, p = .005$), which in turn predicted reduced resting left central EEG power ($b = -.012, p = .009$) (indirect effect = $-.007, [-.006, -.0001]$). The direct effect of PPD on infant power was nonsignificant with chaos in the model, demonstrating a link between maternal depression and infant brain functional organization through a home environment mechanism.

P4-83 - The influence of learning cues and model attractiveness on children's attention and imitation

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Details

When children interpret behavior as conventional rather than instrumental, they exhibit high fidelity imitation (e.g., Clegg & Legare, 2016). In this study, we examined whether verbal cues of instrumental or conventional behavior and model attractiveness influenced children's sustained attention and subsequent imitation. During the study, 4-5- and 8-9-year-old children ($N = 185$) heard instrumental or conventional instructions and saw a video of a high or low attractive model making a necklace. Afterwards, they were given the same objects the model used and were asked to teach a puppet what

they learned. Children's heart rate was recorded as a measure of sustained attention (e.g., Weber et al., 1994). Results from an analysis of variance indicate that older children showed higher imitative fidelity than younger children $F = 13.272, p < .001$ and children in the conventional condition had greater imitative fidelity than children in the instrumental condition $F = 5.223, p < .001$. Results from a regression with condition, model attractiveness, and sustained attention predicting imitative fidelity was statistically significant $F = 2.584, p = .039, R^2 = .063$, and children who saw the low attractive model had statistically significantly lower imitative fidelity scores, $b = -.488, SE = .225, p = .031$. These results suggest an interplay between attentional mechanisms and social biases that influence children's imitative behavior.

P4-84 - Evaluating the functional forms of developmental change in infants' linguistic and cognitive development using (meta-)meta-analysis

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Details

Developmental psychology focuses on how psychological phenomena emerge with age. While this aspect of theory is typically underspecified, researchers often informally assume linear growth models by including age as a predictor in linear models. In this work, we aim to evaluate this assumption by examining the functional forms of the developmental trajectories across 24 phenomena using (meta-)meta-analysis. Surprisingly, for most meta-analytic datasets, we could not differentiate various functional forms from the null hypothesis: the phenomenon stays constant throughout development. We investigated various hypotheses on why so many developmental phenomena stay constant, including age-related publication bias, experimental selection, and methodological factors. However, none offers sufficient explanation for the lack of differentiation in functional forms. Our work challenges the traditional linear growth models in developmental psychology and suggests a need for re-evaluating the methods and assumptions commonly used in this field.

P4-85 - Development of racial categorization and its neural mechanism from childhood to young adulthood

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Details

Racial categorization, a perceptual framework designating individuals into races based on shared characteristics, involves two cognitive processes: the encoding of inter-racial differences and the encoding of intra-racial similarities. Although children's capability to perceive racial differences and categorize races is established, the neural underpinnings and their development remain elusive. Utilizing a steady-state visual evoked potential (ssVEP) paradigm combined with a repetition suppression (RS) paradigm (Fig. 1), this study aims to determine the neural mechanisms underpinning racial categorization and their development from preschool to young adulthood. For this purpose, 92 children were divided into three age groups (5-6, 7-8, and 9-11 yrs), alongside a young adult group. The ssVEP experiment showed that our brain can already encode inter-racial differences from preschool age (Fig. 2). However, the ability to encode intra-racial similarities is not fully established until early adolescence, as demonstrated by the RS results (Fig. 3), suggesting that this process is experientially acquired and likely hinges predominantly on semantics.

P4-86 - Autism-related functional connectivity and episodic memory differences

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Details

Individuals with autism struggle with episodic memory, particularly in recalling spatial details, compared to typically developing controls (TDC). This may stem from differences in dorsal stream function affecting spatial processing in autism.

This study aimed to explore how autistics and TDC differ in neural mechanisms subserving spatial processing. We examined resting-state connectivity between regions associated with visual processing in the dorsal stream and the parahippocampal cortex, given the demonstrated role of the latter in representing spatial context. Our tasks assessed memory for objects with contextual details, like color borders or spatial positions.

In a sample of 95 participants (40 Autism, 55 TDC, Mean age = 11.52 ± 0.84 years), we found that connectivity between the Visual Cortex-3A (V3A) and the Parahippocampal cortex was marginally significant in TDC, $M = 0.075$, $SD = 0.205$, compared to autistic participants, $M = -0.007$, $SD = 0.245$, $t(75.02) = -1.72$, $p = .09$. TDC participants also outperformed autistic participants on the spatial memory task, $t(62.08) = -2.13$, $p = .03$. Moreover, this V3A and parahippocampal connectivity correlates

significantly with d' for spatial position in TDC, $r = .39$, $p = .003$, but not in autism, $r = .09$, $p = .58$, suggesting that difficulty with visual dorsal stream processing may in part explain difficulties in spatial memory in autism.

P4-88 - The role of testimony of a native speaker in children's judgments of improbable events

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Details

Children tend to judge improbable events (i.e., events that have a low likelihood of occurring but are possible in principle, such as having a fox as a pet) as impossible (Goulding & Friedman, 2021). Here, building on past research showing that children epistemically trust native-accented speakers over foreign-accented speakers (Kinzler et al., 2011), we ask whether children are more likely to judge improbable events as possible if endorsed as such by a native speaker of their own language. Children (7-8 years old) were presented with six improbable events in three between-subject conditions ($N = 70$). In the Native-Positive condition ($n = 23$), the native-accented speaker consistently provided a positive statement about an improbable event (e.g., a person can have a fox as a pet), while the foreign-accented speaker consistently provided a negative statement about the same improbable event. In the Native-Negative condition ($n = 24$), the roles were reversed such that the native-accented speaker consistently provided a negative statement about an improbable event while the foreign-accented speaker provided a positive statement about the target event. In the Baseline condition ($n = 23$), there was no informant, and children were simply shown the six events one by one. In all three conditions, after each target event children were asked whether the event could really happen or not, and how sure they were of their answer. One way ANOVA showed no difference in the average scores of children between three conditions, $F(2, 70) = .81$, $p = .447$, partial $\eta^2 = .02$. These null findings show that native accent does not lead children to reason about improbable events as possible.

P4-89 - Group membership biases children's evaluation of evidence

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Details

An influential body of work in developmental psychology suggests that young children rationally explore the evidence available to them in order to arrive at accurate conclusions. However, as the large majority of this work has examined children's epistemic practices in individual contexts, we know little about how children develop their knowledge in a social world. What we do know is that children are sophisticated social agents who track what others believe and what others believe about them, particularly in group settings. In the current project, we examine how being in a group context influences children's epistemic practices. Specifically, in two pre-registered studies ($N = 138$), we tested how belonging to a minimal social group impacts children's evaluation of evidence when forming and revising their beliefs. In Study

1, we tested whether 4-6-year-olds jump to conclusions to form group beliefs. We found children were more convinced by evidence that supported their ingroup's belief, which led children to prematurely adopt incorrect group beliefs. In Study 2, we tested whether 4-6-year-olds were resistant to revising their group's beliefs. We found children were less convinced by evidence that opposed their ingroup's belief, which led children to hold onto their initial group belief more strongly. Taken together, these findings suggest that from a young age, children conform to what their group believes, resulting in children holding epistemically irrational beliefs.

P4-90 - Measuring scientific interest in preschool

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Details

Extensive research has been done on school-aged children's scientific interest and its impact on science achievement, but little is known about scientific interest development during *early* childhood. Such lack of understanding may be due to the limited availability of developmentally appropriate and psychometrically robust instruments. This study aims to overcome this limitation by evaluating four early scientific interest measures in a sample of 37 preschoolers ($M = 4.16$, $SD = .87$): a freeplay observation of children playing with scientific and non-scientific toys, two child-reports (a rank-order activity preference task, a questionnaire on general interest in science), and a parent report about child's interest in scientific and non-scientific topics. Results showed that only the child-report measuring general scientific interest had good internal reliability ($\alpha = .86$), but it did not significantly correlate with other measures. Further analysis revealed overall high levels of general science interest in contrast with lower endorsement of specific science-related interests (e.g., preferred toys and activities). Next steps for developing more nuanced and sensitive early scientific interest measures are discussed.

P4-91 - 'Why don't you give it a try?' Even 3-year-old children master some modal reasoning tasks if they have a more agentive task structure

Leonie Baumann¹, Lydia Schidelko¹, Marina Proft¹, Johannes Rakoczy¹

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Details

Considerable debate surrounds the emergence of the ability to reason about multiple incompatible possibilities during cognitive development. The present study aims to contribute to clarifying why preschool children pass some modal reasoning tasks (e.g., Alderete & Xu, 2023) and fail others (e.g., Beck et al., 2006; Leahy, 2023). We tested whether modal reasoning competence can be uncovered earlier with tasks that have an agentive structure: children choose between performing an action that *must* lead to a reward or an action that *might* lead to a reward. Agentive modality, pertaining to what can be done rather than what is the case, has been suggested to be an early emerging form of modal cognition (Vetter, 2022). We tested 60 3- to 4-year-old children in three tasks. In the agentive slides task

(modified from Beck et al., 2006; Leahy, 2023), children chose between dropping a marble into one of two slides. In the novel agentive coins task, children chose between tossing one of two coins. Moreover, we administered a false belief task to investigate whether children's modal reasoning performance is related to their Theory of Mind. Results show (i) children perform well in the agentive coins tasks, (ii) not differently in the agentive slides task, and (iii) no correlations with the false belief task. Future research should investigate children's performance in a non-agentive version of the novel coins task to examine the effect of the agentive test context.

P4-92 - Effects of "we"-framing and partner number on 2- and 3-year-olds' commitment

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Details

Committed partners often feel normatively bound to one another. This deontic pressure causes partners, for instance, not to abandon one another for fleeting, attractive alternatives. Prior research suggests that this sense of commitment emerges at around 3 years of age. The present study investigated effects of linguistic "we"-framing and partner number on 2- and 3-year-olds' commitment ($N = 48$ per age group). One or three puppet partners framed a boring game using "we"-framing or "you"-framing. As participants played with their partner(s), a fun, alternative game appeared. Two-year-olds remained longer with partner(s) before abandoning them following "we"-framing compared to "you"-framing. There was no reliable framing effect on 3-year-olds' behavior because they too readily abandoned their partner(s) for the alternative game. There was no effect of partner number on the behavior of either age group. This is the first report of a manipulation influences 2-year-olds' sense of commitment.

P4-93 - Children's multifaceted stereotypes about intelligence: evidence from British, Chinese, and Indian contexts

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Details

Cultural stereotypes about intelligence are thought to hinder diversity in science and maths fields, but relatively little is known about the development of these stereotypes, particularly beyond American contexts. In two pre-registered studies, we asked 481 British elementary schoolers to nominate "really clever" individuals, allowing us to characterize the traits children most closely associate with intelligence. Children exhibited clear gender and racial biases, nominating men/boys 1.8 times as often as women/girls and White individuals 5.9 times as often as people of color. Children also linked intelligence and scientific success, nominating scientists more often than all other professions combined. We observed inverse patterns when children were asked to nominate "really kind" individuals. We are now examining the cross-cultural replicability of these findings in India and China (current $Ns > 105$). Thus

far, results suggest that children endorse pronounced, multifaceted stereotypes about intellect across cultures, associating intelligence with White male scientists by age 8.

P4-94 - Social metacognition: 3-year-olds demonstrate explicit metacognitive competence in social paradigm of partial ignorance task

Marlene Meyer¹, Marina Proft², Lydia Schidelko², Johannes Rakoczy², Jan Engelmann³

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Details

Research on the ontogeny of metacognition indicates a protracted development of children's ability to assess their epistemic states. Interestingly, they master so-called *partial ignorance tasks* surprisingly late: they fail to acknowledge their uncertainty in light of multiple possibilities until they reach the age of 6 (Rohwer et al., 2012). However, these experiments study children's metacognitive abilities in non-social contexts – neglecting theoretical claims that explicit metacognition serves communicative and cooperative functions (Frith, 2012; Shea et al., 2014). To address whether this approach has underestimated preschooler's explicit metacognition, we introduce a novel paradigm, embedding the partial ignorance task in an inherently socio-communicative context. Children were asked by their conversational partner (second experimenter) in a cooperative task whether they knew which one of several toys was hidden inside a box. Across three studies (N = 162), we find that already 3-year-old children demonstrate explicit metacognitive competence in such a sufficiently social interaction. Specifically, both 3- and 5-year-olds spontaneously and explicitly expressed their uncertainty when giving advice to their partner under partial ignorance. Our results support the hypothesis that a social test context enhances children's metacognitive abilities. This is in line with a more general class of theories that emphasize the social origins and nature of higher human cognition.

P4-95 - Young children and parents do not prefer magical solutions to magical problems

Jennifer Van Reet¹

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Details

How do young children and parents reason about everyday magical problems (e.g., monsters under the bed)? Previous research suggests children are adept at creating boundaries between reality and fantasy and among different genres of fantasy. But, children favor solutions encountered in realistic contexts over fantastical ones.

Two studies involving preschoolers and one survey of parents explored how participants reason about magical problems. Children heard stories of real and magical problems and, for each, had to choose whether the character should employ a real or magical solution. Overall, children tended to choose magical solutions for magical problems at chance rates and real solutions for real problems (See Figure). Children rated the solutions as more effective overall when they matched the genre of problem. Parents

completed a retrospective survey about magical problems faced by their children and what types of solutions they attempted. Results indicate that 41% of parents could recall at least one magical problem experienced by their child. Parents who reported using magical solutions to those problems were significantly more likely to be imaginative thinkers themselves.

Taken together, these results suggest that parents and preschoolers do not expect that magical problems should have magical solutions. Only more imaginative parents attempt magical solutions even though children rate them as more effective.

P4-96 - Effects of counting fluency training on preschoolers' mathematics abilities

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Details

Early mathematics interventions often seek to teach preschoolers number principles, such as the later-greater principle and successor function. Recent work, however, indicates many errors stem from children struggling to use their count list effectively instead of not understanding principles (Ferrigno et al., in prep; Schneider et al., 2021). Here, we developed a preschool-based intervention to increase children's counting fluency (ability to flexibly navigate the count list). Children played two training games where they judged the relative order of numbers and practiced counting from different starting numbers. We then tested if these training tasks improved 3- to 4-year-olds' counting fluency more than control alphabet training tasks and if these tasks, in turn, led to better performance on number principle tasks and a standardized mathematics assessment (TEMA-3). We have tested 30 children thus far. Children in the count list training condition showed significant increases in performance in both the Successor and What Comes After *N* tasks, whereas those in the alphabet control did not demonstrate significantly increased performance. Our findings provide novel evidence that early mathematics errors are due to difficulties with counting fluency rather than number principles, suggesting that preschool mathematics education should emphasize counting fluency more.

P4-97 - Children's judgments of inner conflict

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Details

Experiencing an immoral temptation—and then ultimately overcoming it—can increase one's moral standing in the eyes of adults. But 3- to 8-year-olds think those who experience this internal struggle are morally worse (Starmans & Bloom, 2016). Why do young children condemn those who are morally conflicted? Here, we test two theories: 1) Children disapprove of those who have immoral temptations, or 2) Children disapprove of those who are conflicted. To contrast these theories, we explored judgments about people who are conflicted between two morally *good* actions.

Adults and 3- to 4-year-olds were shown scenarios depicting two characters performing a good action. One character was conflicted about which of two good actions to do (e.g., which friend to share with), while the other was not (e.g., wanted to share with only one friend). Adults thought that the character who wanted to do two good actions was better (73%), while children thought the unconflicted person was better (60%).

Experiment 2 (ongoing) examines whether these judgments also extend to non-moral struggles (e.g., wanting to play with two toys vs. only wanting to play with one). Results so far suggest that children again prefer those who are fully committed to one course of action.

These results suggest that it's not that young children specifically disapprove of those who are tempted to act immorally. Rather, they disapprove of those who experience any sort of internal conflict.

P4-98 - Why work hard? Examining children's intuitive theories about effort in school

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¹ New York University

Details

Children's beliefs about effort—for example, *who* has to work hard to succeed—can affect their motivation in school: If a child believes that they must work harder than others to succeed in school, they may be less interested and motivated in school. With the current research, we build upon this prior knowledge about children's effort beliefs by examining intuitive theories of effort: *Why* do children believe others work hard? Twenty-two 5- to 12-year-old children (data collection ongoing) residing in the United States responded to four open-ended questions about why they believe (1) some girls work hard, (2) some girls do not work hard, (3) some boys work hard, and (4) some boys do not work hard in school. Responses were transcribed and thematically coded. So far, several recurring intuitive theories of effort emerge: interest in the subject, perceived importance of effort (e.g., for future success), self-efficacy (e.g., expending effort to avoid failure, not expending effort because they're already smart), and family pressure. Future analyses will compare theories across target group gender, and participant gender and age. This work will deepen knowledge around children's intuitive theories of effort, building understanding around why children think others expend effort and how those beliefs might affect their own motivations and behaviors at school.

P4-99 - Robots among children: comparing child and GPT-4 performance on a global-local processing task

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Details

A fundamental requirement in research with young children is that the participants are, in fact, young children. This is easily validated in the lab, but more challengingly so in online studies. While remote research methods have offered several benefits (e.g., continued operation during pandemics, access to populations outside the proximity of the lab) (Su & Ceci, 2021), they have also created challenges in assessing data quality (Tompkins, 2022). It is more challenging in remote studies to assert what the participant saw, what they did, and who they were. While ‘bot’ responses are an acknowledged issue with text surveys (Chmielewski & Kucker, 2020), the visual tasks often used with young children might appear to require human input. Recent advances in artificial intelligence may challenge this assumption. To evaluate this risk, we provided a global-local processing task with identical instructions and stimuli to children ($n=127$ *Mage* = 5.06 years, 54% female) and to GPT-4, a vision-capable AI model created by OpenAI (2023). The AI model robustly favored stimuli with locally matching elements over globally matching arrangements (92.0% (335/364) of responses favored local match), while children varied in their responses (46.4% local). While the model performed differently than a child, its responses were reasonable, indicating a preference in 91% (364/400) trials. We suggest this result provides additional motivation for robust data quality measures in remote research.

P4-100 - A new questionnaire measure of autonomy support for parents of preschool children

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Details

Prior research suggests parent autonomy-supportive behaviors foster preschool children’s executive function skills. However, measurement of this construct is largely confined to observing brief parent-child interactions. There is currently no comprehensive self-report measure of autonomy support available for researchers. Thus, we developed a 30-item Likert questionnaire to measure various aspects of parent autonomy support and tested it with 26 parents of preschoolers (26-57 months). Cognitive interviews with a subset of participants ($n = 7$) evaluated item relevance, wording, and clarity. Parents also reported on their child’s temperament and executive function skills. Results showed that scale items captured adequate variation across participants and demonstrated acceptable internal consistency ($\alpha = .71$). Preliminary results showed autonomy support on the new questionnaire were associated with higher ratings of children’s working memory on the BRIEF-P ($r = .37, p = .06$) and effortful control on the CBQ-VSF ($r = .35, p = .08$), but these correlations did not reach significance. Qualitative insights from interviews guided adjustments to item wording to enhance clarity. Ongoing research will further test the construct and predictive validity of this new measure.

P4-101 - Relations between laypeople's beliefs about memory and their perceptions of children's disclosures of maltreatment during conversations with parents

Gabrielle Principe¹, Catherine Hopkins¹, Lizzie Petagna¹, Katie Elston¹, Madeline Keller¹, Aaliyah Pickens¹, Ava Lubin¹

¹ College of Charleston

Details

In most cases of childhood sexual abuse, children's testimony serves as the sole piece of evidence. Often, allegations first arise during interactions between the child and a non-offending parent. Research demonstrates (see Principe & London, 2022) that these conversations have the power to shape children's later formal statements. Specifically, at times, parents may unwittingly use high levels of leading or suggestive questions that can produce false accounts that can be as elaborate and compelling as reports of true experiences. As such, understanding laypeople's perceptions of parental influence on children's memory is paramount to arriving at accurate and just conclusions in cases involving young witnesses.

In this study, we explored connections between people's beliefs about memory and suggestive questioning in the context of parent-child conversations modeled after those in real cases. Participants ($n = 245$) read and then recalled either a neutral or highly suggestive conversation between a parent and child in which a singular disclosure of sexual abuse was made. We also asked participants about their beliefs about memory, suggestibility, and child sexual abuse, as well as several aspects of the conversation.

Results indicated strong relationships between people's beliefs about memory and suggestibility and their ability in the conversations to distinguish suggestive from nonsuggestive parental questioning, whether the disclosure was spontaneous or occurred only after multiple suggestions, the appropriateness of suggestive questioning, the reliability of the disclosure, and their recall of who said what. The implications of these and other findings will be discussed for children's treatment in sexual abuse cases.

P4-102 - Investigating the impact of playful learning landscapes in early childcare centers

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¹ Temple University, ² Temple

Details

Playful Learning Landscapes (PLL) is an evidence-based initiative transforming everyday spaces where children and families gather into playful learning opportunities. The current project is the first to implement and investigate PLL in early childcare education (ECE) centers. ECE centers ($n = 6$) were selected to receive PLL installations that either targeted STEM or literacy learning. Teacher-child interaction quality and individual child learning outcomes were investigated pre- and post-installation.

Observation of teacher-child interactions (n = 400) revealed more STEM and literacy language use and higher engagement at PLL compared to pre-installation interactions on the playground. Results from the individual child assessments (n = 134) showed that children attending a literacy-focused PLL center showed improvements in their literacy skills – specifically in their ability to define “character” and incorporate a setting in a story. Findings contribute to a growing body of work indicating the effectiveness of PLL.

P4-103 - Role representations: developing representations used to reason about agents who occupy roles

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Details

This study investigates how children and adults represent agents who occupy roles (“role actors”). We propose that when reasoning about role actors, people rely on inferences about the role’s obligations more than the actor’s mental states; thus, these inferences transfer to other agents who occupy the same role. We showed participants (N=100 adults; N=116/128 children ages 5, 6, and 9,10) a video of either a role actor or a non-role actor blocking another agent and asked them questions about the actor and their motives. Then, participants answered whether a *new* agent (another role or non-role actor) would also block. We hypothesized that participants would explain a role actor’s behavior in terms of obligation (they *had to* block) and predict a new role actor would act the same, but would explain a non-role actor’s behavior in terms of mental states and traits (they *wanted to* block and are *mean* for blocking) and predict that another non-role actor would behave differently. Adult responses were in line with these predictions. Children also inferred that the role actor acted out of obligation, but only *older* children (9 & 10 yrs) reasoned that the non-role actor wanted to block more and that a new role actor was more likely (than a non-role actor) to block as well. These results outline a developmental trend in which children are more drawn toward mental state inferences than adults, but learn that roles entail obligation and consistency across agents in middle childhood.

P4-104 - Because I want to: valuing goals for their own sake

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Details

People often do not reconsider their choices, sticking with their goals even when they would be better off abandoning them. Prior work found this behavior in both adults and young children in prosocial contexts. Here we ask whether this generalizes to idiosyncratic goals with no instrumental value: choosing one of two similar objects to ‘make’ (Fig. 1). We either revealed goal difficulty at the choice point (Goals+Cost condition) or revealed later that the chosen goal would be harder, and offered children a chance to switch goals (Goals First). In Experiment 1 (n=59), children stuck with the harder

drawing on Goals First trials (M=65%) but picked easier drawings given both Goal+Cost information (M=23%; between-subjects $t(57)=5.3, p<.001; d=1.38$). In Experiment 2 we control for a bias to persevere on Goals First trials by additionally revealing that the chosen goal had already been achieved (Goal Devalued trials). Children (N=23 of 36 planned) persisted more on Goals First trials (M=56%) than Devalued trials (M=42%; within-subjects $t(22)=2.2; p=.04; d=.45$). We also manipulated context (prosocial or idiosyncratic) within-subjects and found no main effect or interaction with trial type. In summary, while children rationally prefer easier goals and are able to switch away from goals that are newly redundant, they don't always want to. Our results raise questions about the nature of resolve and how children assign value to goals and plans.

P4-105 - Structured activities facilitate grandparent and grandchild enjoyment of triadic videochat interactions

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Details

Bronfenbrenner's microsystem is the immediate environment that is directly experienced, but videochat now allows children and remote family members to build virtual connections. Structuring videochat interactions to promote reciprocal interaction and shared focus may lead to more engaging experiences that promote feelings of enjoyment for all members of the triad (parents, children, grandparents).

We compared two approaches (reading and play) of instructing grandparents on engaging in videochats with grandchildren (18 months - 5 years). Families (n=43) rated their enjoyment of videochat interactions at the start and end of the study, and submitted 11 recordings (1 baseline, 9 after instructions, 1 final) of virtual interactions. We analyzed enjoyment scores in several 2 (time: start vs. end) X 3 (condition: reading vs play vs control) repeated-measures ANOVAs, one for each outcome variable (parent, child, grandparent enjoyment).

Results for the younger age group (<3 years) showed that enjoyment increased in the reading condition for children and grandparents ($p=.045$); whereas in the older children (3-5 years) child enjoyment increased over time across all conditions ($p=.05$). In both age groups, grandparent enjoyment was higher overall than child and parent enjoyment ($p<.001$).

These results show that structured activities facilitate grandparent and child enjoyment of videochat interactions, and have implications for families' use of videochat to connect across distance.

P4-106 - Comparing univariate and multivariate approaches to fNIRS data analysis

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Details

Adult neural responses to perceptual stimuli and cognitive tasks exhibit strong, reliable spatial organization within and across people. The emergence of this functional brain organization in infancy and childhood may underlie associated perceptual and cognitive development, so it is important to refine cognitive neuroscience methods that can capture the existence of and change in patterns of neural specialization in the first months and years of life. In methods with high spatial resolution, such as fMRI and EEG, multivariate analysis techniques can capture fine-grained neural patterns associated with highly specific aspects of perception and cognition. Recently, researchers have begun to apply similar approaches to data collected using functional near infrared spectroscopy (fNIRS), a neuroimaging method well-suited to research with awake infant participants. However, the spatial resolution of fNIRS is much lower, and researchers often measure from units spanning one or more lobes of the brain, rather than from within a functional region of interest. Using multiple existing fNIRS data sets, we tested if multivariate analyses of fNIRS data actually provide more sensitivity to functional organization than univariate analyses. We found that while we were able to successfully implement multivariate decoding in some fNIRS datasets, it may depend on the presence channels with strong functional preferences that are also evident in univariate analysis.

P4-107 - Children's cost-benefit analysis about agents who act for the greater good

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Details

Acting for the greater good often involves paying a personal cost to benefit the collective. In two studies, we investigate how children ($N = 184$, $M_{\text{age}} = 8.02$ years, $SD = 1.15$, Range = 6.00 - 9.99 years) reason about cost and consequence. Children predicted how many agents would pay a personal cost to prevent a consequence for their entire community and made judgments about an agent(s) who refused to pay this cost. In Study 1, children expected more agents to pay a minor cost to prevent a major consequence and judged refusal to pay the cost as less permissible than in the opposite case. Study 2 investigated the intermediate cases (Major/Major and Minor/Minor Cost/Consequence). Children expected agents to pay a minor cost regardless of consequence, and only expected agents to pay a major cost when consequence was major. In their judgments, children only considered consequence – refusal to pay the cost was more permissible when consequence was minor, regardless of cost. In two studies, these findings demonstrate that children engage in cost benefit analysis when making predictions and judgments about the greater good.

P4-108 - Learning loopholes: the development of intentional misunderstandings in children

Sophie Bridgers¹, Kiera Parece², Ibuki Iwasaki¹, Annalissa Broski¹, Laura Schulz¹, Tomer Ullman³

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Details

When people have conflicting goals, they sometimes use intentional misunderstandings (loopholes) to avoid outright non-compliance. In Study 1, we investigated *why* children engage in loophole behavior by examining how children evaluate the consequences of loopholes compared to direct compliance and non-compliance. Children (N = 108, 4 to 9 years) predicted that loopholes would result in less trouble than non-compliance, suggesting that children perceive loopholes as a means to reduce social consequences. In Study 2, we explored children's reasoning about *when* loopholes are exploited by asking them to predict a protagonist's behavior when the goals of two social partners were either aligned or misaligned. Children (N = 140, 5 to 9 years) indicated that when goals were aligned, a child protagonist would be more likely to comply with their parent's request, however when goals were misaligned the child would be less likely to comply and more likely to use loopholes. In Study 3, we probed children's (N = 60, 5 to 9 years) abilities to actively generate a loophole in real time given a request. We found an age effect such that as children got older, their ability to produce loopholes increased. This work provides us with a better understanding of children's reasoning about intentional misunderstandings and how they navigate the gray area between compliance and defiance across early childhood.

P4-109 - Do parents and children agree about children's play preferences?

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¹ Cornell University

Details

Parents' beliefs about their children's play preferences have implications for the play opportunities available to their children. To examine whether parents and children agree about children's spatial play preferences, we asked thirty-four parents and their children ($M = 4.78$ years, $SD = .47$ years) to separately select which activity across eight pairs of activities the child would prefer. Four pairs depicted images of a spatial and a non-spatial activity (e.g., create an origami pig or color a pig drawing) and four pairs depicted a simpler versus more complex spatial activity (e.g., a Lego house with few versus many bricks). Percent agreement was calculated by summing the number of questions in which parent and child chose the same activity and dividing this sum by the total number of questions answered. A one sample t-test against chance (.50) revealed that dyads agreed on more activities ($M = .60$, $SD = .23$) than expected by chance, $t(33) = 2.54$, $p < .05$. In addition, dyads did not differ in their percent agreement for spatial versus non-spatial activity ($M = .63$, $SD = .29$) and simple versus more challenging spatial activities ($M = .57$, $SD = .29$), $t(33) = 0.93$, $p = .36$. These results suggest that parents have insight into the play activities their preschool child prefers.

P4-110 - Exploring loophole behavior: a comparative study of autistic and non-autistic populations

Kiera Parece¹, Sophie Bridgers², Annalissa Broski², Tomer Ullman³, Laura Schulz²

¹ Harvard & Massachusetts Institute of Technology, ² Massachusetts Institute of Technology, ³ Harvard University

Details

In day-to-day life we often hold goals that are different, or at odds, from those of our social partners. When faced with situations where goals are misaligned, a person might choose to sidestep non-compliance by intentionally misunderstanding the meaning of their partner's request (technically satisfying it by upholding the letter of the request, but violating the underlying spirit). The use of intentional misunderstandings, or *loopholes*, relies on the integration of complex social cognitive skills such as language understanding, rational planning, and goal alignment. In this work, we surveyed parents to study the emergence, extent, and scope of loophole behavior in childhood among autistic and non-autistic children. Loophole behavior emerged significantly later in children with autism diagnoses (N = 202) than those without (N = 425), and among children currently engaging in loophole behavior, autistic children were significantly older than non-autistic children. However, loophole behavior emerged equally often in both groups of children. These results build toward a comprehensive, neurodiverse picture of children's understanding of intentional misunderstandings and introduce a novel method for exploring variance in autistic and non-autistic children's social reasoning and decision-making.

P4-111 - Context-dependent language input in parent-infant interactions: a comparative analysis of puzzle and busyboard play

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Details

Language input during parent-infant interactions is crucial for early language acquisition. Although the quality of parental speech to infants predicts later language ability, it is also the case that parental speech varies with the context. We transcribed parental speech during play in a sample of 53 parent-infant dyads (*M* infant age = 9.2 months; 17 girls, 36 boys). Dyads participated in 3-min puzzle and busyboard play activities. Sessions were transcribed for all vocalizations made by parents. From the transcripts, we calculated the total number of words (i.e., tokens) and the unique number of words (i.e., types) uttered by each parent. We also calculated the total number of tokens and types of *spatial* words and *object naming* words provided by parents. Our final analyses will include data for *action* words as well. Preliminary analyses revealed that the puzzle task prompted higher levels of total tokens and types from parents compared to the busyboard task. Furthermore, regardless of the task, parents consistently provided more spatial words than object labels. Nevertheless, parents provided more object labeling during the puzzle task in comparison to the busyboard task. These findings underscore the context-dependent nature of language input during parent-infant interactions, shedding light on how different play activities may elicit varied linguistic responses from parents.

P4-112 - Ten- and 11-month-old infants use others' emotions to individuate agents

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Details

People's emotional responses towards each other can shed light on the relationships that they have. If one person looks at another and says "Ew", one may infer that the two people have an antagonistic relationship. The present experiments test the hypothesis that 10- and 11-month-old infants represent new individuals, at least in part, based on their relationships with others. In Experiment 1 ($n = 8$), infants saw videos in which there was a screen, and two animate pink cones emerged from behind the screen. A yellow circle agent responded positively (saying "Wow!" as though excited) when a cone emerged from the screen at one time and negatively (e.g., saying "Ew!" as though disgusted) when a cone emerged from the screen another time. These distinct responses provide evidence for two distinct kinds of relationships. We examined whether infants looked longer when one vs. two cones were revealed to be behind the screen. Infants looked longer when there was one agent behind the screen (mean = 15.35 s) than when there were two agents (mean = 10.60 s) ($b = -0.50$, $p = .019$). These findings suggest that infants use social emotions to individuate agents. In ongoing research (Experiment 2, preregistered, target $n =$ at least 56), we are attempting to replicate these findings and test whether infants' inferences are specific to agents. These findings will shed light on how infants use others' relationships to learn about the world.

P4-113 - Efficacy of indirect perspective-taking training in typically developing children.

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Details

Spatial abilities are vital in the comprehension, manipulation, and navigation of physical environments (Montello, 2015). The present study focuses on indirect training of perspective-taking performance. Twenty-nine children between the ages of five to nine participated in this study. Participants completed two initial assessments designed to measure perspective-taking ability, Three Mountains task as adapted from Piaget and Inhelder (1956), and the Dog task as adapted from Newcombe and Huttenlocher (1992). They also completed the Raven's Two Progressive Matrices Task (Raven et al., 2018). Following initial assessment, they were exposed to sixteen weeks of experience in two visual search tasks that involved perspective taking. After sixteen weeks of experience, both groups were reassessed on perspective-taking ability. After removing those who scored at the ceiling on initial assessments, our findings indicate a significant positive correlation between age and improvement on the Three Mountains task [$r(23) = .39$, $p = .027$]. The Dog Task did not show a significant correlation in improvement, but was trending positive [$r(16) = .21$, $p = .201$]. Interestingly, there was no significant correlation between Raven's age equivalent scores and improvement on either task. This pattern of

correlations suggests that physical age may be an important variable in determining how spatial experience promotes improvement in spatial activities.

P4-114 - An eye-tracking task assessing visual short-term memory in 12- to 36-month-old children

Van Pham¹, Aaron Beckner², David Tompkins², Marianella Casasola², Vanessa Lobue³, Lisa Oakes¹

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Details

Visual short-term memory (VSTM) serves as temporary storage for visual information, facilitating ongoing cognitive tasks, and is associated with IQ and other cognitive abilities (Luck & Vogel, 2013). In infants and adults, VSTM is assessed using a traditional change detection paradigm; participants view a *sample array* containing several items, followed by a brief *delay*, and lastly, a *test array* consisting of previously shown items and one or more items that may have changed. Adults verbally describe or indicate which items changed in the array; infants' change detection is inferred from their preferential looking at the item that has changed. We adapted this eye-tracking paradigm for use with children 12 to 36 months of age ($M_{age} = 22.6$ months, $N = 48$, 24 girls). On each trial children were presented with a 500-ms *sample array* of three colored circles, followed by a 300-ms *delay* (blank screen), and finally, a 2000-ms *test array* that was identical to the test array except one randomly chosen circle had changed color. Children's mean *change localization* score (the duration of looking at the changed item divided by the total duration of looking at all three items during the test array) was significantly above chance, $t(47) = 7.83$, $p < .001$, indicating that as a group children preferred the changed item. The connection between these results and previous findings with adults and infants will be discussed.

P4-116 - An analysis of assessments of specific and general math skills for preschool children

Pritha Sengupta¹, Talia Berkowitz¹, Skye Gasataya¹, Anna Shusterman¹, Claudia Ferrara¹, Emma Trapani¹

¹ Wesleyan University

Details

Differences in children's numeracy skills at the start of kindergarten can persist through schooling (Duncan et al., 2007). Thus there is a need for reliable and nuanced assessments that can accurately measure and track children's abilities. We examine how 5 assessments of specific early numeracy skills relate to one another and to a measure of general math knowledge. 575 three to five year old children ($M = 48.53$ mos, $sd = 7.21$) completed assessments of cardinality, counting, magnitude comparison and numeral identification and the Preschool Early Numeracy Screener (PENS; Purpura, et al., 2015), a measure of general math skills. An exploratory factor analysis found that the five measures of specific math skills loaded onto one factor, explaining 64% of the variance. After controlling for age, all skills were significantly correlated with cardinality, a critical early numeracy milestone (range: 0.31 - 0.88, all $p < .001$). A regression with PENS score as the dependent variable, controlling for age, found that Give-A-Number (GAN) accounted for 39% of the variance, more than any other assessment. -GAN and age

together accounted for 56.5% of the variance in the PENS score, and adding other measures of cardinality, magnitude comparison, and counting to the model explained an additional 8.4% of variance. Thus, to assess math ability in preschool-aged children, a single general math measure, like the PENS, may be adequate for many purposes.

P4-117 - Adult mealtime language use and child language outcomes in Spanish speaking homes in the US.

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Details

Past research investigating individual parent-child relationships highlights that quality interactions, including using open-ended questions and reducing directives, positively influence a child's language development. Unlike many studies focusing solely on the primary caregiver, this research considers the broader linguistic environment by incorporating input from all adults in the home during mealtimes, a particularly stressful time of the day for parents of young children. Analyzing mealtime interactions of 17 Spanish-English bilingual children (ages 3-6), adult utterances were categorized as declarative, imperative, or question (closed or open-ended) and child English and Spanish abilities were measured by the QUILES:ES. Adults' use of closed-ended questions was negatively correlated with children's language abilities ($r(13) = -.568, p = .027$), while open-ended questions surprisingly did not correlate with improved language outcomes. We believe the focus on mealtime interactions brought forth unique insights into reshaping adult language during meals to positively influence child language development.

P4-118 - Enhancing the mathematical landscape in preschool classrooms: opportunities and challenges of implementing a play-based early numeracy intervention

Skye Gasataya¹, Remi Feuerman¹, Andi Wiley¹, Sophie Williamson¹, Pritha Sengupta¹, Talia Berkowitz¹, Anna Shusterman¹

¹ Wesleyan University

Details

Early mathematical achievement is a strong predictor of later academic success (Duncan et al., 2007), yet preschool teachers often lack the appropriate resources to adequately support children in their early math education (Hindman, 2013). We designed and piloted a collection of 11 engaging and flexible early numeracy games in 19 preschool classrooms with over 600 students. Using qualitative observational and focus group data, we examined whether and how teachers implemented the games in their classrooms. We found that game materials were present in classrooms but often missing the critical math component; teachers erroneously believed that the games did not sufficiently challenge children's math abilities; and teachers maintained gendered beliefs regarding children's interest in the math games, despite training and evidence contradicting this belief. These findings have important implications for

the design of future interventions and highlight the importance of adopting a co-design framework to improve teacher buy-in.

P4-119 - Reassessing children's cardinal principle knowledge on the give-a-number task

Saige Rovero¹, Pritha Sengupta¹, Skye Gasataya¹, Talia Berkowitz¹

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Details

Previous research has established that children learn the meanings of number words by progressing through a series of fixed stages (e.g. Sarnecka & Carey, 2008, Wynn, 1990; 1992). Historically, children have been categorized as subset knowers (meaning they understand only a subset of the numbers in their count list) until they develop an understanding of the number 5, at which point it is assumed that they have acquired the cardinal principle, the idea that when counting a set, the last number in the count list refers to the number of objects in that set. However, recent publications by Krajcsi and colleagues (2021; 2022; 2023), have suggested that classifying children who can create a set of 5 or 6 on the Give-A-Number task as Cardinal Principle (CP) knowers may be overestimating their abilities. Instead, they propose that some children may be Large Number Subset (LNS) knowers, motivating a re-evaluation of more typical approaches to categorizing CP-knowers. In a dataset of 495 children (mean = 48.9 months), we found that 9.4% of children previously classified as CP-knowers could potentially be reclassified as 5-, 6-, or 7-knowers. We suggest that their failure to demonstrate full CP knowledge may be related to non-conceptual factors such as working memory and executive functioning capacities, and discuss ongoing work attempting to elucidate factors that contribute to the performance of ostensive LNS-knowers on the Give-A-Number task.

P4-120 - A cross-cultural examination of children's reasoning about social-status inequalities

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Details

Children are remarkably sensitive to status inequalities between social groups, but we know relatively little about how such inequalities shape children's group-based reasoning (Shutts & Kalish, 2021). In a cross-cultural investigation, we examined the causal role of social-status differences in children's reasoning about the traits of novel social groups in three cultural contexts: the United Kingdom (N = 148), the United States (N = 116), and mainland China (data collection ongoing). Across samples, children have consistently inferred that low-status groups are relatively nicer than high-status groups and that high-status groups are relatively more intelligent than low-status groups ($ps < .02$). These findings inform how societal processes influence children's reasoning about social groups in diverse cultural contexts.

P4-121 - Show or tell? Preschool-aged children flexibly adapt how they communicate based on others' auditory access.

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¹ Stanford University

Details

As adults, we effectively tailor our communication based on others' sensory access; in noisy environments, for example, we might substitute speech for gestures or demonstrations. Although preschool-aged children understand how auditory noise disrupts others' communication (Chuey et al., 2022), it remains unclear whether and how children utilize this understanding in their own communicative behaviors. The current work asked whether 4- to 5-year-olds (n=48) adapt how they communicate based on others' auditory access. Children were verbally told how a novel toy works and were then asked to teach a learner how it works. To manipulate the learner's auditory access while minimizing the influence of the learner's real-time reactions, the learner was a puppet wearing headphones that played loud music (noisy condition) or nothing (noiseless condition). Compared to children in the noiseless condition, children in the noisy condition were more likely to use physical demonstrations ($p = .003$) and less likely to use verbal instruction ($p = .022$). These results suggest that, by around age 4, children are not only sensitive to others' auditory access but can also flexibly adapt the modality of their communication accordingly. Our results extend work on Theory of Mind beyond reasoning about others' visual access into the auditory domain, with implications for how mental-state reasoning can support communication in perceptually compromised contexts more broadly.

P4-122 - "Oh! Um... Sure": children use other's linguistic surprisal to guide stereotype inferences

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Details

Conversations with adults are a key venue for learning about the social world, and consequently for the transmission of stereotypes. Imagine a boy wants to buy a Barbie and his caregiver provides a permissive, gender egalitarian response, but that response comes with markers of surprise (e.g., saying "Oh! Um... Sure"). What message does he receive? In a pre-registered study (n = 120, ages 4-9), we asked whether children use surprisal feedback to reason about gender stereotypes. Children heard an adult affirm a target boy's toy choice, but their response was either fluent (baseline) or marked with surprise (surprise; "Oh really? Um... Sure, honey. Uh... We can buy you that one"). Children were asked to infer whether the boy had chosen a boy-stereotyped or girl-stereotyped toy. In the baseline, children at all ages showed strong gender stereotypes, rarely inferring that the boy chose a "girl"-toy (< 25%). Importantly, by age 6 children were sensitive to how the feedback was given, being more likely to infer the boy chose the "girl" toy in the surprise (38%) than baseline condition (12%, $p = 0.01$). This study shows that children use conversational cues to surprisal when reasoning about the behaviors adults expect, even when these cues run counter to the adult's explicit messaging. In an ongoing follow-up (n

= 89/120 planned, ages 4-9), we explore how this same inference guides children to learn how an alien group should behave and predict which acts would lead to being teased.

P4-123 - Understanding the relation between curiosity and creativity in elementary students

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Details

Curiosity and creativity are theoretically linked constructs, but most evidence relies on self-report, and the relation is rarely studied in children (Schutte & Malouff, 2020). In a previous study (Authors, 2023), we found evidence of an association between curiosity and creativity with self-report data, but not behavioral measures. These measures included an open-ended free exploration task to assess curiosity and a divergent thinking task to assess creativity. We replicated and expanded upon our previous study by testing an updated version of the open-ended curiosity task that allowed for greater exploration and added another measure of curiosity that examined uncertainty preference. In a new sample of 98 students (49 girls, $M_{age} = 7.57$ years, $SD = 1.11$), we found again that curiosity and creativity were positively and significantly related on the self-report measure ($r = .49$, $p < .001$), but were again not associated for either the free exploration or uncertainty preference tasks (r values 0.02-0.10; p values $> .05$). These findings highlight that curiosity and creativity are complex constructs that are difficult to measure, and while there is theoretical and some empirical evidence linking them, more work is needed to understand their potential overlap and connections as well as distinctions.

P4-124 - Exploring in depth: examining children's exploration patterns in a revised curiosity task

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¹ University of Virginia

Details

Curiosity occurs when a child experiences a gap in knowledge and seeks to close that gap, and can be measured using exploration tasks (Author, 2012). This work explored the extent to which children's exploration showed breadth and depth, and variation with age. In prior work (Author, 2023), 82 children ages 5-10 completed an open-ended digital exploration task. Children could click shapes (9 total) to hear facts. There was more depth exploration with age, but only 3 available facts per shape may have limited the availability of exploring in depth and overall variability in total explorations (57% of children explored all facts). In a revised version of the task, each shape provided 7 facts, allowing analysis of breadth (switching between shapes) vs. depth exploration (consecutive clicks on the same shape). A depth-proportion score was calculated by dividing consecutive-same clicks by the total number of clicks. Children ($N = 88$) explored 18.8 ($SD = 11.5$) facts, with 17.2% ($SD = 22.4$) depth explorations. Total clicks did not differ from the old version ($M_{old} = 20.7$, $SD = 8.5$, $t(150) = 1.13$, $p = .26$), but there was a greater proportion of depth exploration in the new version ($M_{old} = 4.7\%$, $SD = 9.3$, $t(150) = -4.18$, $p < .01$). Age was not associated with total or depth exploration on the new task. These findings demonstrate the

importance of task design in understanding children's exploration, and we will further discuss how these results can contribute to the literature on children's curiosity.

P4-125 - Developmental trajectories of Muslim children's differentiation of the mind and soul

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Details

Researchers have hypothesized that the concept of the soul as distinct from the mind is due normative developmental processes and cultural learning (Bering, 2006; Barlev & Shtulman, 2021). Adults and children typically assign cognitive functions to the mind and spiritual functions to the soul (Lindeman et al., 2015; Richert & Harris, 2008), but the developmental trajectory is still unclear and other cultural examples are lacking.

The ongoing study examined whether Muslim children ($M = 8.65$, $SD = 2.74$) assign cognitive, emotional, desire, moral, or religious functions to the mind or the soul and whether age was related to the choice. Currently, thirteen Muslim children from the Houston-area were interviewed with recruitment ongoing. Children were presented with a short vignette about a novel fictional adult and then asked whether the mind or soul was responsible for 2 functions per category. Answers were averaged by category resulting in 5 scores that ranged from 0 [*Mind*] to 1 [*Soul*].

A RM-ANOVA found a main effect of function, $F(4, 48) = 3.435$, $p = .015$, indicating children differentiated between the function categories and whether the mind or soul was responsible for them. Correlations were calculated between children's age and each function category: cognitive ($r = -.055$, $p = .859$); emotion ($r = -.731$, $p = .005$), desire ($r = -.629$, $p = 0.21$), morality ($r = .434$, $p = .138$), and religiosity ($r = .260$, $p = .390$). These results indicate that Muslim children do differentiate between the soul and the mind. Additionally, there is a developmental trajectory in whether they attribute emotion or desire properties to the mind or soul.

P4-127 - Explaining exploration: children's reasoning behind their information seeking

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¹ University of Virginia

Details

Curiosity is defined as information seeking to fill gaps in knowledge (Author, 2012), and is often measured as exploration. We tested whether children's exploration on an open-ended exploration task aligned with this definition. Children ($N=61$) explored by clicking shapes to hear facts with each shape representing a different topic. The task assessed the total exploration and patterns of depth and breadth exploration (consecutive clicks on same vs. different shapes). After exploring, children were asked how they decided what to explore. More than a quarter of children (26%) explained that they clicked on

shapes to know more about something (generally or about a specific topic), with 36% reporting having a method of exploring such clicking shapes in order, 11% responding “I don’t know”, 11% mentioned exploring randomly, 13% said they clicked on shapes they liked, and 2% described the task procedure. Children explored 17.4 ($SD=10.9$) facts on average, and children who struggled to explain (e.g., “I don’t know”) explored the most ($M=25.0$, $SD=13.7$); those whose responses were non-substantive (e.g., procedural or random exploration) explored the least ($M=9.0$, $SD=1.4$). Higher depth exploration was associated with children responding that they wanted to know something more about a specific topic. These explanations suggest different motivation for exploration, with some more related to curiosity than others, indicating important considerations for future curiosity research.

P4-128 - Infants’ and children’s reasoning about rationality and morality

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Details

Adults tend to perceive entities with more mental capacity as having higher moral standing (Gray et al., 2007). Here we asked whether 16-month-olds expect an individual with reduced mental capacity, as shown by having acted irrationally, to have lesser moral rights. We built on prior findings showing that infants can detect an individual’s irrational behavior and expect an individual to be treated fairly. In two violation-of-expectation studies, infants first saw an experimenter, E3, who acted rationally or irrationally (e.g., reached for an object inefficiently or reached for an object that is inconsistent with her goal). Later, E1 divided two toys between E2 and E3 either fairly or unfairly, disfavoring E3. Results showed that infants in the rational condition expected fairness, but infants in the irrational condition did not find the unfair outcome unexpected and looked equally at the two events. This suggests that infants may perceive irrational individuals as having reduced moral rights and do not have to be treated fairly. Experiment 3 provided additional data with 5-8-year-olds.

P4-129 - Children's developing ability to provide clarification in everyday conversations

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Details

Speakers often need to clarify their utterances to prevent breakdowns in understanding. The developmental origins of this skill remain largely unexplored. Using longitudinal transcripts from English-speaking households in the CHILDES database, we examined how children ($N = 7$) use the word ‘but’ to clarify messages in everyday conversation. ‘But’ statements were coded as *Clarification Attempts* (i.e., instances where ‘but’ was used to elaborate on a previous statement) or *Other*. A mixed-effects linear regression model indicated that children’s *Clarification Attempts* increase greatly between ages 3 and 5, mirroring the development of theory-of-mind skills (see Figures 1 and 2). These findings suggest that children’s evolving clarification skills reflect increasing sensitivity to listeners’ informational needs. To

support this interpretation, ongoing work is analyzing whether clarification attempts are more frequent when: a) the child describes something that the listener has expressed ignorance about, or b) the listener expresses confusion about the child's preceding statement.

P4-130 - Wayfinding experience is related to spatial skills in 4- to 6-year-olds

**Shannon Pruden¹, Yinbo Wu¹, Nick Mattox¹, Hannah Bowley¹, Priscilla Lioi¹, Yvonne Ralph²,
Vanessa Vieites¹, Melanie Rengel-Isea¹, Amanda Renfro¹, Timothy Hayes¹, Anthony Dick¹, Aaron
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Details

Spatial skills, including mental rotation and navigation, predict math and science achievement in childhood and entry into Science, Technology, Engineering and Mathematics education in adulthood. We examined the role of early childhood wayfinding experience (distance travelled and frequency outside play) in the development of children's spatial skills. One hundred 4- and 6-year-old children (55 girls; Age=5.61 years, SD=0.89 years) completed a Mental Transformation task and Spatial Reorientation task. Parents completed a Wayfinding questionnaire. Greater distance travelled and high frequency outside play were positively associated with spatial reorientation accuracy (coefficient=8.92, SE=3.25, $p<.01$; coefficient=2.60, SE=1.47, $p=0.07$), controlling for age and gender. Distance travelled and frequency outside play were negatively associated with spatial reorientation errors (coefficient=-4.38, SE=2.20, $p<.05$; coefficient=-2.69, SE=1.33, $p<.05$), controlling for age and gender. No significant relations between wayfinding experience and mental transformation were found. Wayfinding experiences are beneficial to some spatial skills in young children and may offer potential explanations for development of spatial skills.

P4-131 - How does undermining the stereotypes that science is done by (white) men working alone impact girls' interest in science?

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Details

Women are underrepresented in some science fields, partly because of stereotypes that science is solitary work that is done by men—stereotypes that even children are familiar with. Across two preregistered studies, we tested whether undermining these stereotypes increases girls' interest in an unfamiliar science (geophysics). In Study 1, we asked 290 4- to 9-year-old children (50% girls, 50% boys, 53% children of color, 47% white children) how interested they would be in geophysics when learning about it from a same-gender (vs. other-gender) geophysicist who works together with other people (vs. alone). All children were more interested when learning about the science from a same-gender geophysicist who works with other people (vs. alone). In Study 2 (current N = 335, planned N = 336, 50% girls, 50% boys, 55% children of color, 45% white children), we manipulated who the geophysicist was

said to be working with: white men (stereotype-congruent), a racially and gender-diverse group (stereotype-incongruent), or alone (stereotype-congruent). Preliminary results suggest that girls' interest in geophysics decreases with age in the "white men" and "alone" conditions, but crucially not in the condition where the other geophysicists are diverse, suggesting that *who* you work together with matters for girls' interest in science.

P4-132 - Children's use of feature-based and alternation-based rules to explain causal functions

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Details

From a young age, children learn about different kinds of causal relationships in their everyday environments. Many of these causal rules reflect stable characteristics of individual objects in an environment; however, other rules can reflect higher-order relationships between multiple objects, such as a pattern of alternating sequences. In an initial experiment, we introduced 5- and 6-year-old children (N = 64) to a machine which activated according to a causal rule when trays were placed on it. Initially, the pattern of activations satisfied both a feature-based rule (trays with red blocks activate the machine) and an alternation-based rule (every other tray makes it go). However, the final 4 trays matched only one of the two possible rules, depending on the condition. Children were then asked to infer the activations of 8 new trays.

We found that children's inferences more closely matched the alternation rule in the alternation-based rule condition, and the feature rule in the feature-based rule condition. A small number of children preferred non-changing activation patterns, in which either all trays did or all trays did not activate the machine, and a substantial minority of children made choices that were not captured by these rules. However, some of these children provided open-ended explanations which made references to alternating sequences with different activation patterns, (e.g., "yes, yes, no, no"), suggesting children may find causal rules involving sequences particularly salient.

P4-133 - Unfolding potential: the role of mental folding as a distinct spatial skill in predicting children's math ability

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Details

Spatial skills are shown to be related to math performance throughout development and are highly predictive of success and participation in STEM fields. Mental rotation ability is a commonly used measure of children's overall spatial ability. However, spatial skills are multifaceted. We developed another measure of spatial skill, targeting children's mental folding. Mental folding skill has been well studied in adults but less in children (Harris et al, 2013). Testing 150 children (M_{age} = 87.4 months) we

found that, like with adults, mental folding is a distinct yet related skill to mental rotation. Both mental folding and mental rotation uniquely predicted performance on number line estimation ($B_{\text{folding}} = -0.6, p < 0.01$; $B_{\text{rotation}} = -0.73, p < 0.01$) and general math ability ($B_{\text{folding}} = 0.47, p < 0.001$; $B_{\text{rotation}} = 0.44, p < 0.001$) after controlling for age, gender, and vocabulary. Moreover, while sex-related differences in performance existed for mental rotation ($B = 1.15, p < 0.05$) they did not for mental folding performance ($B = 0.39, p = 0.5$). This work implicates mental folding as an important spatial skill to focus on in children.

P4-134 - Children's and adults' reasoning about sharenting conflicts

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¹ University of Manitoba

Details

Parents commonly share personal information about their children on social media, known as sharenting. Oftentimes these posts create conflicts where parents and children disagree about whether they should be taken down (Verswijvel et al., 2019). But, what psychological factors might influence how children and parents think about these conflicts? Similar to other moral conflicts, there are different stances that can be taken when reasoning about them. For example, an outcome oriented stance might focus on whether the post has a negative effect on others; where an autonomy oriented stance might focus on the rights of the child whom the post is about (i.e., informational autonomy). Using a 2X2 design, we examined how autonomy as operationalized by the content of the post (parent/child), and valence as operationalized by whether the post was positive/negative, influenced children's and adults' thinking about whether social media posts should be taken down (per a child's wishes), or left up (per the parents). Study is ongoing. Mixed binary regressions were conducted. So far (Fig 1), adults (N = 34), generally support the child's wishes to take down posts, regardless of posts content/valence. But, children's (N = 28, 6- to 8-years) responses are being mainly driven by valence ($p < .001$) or judgements that parents should take down all negative posts. This study will be an important step towards understanding children's and parent's reasoning about sharenting conflicts online.

P4-135 - Children's endorsements of resource distributions in an unequally resourced peer scenario

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Details

Previous research has established that when dividing valuable resources among third parties, children attend to merit to create equitable distributions. However, little is known on how they attend to pre-existing disparities in resources.

In the present study 8-12 year old children (n = 68, data collection currently at n = 65) rate different distributions of coins in a fictional video game on a 6-point Likert-type scale. We predict that these endorsements will differ based on allocation type (3:1, 2:2, 1:3) such that children endorse inequality to establish equity for characters who have less. Through an experimental design using vignettes, we examine whether children consider resource origin when endorsing resource distributions, and if children are more more motivated to endorse inequality to establish equity compensating from pre-existing inequality. We also hypothesize that children will endorse distributions that rectify inequality more often when a character has more resources due to their parents' purchases for the game ('wealth') than the amount of time they've played the game ('merit').

Preliminary results (n = 65) show that children across age groups endorse equity (mean = 5.08) over equality (mean = 3.96) when distributing tokens in an economic vignette, regardless of resource origin. This adds novel insight into the way children think about economic equity.

P4-136 - Reuse and remixing in question asking across development

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Details

Asking questions is an important and often-used tool for human learning. But asking informative questions often poses a difficult challenge, especially for children: of all possible questions that could be asked in any particular situation, few are informative. How do children formulate informative questions? In this work, we propose and test the *question reuse and remixing hypothesis*: that people repurpose and recombine elements of past questions for new situations. For example, if a child has gained information using the question "What sound does a dog make?", they will think of this type of question later when encountering a novel animal (e.g., to ask about a goat). We call this *reuse*. In addition, they might ask other questions about the goat's sound, like "Does it make snoring sounds when it's sleeping?" We call this *remixing*. In two studies with five- to ten-year-olds (N = 322) and adults (N = 215), participants asked questions to identify hidden monsters. We found evidence for both question reuse and question remixing, with no age-related changes. In addition, we found that participants of all ages were more likely to reuse questions when it was more informative to do so. Taken together, our results suggest that *reuse and remixing* might provide a simple method for searching the vast space of possible questions. These strategies enable both children and adults to ask informative questions.

P4-137 - Associative learning following childhood stress: how childhood unpredictability shapes action selection biases

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Details

Adaptive learning requires flexibly approaching and avoiding stimuli based on feedback. However, childhood unpredictability may bias individuals toward an inaction bias to avoid unexpected punishments in novel learning environments. This current pre-registered study investigates whether childhood unpredictability is related to an increased inaction bias in an associative learning task. Specifically, we used emotional feedback as an incentive for learning because it may be more salient for children who experienced unpredictable parental care. In this study, children learn whether to press the button in response to four cues (a Go/No-Go task) that result in either positive or negative pictures as rewards or punishments. While it is optimal to approach new stimuli (Go) at the beginning, we found that children who reported to have had unstable childhood experiences avoided them (NoGo) more than their low-stress peers, providing initial evidence for the inaction bias (N = 72). Interestingly, as the task progressed, these children showed increased Go responses, even when NoGo was appropriate, hinting at learning difficulties or impulsiveness. These findings suggest that childhood unpredictability may impact learning flexibility through a habit-like cognitive bias to avoid novelty.

P4-138 - Storybook interventions: investigating cognitive flexibility among dual immersion parents and children

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Details

The COVID-19 Pandemic has impacted children and families, including increased levels of stress and anxiety within educational settings. For dual immersion programs, these circumstances have only exacerbated existing challenges in literacy and language acquisition. The current research explores the effects of utilizing storybook interventions to improve cognitive flexibility, self-efficacy and motivation for learning. Participants included children (ages 6-12, N=80) and parents from dual immersion Spanish-English programs. Experimental conditions included two stories promoting Growth Mindset and dual language learning. Participants in the experimental condition improved from T1 to T2 particularly on questions of self-efficacy, growth mindset, and motivation compared to the control condition. Parents in this condition also had more conversations reiterating the importance of language learning. Results suggest the impact of pro-bilingual literature for multilingual learning and an effective strategy in decreasing levels of stress and anxiety while increasing mindfulness for parent and child.

P4-139 - Growing up bilingual in America: identifying developmental perceptions and motivations of language learning

Nicole Goldman¹, Roberto Ventura¹, Beatriz Jimenez¹, Drestine Leogo¹, Jazmine Smith¹, Kandice Grote¹

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Details

Research suggests bilingualism leads to increased cognitive advantages shifting positively towards multilingual education. The current research seeks to shed light on what socioemotional motivational factors contribute to the bilingual experience, language use, and cognitive development, including the speaker's past and current perceptions and motivations of language learning (e.g. potential stigma surrounding bilingualism). Data collection included motivational factors including language maintenance and use (e.g. code-switching), academic motivation, relationships (e.g. family, peers), and media use. Results revealed positive relationships between socioeconomic factors (e.g. sustaining a language for job benefits or opportunities) and language premiums related to work opportunities (e.g. supplemental or preference pay if bilingual). Qualitative data revealed emotional triggers when reflecting on childhood experiences vs. increased confidence as adults (particularly academically) suggesting a deeper emotional connection between overall development, sense of identity, and language development. Results support identifying socioemotional factors related to bilingual cognition and motivation.

P4-140 - Vocalization and gesture: frequency and function in early language development

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Details

This study quantified proportions of vocalizations and gestures produced by children and the functions of each event with longitudinal data on the second year (13, 16 and 20 mo.). We found that vocalizations predominated, especially in conventional (learned) communication, where 11 times more spoken words were observed than gestures that could be viewed as signs, which are equivalent to words. Our framework of observation highlights the fact that more than ¾ of gestures across these second-year data were deictics (e.g., pointing and reaching), acts that while significant in supporting the establishment of referential vocabulary in both spoken and signed languages, are not signs, but have single universal deictic functions in the here and now. In contrast, words and signs are functionally flexible, making possible reference to abstractions that are not bound to any particular illocutionary force nor to the here and now.

P4-141 - How social learning affects children's formation of negative bias about social groups

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Details

Given preschoolers' ability to demonstrate bias against outgroup members (Cvencek et al., 2011), understanding how prejudice forms in early childhood through social learning is crucial. In this ongoing study, 29 4-to-7-year-old children ($M_{age}=5.920$, 48.3% female) learned four negative pieces of information about a novel social group either through observing a parent's action ($N=15$) or a parent's testimony ($N=14$). Findings suggest that children exposed to negative testimony endorsed stronger negative beliefs than those who observed negative actions, such that they believed that the group members are to be avoided, hurt animals, are not good with money, and are not good friends ($F(1, 23) = 90.536$, $p < .001$). Further, while the two groups of children did not differ in how they distributed resources and distanced themselves from the novel group, children who learned through testimony negatively evaluated the group's moral worth ($t(23) = 3.179$, $p = .004$) and their capacity for friendship ($t(25) = 2.582$, $p = .016$). Results from this study underscore the harmful effects of explicitly biased statements from parents.

P4-142 - The neural mechanisms of numerosity judgment in 3.5-year-olds

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Details

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Numerosity perception is an essential part of everyday life. Previous research suggests that children may develop an ability to perform non-symbolic quantity comparisons before formal mathematics education. This study aimed to explore the neural basis of non-symbolic numerosity judgment in preschool children. We administered a dot comparison task adapted from the one developed by Halberda and Feigenson (2008). Children were presented with displays of dots, with the ratios ranging from 1:2 (easier ratios) to 9:10 (harder ratios), on the left and right sides to select the side with more dots. Neural data were collected using functional near-infrared spectroscopy (fNIRS) to measure hemodynamic activity from bilateral frontal to parietal regions. Behavioral analyses show that children performed marginally better on the easiest comparison trials with a level of accuracy of only 60% correct as expected. When looking at neural data, 3.5-year-olds engaged a network of left frontal-parietal regions more strongly for the hardest ratios relative to the easiest ratios. The results motivate future work further exploring the neural mechanisms of numerical magnitude representation during early childhood.

P4-144 - Task improvement mediated by resting state functional connectivity differences in children over time.

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Details

This project examines how resting state functional connectivity mediates improvement on executive function tasks in young children (N=20). This data was collected at two time points, year one when the children were two and a half years old, and year two when the children were three and a half years old. To collect the resting state data the children watched a short video while wearing an fNIRS cap. We analyzed this data in conjunction with a dimensional learning (DL) and a Simon task.

We saw that accuracy and reaction time improved with age in both tasks. In the DL task, we looked at color comprehension, color production, shape comprehension, and shape production, and for the Simon task, we looked at neutral, congruent, and incongruent trials. We analyzed how the resting state functional connectivity results differed by year and how these differences mediated the improvement in the scores on both tasks.

There were distinct, significant differences in functional connectivity based on the year and how this interacted with the accuracy and reaction times. Generally, there were more significant results from year two, demonstrating that there are functional connectivity changes based on age. With the tasks, there were varying significant results, mostly from year two for all conditions except for reaction time on the Simon task. These changes varied in strength and direction and demonstrate that changes in resting state functional connectivity do mediate task improvement.

P4-145 - Sensible nonsense: children's explanations of physical violations vary by age

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Details

Young children appeal to magic when they see something seemingly impossible (Rosengren & Hickling, 1994), an explanation that is gradually replaced with accurate physical mechanisms as they age (Phelps & Woolley, 1994). Is this transition an all-or-none binary, or are children's burgeoning physical explanations initially implausible or even impossible? Characterizing these explanatory transitions could also reveal fine-grained changes in the content and causal structure of children's physical beliefs. We asked children (N=32, ages 3.5-9 years; preregistered sample of N=120 to be collected by March) to explain how 4 physics-violating magic tricks were done. Freeform explanations were coded as either "*plausible physics*" (probable real-life mechanisms), "*magic*" (impossible supernatural power), "*sensible nonsense*" (improbable or impossible mechanisms that *would* account for the trick if possible), or "*no response*" (inter-rater reliability = 95%). In line with previous work, with increasing age, we find a

general decrease in appeal to magic ($B_{\text{age}} = -20.66, p < 0.05$) and a rise in physically-plausible explanations ($B = 3.11, p < 0.01$). However, we also see a rise in "sensible nonsense" ($B = 1.30, p < 0.01$), suggesting the transition to physically-based explanations is not a simple binary transition. Our findings suggest a potential intermediate stage of children's intuitive reasoning as they transition out of magical beliefs, but before forming a holistic understanding of physics.

P4-146 - Beyond explore-exploit: creative curiosity in play

**Junyi Chu¹, Joshua Rule², Mariel Goddu¹, Verity Pinter¹, Emily Rose Reagan², Elizabeth Bonawitz¹,
Alison Gopnik², Tomer Ullman¹**

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Details

What motivations drive children's diverse actions during play? Decision-making theories suggest a trade-off between exploring unknowns and exploiting known rewards, but this confounds different kinds of exploratory gain. Beyond immediate information gain about the environment, exploration may also help agents learn in more abstract ways, such as building mental models of possible actions and goals. In two pre-registered experiments, we test the hypothesis that children at play optimize for both kinds of exploration by comparing actions and learning outcomes when children are told to have fun (PLAY), learn about the environment (LEARN), or optimize for known rewards (EXPLOIT). Experiment 1 ($n=72$, ages 5-10 years) uses a foraging task. Across conditions, we found similar *learning* outcomes (e.g., memory for superficial & functional details; $F(2,67) < 1, p = .73$) but not *actions*. "EXPLOIT" participants foraged more quickly and extensively, while PLAY participants were most likely to engage in spontaneous goal-directed behaviors (e.g., construction, sorting). To probe a wider range of possible goals, in Experiment 2 ($n=180$, ages 2-10 years) we used doll houses as stimuli. Preliminary results ($n=30$ 5-7-year-olds) find that PLAY participants do more Goal-directed and Pretense actions, while LEARN participants do more Environment-directed actions. These results suggest play is meaningfully different from more narrow forms of exploration.

P4-148 - Interactions between knowledge and memory

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Details

We examined how prior knowledge affects the positive and negative effects of multiple-choice tests in children. Past research finds both positive and negative effects of multiple-choice testing on learning. Participants who have been previously tested on the material answer more questions correctly on a final test, but they are also more likely to incorrectly answer with multiple-choice lures. Surprisingly, older children show larger negative testing effects, possibly because of their increased knowledge. In the current experiment we experimentally manipulated knowledge by having children learn about one of two novel alien species. In a sample of 54 children (ages 6 – 10) we found that both the positive and

negative effects of multiple-choice tests were amplified with greater knowledge. Overall, knowledge was beneficial. However, participants' errors on the multiple-choice test were more likely to persist onto a final test when they had greater knowledge. A more elaborate semantic network supported memory for both correct and incorrect responses.

P4-149 - Children's preferences on leadership based on group majority vs. authority choices

Isabel Herrera Guevara¹, Nadia Chernyak¹

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Details

Previous research has shown that children recognize inaccurate information given by individuals/experts and selectively retain information from those that have been reliable before [Luchinka et al. (2020)]. At the same time, during the same developmental time window, young children develop strong beliefs about cultural knowledge as being transmitted through *group majority*: Children take into account numerical size of groups and when in disagreement, believe that the larger groups are more likely to prevail [Heck et al. (2021)]. In this study ($N = 36$, target $N = 80$) we investigated children's (ages 3- to 7-years-old) preferences between two candidates who want to become a class leader (described as an important/respected role) when one candidate is supported by the democratic peer majority of the classroom (e.g., 70% of the children choose this candidate) and the other candidate, with minority support, is chosen by an authority figure (teacher). Current results from this study suggest that with age, children show a greater likelihood to take into account classroom majority votes when deciding who should be the leader.

P4-150 - Objects to think by: what predicts children's pretend play preferences?

Michelle Wong¹, Junyi Chu¹, Tomer Ullman¹, Elizabeth Bonawitz¹

¹ Harvard University

Details

How do children at play decide what goals to pursue? While prior work has examined how exploratory play reflects a desire to gain information about the environment, this fails to account for other forms of play, such as imaginative pretense. In this study, we take a closer look at how children choose goals during pretend play, when information gain and extrinsic rewards are no longer relevant. We test the hypothesis that children are sensitive to opportunities to think and explore in more abstract ways (e.g. about imagined possibilities). We designed 16 pairs of scenes and objects, some which offer better options for imagining possibilities than others (**Figure 1**). Children ($N=20$, ages 6-8 years) chose which of the two objects they would rather play pretend with for each scene, before generating as many ideas as they could for each object (e.g. "*What could this paper towel tube be if we were playing pirates?*") We found that object preferences depended on which scene was presented ($B = 2.65$, $OR = 14.15$, $p < .001$). We are currently transcribing children's idea generations. If children are sensitive to opportunities to think, then they should prefer objects that are easier to generate ideas for. These results attribute

purpose to “play-for-fun” and reveal new insights for understanding how children reason about possibilities, explore the world without expecting information gain, and how such factors shape decision-making.

P4-151 - The role of practical implicatures in modulating preschoolers' exploration

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Details

We extend previous findings by modulating the strength of practical implicatures within pedagogical statements to understand the extent to which pedagogy has a granular effect on children’s exploratory play based upon the pragmatic inferences it encourages. Participants aged 3-6 (N = 144, 47% Female) were recruited on the floor of a museum. Demographics were representative of the area (72% White(16%Latinx), 15% Multiracial, 10% Asian, 2% Black, 1% American Indian). Children were split into a strong implicature pedagogy condition (SIP)-"this is the only thing my toy does", a weak implicature pedagogy condition (WIP)-"this is one of the things my toy does", a naïve condition, and a baseline condition. We hypothesized that those in the SIP condition would a) play for less time with the toy b) spend a greater proportion of time with the target function, c) demonstrate fewer unique actions and d) discover fewer non-demonstrated functions than those in naïve and baseline conditions. Preliminary results reveal that those in the SIP condition performed fewer non-demonstrated functions ($F(3, 138) = 7.41, p < .001$) and unique actions ($F(3, 138) = 4.00, p = .009$) than those in the naïve condition. Those in the SIP condition also played with the toy for less time overall ($F(3, 138) = 3.22, p = .025$) and played more with the target function than those in the baseline condition ($F(3, 138) = 4.44, p = .005$). Children in the WIP condition discovered fewer non-demonstrated functions than those in the baseline condition but did not differ from children in the baseline and naïve conditions in a) how long they played with the toy, b) how many unique actions they performed on the toy, and c) how much time they spent with the target function.

P4-152 - Inclusive collaboration and harmony, across generations in Mayan families

Barbara Rogoff¹, **Itzel Aceves-Azuara**²

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Details

Research has found that in a number of Indigenous-heritage communities of the Americas, children and families often engage in sophisticated, fluid collaboration. However, with globalization, Indigenous family interactions may come to resemble those of highly schooled European American families.

This study followed Mayan mothers and their 2 young children across 30 years in the same 22 extended families. For both generations, the local research assistant asked the mother to help the toddler operate a sequence of attractive, unfamiliar objects, during a one-hour family interview about children's routines.

The follow-up Mayan families collaborated inclusively, with all 3 interacting together, only half as much as the original families – averaging only 38% vs 73% of the time segments. Instead, they often engaged between only two people, with one person left out – three times as much as the original triads (46% vs 15% of segments).

However, contrary to the idea that the later generation would act more like highly schooled European American families, the later generation maintained harmonious interactions. They did not engage more in rough/resistant conflict than the families from 30 years before (5% of segments in both generations), unlike highly schooled European American families. They maintained harmonious interactions. The Mayan families' continuance of harmonious relations is in keeping with longstanding values regarding relationality and harmony.

P4-153 - Interaction with graphics improves learning causal associations in 5-8 years old children

Mishaal Kandapath¹, Sophia Lee¹, Arnav Verma², Fanny Chevalier¹, Jessica Sommerville¹

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Details

Young children learn causal relationships in real-world environments much better by performing their own interventions than by observing others' actions (Sobel & Kushnir, 2006). We investigated whether this effect translates to interventions performed by touch in tablet video games, where causality is communicated based on animations, and causal interventions can be applied to a broader scope of cause-effect relations. Children aged 5 to 8 played 9 unique touch screen video games (see Figure 1) consisting of distinct causal graphs (parallel, chain, and confound graph) and a range of scenarios (abstract, social, and natural cause-and-effect). Children participated in the intervention condition (n = 8 to date of 24), in which they could directly interact with different elements of each scenario to learn their causal effects, or a yoked observation condition (n = 8 to date of 24) in which they watched a screen recording of interventions from a child in the intervention condition. For each condition, we assigned children a continuous score based on their ability to state and reconstruct the cause(s) and effects. To date, children in the intervention condition ($M = 5.04$, $SE = 0.915$) outperformed children in the observation condition ($M = 4.32$, $SE = 0.833$), $p = 0.0073$. These findings suggest that the benefits of interventions (versus observation) extend to cause-and-effect relationships conveyed via digital graphics.

P4-154 - Cultural differences in children's collaboration

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Details

This study examines cultural differences in children's collaboration in a school-like task among 57 sibling pairs of 6-10 year-old children of U.S. Mexican-heritage (from two cultural backgrounds) and U.S. European-heritage children. Previous studies have found that US Mexican-heritage children coordinate fluidly with each other in settings in which they are asked to work together (Alcalá et al., 2018; Ruvalcaba et al., 2016). The present study extends this work to an instructional situation in which siblings are working on their own project (a solar print), guided by an adult, with no suggestion to collaborate.

Coding focuses on five different phases of the activity that provide openings to collaborate, for example, as the children put different objects onto the solar paper and when they put their own materials away in containers once they are done using them. Ten-second segments within each phase are analyzed to determine the extent of collaboration: fluid collaboration to meet one shared goal; collaboration through proposal building and building off each other's ideas; or collaboration through discussion of ideas which includes back-and-forth exchanges.

Preliminary analyses are in accord with expectations: More collaboration, especially fluid collaboration, was observed among US Mexican Indigenous-heritage children when compared to US European-heritage children. The US European-heritage children more often spent the five segments of the task working as individual agents.

Findings help understand how differences in children's collaboration may be tied to cultural practices that serve as strengths, including instructional settings where a deficit model has historically been used.

P4-155 - Unpacking children's multidimensional mind perception of AI versus humans

Ying Xu¹, Annalise Aponte¹, Zhen Li¹, Isabelle Perraut¹

¹ University of Michigan

Details

As children are increasingly exposed to artificial intelligence (AI), understanding their perceptions of it is crucial to examine its potential as children's conversation partners in educational and noneducational contexts. Drawing on the mind perception framework (c.f. Gray et al., 2007), our study examines children's attribution of mind to AI versus humans along three dimensions: agency, experience, and moral patency. Children (N = 75) aged four to eight were randomly assigned into two groups to co-create stories either with an AI (n = 40) or with a human partner (n = 35). The preliminary analysis revealed that children perceive humans as having a higher tendency to experience sensations such as hunger and pain and deserving more moral treatment than AI. However, children attribute a similar

agency level to AI and humans. Furthermore, our results suggest a developmental trend as younger children (ages 4-5) were less likely to view AI as having agency and experience than their older counterparts (ages 6-8). However, age did not appear to impact perceptions of the moral patiency of AI. This study revealed multidimensional nuances in children's perception of AI versus humans' minds, thus calling for future research beyond human/non-human categorization. Researchers and technologists can better design and implement AI systems that are more compatible with children's expectations and cognitive frameworks by gaining a deeper understanding of how children perceive AI.

P4-156 - Trusting young children to help causes them to cheat less

Haiying Mao¹, Paul Harris², Kang Lee³

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Details

Trust and honesty are essential for human interactions. Philosophers since antiquity have long posited that they are causally linked. Evidence shows that honesty elicits trust from others but little is known about the reverse: Does trust lead to honesty? Here we experimentally investigated whether trusting young children to help can cause them to become more honest (total $N = 328$ across five studies; 168 boys; $M_{\text{age}} = 5.94$, $SD_{\text{age}} = 0.28$). We observed kindergarten children's cheating behavior after they had been entrusted by an adult to help her with a task. Children who were trusted cheated less than children who were not trusted. Our study provides clear evidence for the causal effect of trust on honesty and contributes to understanding how social factors influence morality. This finding also points to the potential of using adult trust as an effective method to promote honesty in children.

P4-157 - Canny consumption practices: a window into Indigenous-descent families' environmental practices and connections to Indigenous worldviews of nature

Claudia Castañeda¹, Maureen Callanan¹

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Details

With the goal of better understanding how children from Indigenous-descent communities develop ideas about the environment, this study (1) investigates an overlooked set of environmental practices that I have termed *canny consumption practices* (CCP) and defined as innovative ways of using resources to avoid wasteful behaviors, and (2) and explores their connections to Indigenous Worldviews about nature. Twenty Guatemalan Indigenous-descent families participated in a 30-minute semi-structured interview. Coding was done in the original language (Spanish or Native language) and identified (1) Nature of CCP and (2) Talk about Indigenous and Western worldviews of nature. All parents described at least three CCPs. Parents mentioned CCPs involving Natural Resources (*picking up every corn kernel*) most often; next those involving Food (*breadcrumbs out of stale bread*) and Manufactured Products (*planters out of empty water bottles*). Parents mentioned Indigenous worldviews more than Western worldviews and more than Availability of Resources. There was a positive association between

Indigenous Worldview statements and spontaneous CCPs mentioned. In coining and defining this new term, *canny practices*, along with evidence that links CCP to Indigenous worldviews, this study offers a new angle for exploring the intergenerational transmission of environmental concepts and Indigenous-descent children's conceptualization of nature and the environment.

P4-158 - Individual Differences in Children's Acceptance of Conflicting Information

Isaac Bisla¹, Norwood Glaspie², Pearl Han Li³, Dante Cicchetti¹, Melissa Koenig²

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Details

While children are sensitive to who they choose to trust or learn from, they may accept information that contradicts their initial perception (Jaswal & Markman, 2007). Little is known about the individual differences that can reveal disparities when accepting conflicting information. The present study investigates the impact of child maltreatment as well as differences in maternal adverse childhood experiences (ACEs) and depression on children's decisions to accept conflicting information.

The study sample consisted of 196 3-year-old children and their mothers. Participants' mothers completed the Maternal Interview on Child Maltreatment (Cicchetti et al., 2003), a 10-item questionnaire assessing ACEs, and finally the Beck's Depression Inventory, a 21-item questionnaire measuring characteristic attitudes and symptoms of depression (Beck, et al., 1961). In addition, children completed a tunnel task assessing deference to a speaker's claim adapted from (Robinson & Whitcombe, 2003).

Preliminary results revealed children who were at risk for maltreatment were more likely to revise their original judgment and defer to an adult, despite having better perceptual access than the speaker. Future analysis will examine differences in high and low maternal ACEs and children's responsiveness to contradictory claims. In addition, we will seek to examine differences in children's deference to conflicting claims based on maternal mild, moderate, and severe depression.

P4-159 - Understanding the developmental pathways to behavior problems: The roles of early inhibitory control, emotion regulation, and effortful control

Lilja Jónsdóttir¹, Matilda Frick², Emma Heeman¹, Andreas Frick¹, Karin Brocki¹

¹ Uppsala University, ² Stockholm University

Details

Internalizing (INT) and externalizing (EXT) behavior problems in childhood are robustly associated with psychopathology and maladjustment. While early simple self-regulatory ability has been found to predict INT and EXT later in childhood, the developmental mechanism behind this association remains unclear. This 5-year study will examine the longitudinal relations between inhibitory control (IC) in toddlerhood, more complex regulatory skills at school start (effortful control (EC) and emotion

regulation (ER)), and INT and EXT in middle childhood. Our aim is to investigate whether IC in toddlerhood predicts INT and EXT in middle childhood, and whether EC and/or ER act as differential mediators in this association. Data collection is completed, with an initial sample of 95 children participating. IC was measured at 4 years, using the Day/Night Stroop task. At 6 years, EC was measured using the Children's Behavior Questionnaire, and ER was measured using the Emotion Questionnaire. At 9 years, INT and EXT was measured using the Strengths and Difficulties Questionnaire. Data analysis is currently underway and results will be presented at the CDS meeting in March 2024. Using path analysis, we will examine the fit of the data to our hypothesized model. Elucidating the underlying mechanisms of self-regulation development involved in INT and EXT in childhood may help identify important early indicators of behavioral problems, and therefore inform both theory and early interventions.

P4-160 - Young Children favor Binary Induction over Function Learning in an Ambiguous Situation

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Details

Induction is the ability to generalize knowledge based on prior experience. While developmental research has emphasized the generalization of binary properties, much of human reasoning concerns continuous qualities, such as brightness, price, and age. In this study, we assessed how induction of a continuous quality changes from childhood to adulthood. To do this, we placed young children (ages 4-6, $N = 26$), older children (6-8, $N=38$), and adults (18-43, $N=28$) in an ambiguous situation, consistent with binary induction or continuous function learning. We first presented cartoon bugs varying in width drawn from two separated distributions, allowing the use of continuous or discrete representations. After a classification task, we showed that each bug performs a dance: a sinusoidal movement with amplitude correlated perfectly with bug width. Participants continued to classify bugs but now also matched the movement of their bug to a target. Finally, participants classified and chose the best dance for intermediate bugs. If participants discretized, they could associate a type of bug with a type of dance but not interpolate to items in the middle. Using statistical and mechanistic modeling, we found that younger children are less likely to interpolate and favor binary induction. This highlights the tradeoffs inherent to discretization and suggests a role for representational flexibility in learning which is achieved more often after early childhood.

P4-161 - Individual variation in the part-structure of preschoolers' drawings of visual concepts

Bria Long¹, Judith Fan¹, Holly Huey², Michael Frank¹

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Details

Children's drawings emerge from scribbles into recognizable visual concepts as they learn about the world around them. To what degree do children take distinct or similar paths into depiction? To explore this question, we collected 2064 digital drawings of 10 categories (e.g. *house*) from 70 preschoolers over 15 months (range 7-95 drawings per child, 3.2-5.6 years-old), crowd-sourced part annotations for each stroke, and calculated the emphasis (i.e., proportion area) allocated to each part in each drawing. Similarity in part-structure was assessed via Jensen-Shannon divergence between part-emphasis vectors for all drawings. We found drawings of the same categories from an individual child were more similar to one another than to other children's drawings; children's drawings also became more distinct from one another with age, though there was substantial variation across categories. These analyses suggest that children's early drawings show relative consistency in their part-structure within individual children.

P4-162 - Structural vs. Internal Explanations for Status Disparities in Novel Groups

Norwood Glaspie¹, Melissa Koenig¹

¹ University of Minnesota

Details

Social categories guide our interpretations of the social world, supporting expectations about groups and their members. This ongoing study investigates the influence of structural and internal explanations on children's beliefs about status disparities between novel groups (N=20). Children (age range: 4 - 11 years; $M_{\text{age}}=5.87$, $F_{\text{age}} = 6.12$), were randomly assigned to one of 3 conditions (Structural, Internal, Control) that offered different explanations for disparities in wealth and achievement. Status disparities were attributed to either a structural influence (e.g., "One group made the rules to benefit their group"), an internal influence (e.g., "One group is hardworking/smarter and has always been"), or a random coin flip in the control condition (e.g., "One group won the coin toss and decided who had the better resources"). Children's beliefs about the groups (e.g. Manu and Toma) were examined using social preference and resource allocation measures. We also examined children's beliefs about the mutability of wealth and achievement. Lastly, we use a parent questionnaire to examine the influence of parents' views on social inequality and hierarchy. These basic findings will also be supplemented by qualitative and quantitative analyses of children's open-ended responses, and parents' survey responses. Research from this study could highlight the potential of structural explanations as a mechanism to reduce children's social biases, especially as they apply to wealth inequality and educational achievement.

P4-163 - Selective Trust and Resistance to Suggestibility

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Details

Prior work has suggested that source monitoring abilities are associated with decreased susceptibility to misinformation (Giles, Gopnik, & Heyman, 2002). However, no research has examined whether children's ability to monitor reliable sources of information supports their ability to resist misleading suggestions. If children are given the opportunity to exercise epistemic vigilance and reject misinformation, does this experience support their ability to resist suggestion?

The present study examines how children's selective trust competence predicts resistance to accepting misinformation. We also seek to understand how suggestibility differs based on executive functioning and theory of mind abilities. All child participants will be presented with a 1-minute silent and narrated vignette involving petty theft. Following the vignette, children will be randomly assigned to an experimental condition consisting of a selective trust task or control condition consisting of a memory task. Children across all conditions will complete the Theory-of Mind Scale (Wellman & Liu, 2004), and the Minnesota Executive Function Scale (Carlson, 2021).

The present study has transitioned out of pilot recruitment and preliminary findings have demonstrated that children who scored high on theory of mind were less suggested to misinformation. Ongoing data collection and analysis will seek to examine condition and executive functioning differences in suggestibility to misinformation.

P4-164 - One and the same: does children's understanding of identity statements emerge with their false belief reasoning?

Jana Rechenburg¹, Michael Huemer², Josef Perner², Johannes Rakoczy¹

¹ University of Göttingen, ² University of Salzburg

Details

When do children understand identity statements, and how does this ability relate to other developmental milestones, such as theory of mind? Mental files theory postulates that objects are represented in the mind by mental files, which can be linked to indicate their sameness of referent (Perner et al., 2015). Linking mental files is thus key to master both identity statements (horizontal linking) and the false belief task (vertical linking). This account predicts that successful performance on these tasks emerges around the same time (Doherty & Perner, 2020; Perner & Leahy, 2016). Existing evidence corroborates this prediction (Perner et al., 2011). However, the tasks used in previous studies may have posed similar linguistic and executive performance demands. Co-emergence and correlation between these tasks may thus simply reflect shared performance factors. A different line of research on object identification and individuation raises the possibility that children may be able to make non-verbal identity judgments much earlier in development (e.g., Xu & Carey, 1996). Inspired by previous work on numerical identity understanding in infancy (Xu & Carey, 1996), we developed a simplified

identity task: children saw how object A was put behind an occluder. Then object B was taken out from behind the occluder and put back. Children learned that A was also B and were asked how many objects were behind the occluder. In two preregistered studies (total N = 60, age: 3-4 years) we compared children's performance on the identity task with their false belief reasoning (Wimmer & Perner, 1983). The results will be discussed with regard to children's developing understanding of identity statements and implications for mental files theory.

P4-165 - Examining Socio-Cultural Influences on Children's Developing Knowledge of the Origins of Food and Non-Foods

Helana Girgis¹, Kaylee Heslin¹, Ethan Mays¹, Victoria Corless¹, Samuel Hoffman¹, Simone Nguyen

²

¹ Stockton University, ² University of North Carolina Wilmington

Details

A growing body of research is examining children's categorization strategies of food, which can be both natural (apple) and human-made (cake). However, most of this research is based on White, middle-class samples, which limits the generalizability of these results. This research examines the developmental trends of young children's knowledge of the origins of foods and non-foods from Head Start and non-Head Start schools. Hypothesis.

A total 109 three- and 4-year-olds from Head Start and non-Head Start schools viewed pictures of familiar and unfamiliar natural and process foods, natural kinds and artifacts. For each, they were asked if it was grown in a garden or made in a factory. Responses were coded for accuracy.

A 2 (familiarity) x 4 (item) x 2 (age) x 2 (school) mixed ANOVA revealed a main effect of Familiarity, Item, School, and Age. These were qualified with a Familiarity x Age, $F(1, 104) = 10.03, p = .002$, and Familiarity x Item, $F(3, 312) = 4.31, p = .005$, interactions. Follow up analyses found 4-year-olds were more accurate for familiar items ($p = .001$), but no differences in accuracy for unfamiliar items. Both age groups were the least accurate for unfamiliar processed foods compared to all other items.

Overall, these results suggest differences in knowledge of the origins of foods and non-foods is better explained by age rather than economic status. Moreover, it appears knowledge of processed foods takes longer to develop given the myriad of ways in which it can be created.

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