

**Children's Pursuit of Counterintuitive Information in Books**

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**Data and Materials Availability:**

Data and analytic code necessary to reproduce the analyses presented herein are available on OSF: <https://osf.io/khqp/>

The methods and analyses were preregistered: <https://aspredicted.org/4jt7m.pdf>

### Abstract

For decades, developmental psychologists and educators have emphasized that learning about counterintuitive phenomena may be a critical driving force for cognitive development. Thus far, little is known about the specific content that children seek to enrich their knowledge. Using a novel book-choice paradigm, we directly examine children's preference to engage with media that contains more mundane vs. more counterintuitive content. Children ranging from 3- to 8-years ( $N = 174$ ), from the U.S. and Canada, were presented with pairs of books about animals. The two books in each pair were visually identical aside from their printed title. One book in each pair was described as presenting a fact that (according to validation data on children's and adults' beliefs in these facts) was relatively intuitive, and the other book was described as presenting a fact that was relatively counterintuitive. The youngest participants (3-4 years) demonstrated no preference in selecting books with intuitive vs. counterintuitive facts about animals, whereas older children (5-years onward) demonstrated an increasing preference for counterintuitive content. Combined with validation data on children's and adults' intuitions about the focal facts, these data suggest that children's preference to seek information that adults deem counterintuitive (at least in the domain of biology) increases with age as a function of changes in the strength of children's intuitions about what is possible.

Keywords: Information Seeking; Conceptual Development; Possibility Judgments

### Children's Pursuit of Counterintuitive Information in Books

Learning about counterintuitive events, phenomena, and entities is a critical driving force and marker of cognitive development (Chi, 2008; Kelemen, 2019; Lane & Harris, 2014). Because such information conflicts with one's notions about the physical, biological, or psychological world, it might inspire skepticism *and* curiosity. For instance, children are less likely to believe novel claims that contradict, rather than confirm, their intuitions (Lane, 2018 for review) but they are also more likely to explore such claims (Ronfard, Chen, & Harris, 2021). Science is particularly rife with ideas that contradict our intuitions and expectations. For example, the theory that undergirds our contemporary, scientific understanding of the life sciences—the theory of evolution through natural selection—is highly counterintuitive to children and to adults (Gregory, 2009; Rosengren, Brem, Evans, & Sinatra, 2012). Indeed, the biological world is full of creatures and phenomena that might be considered counterintuitive—some animals hibernate for months without eating or drinking, echolocate, or withstand enormous hydrostatic pressure at the bottom of the ocean.

There are several ways in which children might encounter counterintuitive information. Other people might take the lead, by describing or demonstrating the counterintuitive phenomena. Children might also take the lead themselves, by *seeking* counterintuitive information in text or in other media. Thus far, developmental researchers have focused primarily on how children *react* to counterintuitive information that is verbally described or physically demonstrated to them. Studies of children's epistemic trust have identified that children's beliefs in others' counterintuitive claims are functions of children's existing intuitions, conceptual insights (e.g., understanding the appearance-reality distinction), and attunement to informants' qualities (for review, see Lane, 2018). Work on children's conceptual development

has examined children's search for causal information *after observing* counterintuitive events—infants and preschoolers stare longer at events that they consider to be impossible (e.g., Baillargeon, 2002), spend more time exploring stimuli that behave in ways that defy their intuitions, in efforts to better understand those stimuli (e.g., Stahl & Feigenson, 2015; Ronfard et al., 2017), and ask more questions about counterintuitive relative to intuitive events (e.g., Frazier et al., 2009). Importantly, children's intuitions change and strengthen over the course of development, and so children react to—stare, explore, question—phenomena differently across development as conceptual change leads to certain phenomena becoming more or less 'counterintuitive' (e.g., Baillargeon, 2002; Bonawitz et al., 2012; Chouinard, 2007; Lane, 2018).

Thus far, no published work (to our knowledge) has examined how children *proactively* seek intuitive vs. counterintuitive information from media, when information is being neither intentionally taught to nor demonstrated to them. This is a critical topic given that learning about counterintuitive information requires engaging with—rather than ignoring or avoiding—media with ideas that conflict with our initial impressions and expectations. The current studies address this topic head-on—we examine how children *proactively seek* intuitive vs. counterintuitive biological facts from books, and examine how patterns in information seeking vary across early and middle childhood.

The methods that we employ to study children's information-seeking are inspired by children's (and adults') everyday experiences. When seeking information on a topic, children in many industrialized societies can often *choose* their sources. For example, when one visits a library or a bookstore, they may face dozens of texts on a given topic. Likewise, when seeking information electronically, one can use computers and the internet to engage with thousands of articles, blogs, or e-books, and the user can *choose* which of those media to engage with. Based

on the book titles or their back-cover synopses, one may garner which materials will provide information consistent with one's beliefs and which materials will provide information that counters their beliefs. Drawing inspiration from these common experiences, we developed a novel book-choice paradigm: 3- to 8-year-old children were presented with pairs of books that were visually identical aside from their printed title. One book in each pair presented intuitive information about an animal while the other presented relatively counterintuitive information about that animal. We focus on children's engagement with biological facts—specifically, facts about animals' capacities and behaviors—because learning about the biological world often entails confronting counterintuitive information.

Several patterns of book selection might emerge during the developmental period of 3-8 years. One hypothesized pattern is that *attraction to the counterintuitive* might characterize children's proactive information seeking throughout childhood. This prediction is inspired by work cited early, demonstrating that children preferentially stare at, explore, and question counterintuitive content. Indeed, even infants tend to stare at scenarios that are inconsistent (vs. consistent) with their expectations; such staring is believed to reflect children's surprise in the events (Baillargeon, 2002) and perhaps their dedication of cognitive resources to attempt to understand the events (Feigenson & Perez, 2022). Conceivably, children might also invest more in approaching *new* counterintuitive content.

Yet, there are also reasons to expect an alternative pattern, with children selecting book content that is more *consistent with their intuitions*. In many instances, adults tend to seek information that is consistent with their intuitions rather than information that might challenge those intuitions (Del Vicario et al., 2016; Drummond & Fischhoff, 2017; Golman et al., 2017; Nickerson, 1998; Talluri et al., 2018). When faced with information that contradicts their beliefs,

adults may simply ignore the information (Chinn & Brewer, 1998). Research on children's beliefs about counterintuitive phenomena also inspires the prediction that children will prefer to engage with books that present belief-consistent information. Preschoolers often report that non-normative, 'improbable' events (e.g., an animal not eating for 10 days, or living more than 100 years) cannot occur in real life (Lane & Harris, 2015; Shtulman, 2009). As well, preschoolers often reject information in pretense (e.g., story books) that contradicts their notions of the ordinary world (e.g., Vondervoort & Friedman, 2017; Weisberg et al., 2013). These biases may persist beyond the preschool years, but their magnitude may decrease: children between 3- and 8-years-old increasingly endorse improbable events *as possible*, with older children (8+ years) and adults often reporting that such phenomena are indeed possible (e.g., Shtulman, 2009; Lane, et al., 2016). Perhaps relatedly, between early and middle childhood there is an apparent age-related increase in children's preference for stories with fantastical vs. realistic plots (Barnes et al., 2015).

The current methods allow us to detect whether different patterns emerge across development. For example, perhaps an early preference for intuitive facts will give way to a later preference for counterintuitive facts. Additional, exploratory research questions concern what factors account for age-related and individual differences in children's book selection. We target three variables—parents' preference to read counterintuitive vs. relatively intuitive content to their children, children's intellectual humility (their awareness of gaps and limitations in their knowledge; see Porter et al., 2022 for review), and children's exposure to media about wildlife. Parents' tendencies to introduce children to more counterintuitive (vs. intuitive) content may correlate with their children's decisions to engage more often with books that contain counterintuitive (vs. intuitive) content, as children's reading behaviors early in development

often model their parents' reading behaviors (Baker et al., 2010). Children whose parents more often introduce children to counterintuitive information may be signaling to children the value of being open to new ideas and engaging with counterintuitive information. Alternatively, we might find a relation between children's and parents' book choices because parents' choices reflect their knowledge of their children's interests in or preparedness for that content. Conceivably, children who are more intellectually humble might be more comfortable reading books with content that contradicts their existing intuitions (the 'counterintuitive' books) because they are more aware of the limitations and fallibility of their knowledge. However, prior research on intellectual humility in early childhood is limited (Danovitch et al., 2019; Hagá & Olson, 2017) and has not examined associations between intellectual humility and patterns of information seeking. Children's exposure to wildlife media might reflect their general interest in or comfort with approaching counterintuitive content about novel animals, in which case we would expect a positive association between media exposure and counterintuitive book selection.

To begin testing the generalizability of findings that might emerge, we start here by conducting our study in two contexts—Nashville, TN, United States, and Toronto, ON, Canada.

### **Methods**

This study's methods and analytic plan were pre-registered: <https://aspredicted.org/4jt7m.pdf>

#### **Participants**

We recruited children ages 3.5-8.99 years, from two metropolitan regions—Nashville, Tennessee, U.S., and Toronto, Ontario, Canada. Participants were recruited to campus labs via phone calls and emails, and were recruited to participate in schools by distributing consent forms. If parents consented to participate, children completed the study in one of the researchers' labs or in quiet location at school. The age-range of participants varied somewhat between

Toronto (4.00-8.99 years) and Nashville (3.60-8.80 years), due to differences in participant availability across the two sites. Our target sample size was 160 children, based on power analyses (using G\*Power 3.1; Faul et al., 2007) that indicated that a minimum of 159 participants were required to detect medium-small or larger effect sizes ( $f^2s \geq .05$ ) with statistical power  $\geq .80$  and  $\alpha = .05$ , for regression analyses that include between 3 and 7 predictors. We met 90% of our recruitment goal in Nashville ( $n = 72$ ; 36 females; 36 males;  $M_{age} = 6.11$ ,  $SD_{age} = 1.64$ ), before data collection was halted by the COVID-19 pandemic. We exceeded our recruitment goal in Toronto ( $n = 102$ ; 50 females; 52 males;  $M_{age} = 6.38$ ,  $SD_{age} = 1.51$ ), resulting in a combined sample of 174 children. An additional 2 Nashville participants and 18 Toronto participants began the study but provided incomplete data because of inattentiveness, unwillingness to complete the study, or technological errors; their data are excluded from analyses.

All Nashville parents completed a voluntary demographic survey, with 93% identifying as White, 3% identifying as Asian/Asian-American, and 4% identifying with multiple racial/ethnic categories. Ninety-seven Toronto parents completed the demographic questionnaire; 60% identified their children as White, 23% Southeast Asian, 5% Black, 2% Arab, and 10% multiple races/ethnicities. No answer was provided for 5 children. Additional demographic data are provided in Supplementary Materials.

### ***Procedure and Measures***

***Stimuli Identification and Validation.*** Before creating books, we identified a collection of animals, most of which children in this age range are unlikely to be familiar with. We then identified two facts about each animal—one that was more intuitive and one that was more counterintuitive, informed by research on children’s biological concepts and beliefs (e.g., Hatano & Inagaki, 1994; Lane et al., 2016; Shtulman, 2009). We piloted 15 pairs of facts about animals



with 50 adults on MTurk (ages 22 to 61 years), who judged whether each phenomenon was true for an unspecified animal (e.g., “Could an animal live 10 years without eating?”). Participants reported whether each phenomenon could really occur and rated their certainty (“a little sure” or “very sure”). For each fact, responses could range from “very sure that the animal could *not* X” (scored 0%) to “very sure that the animal *could* X (scored 100%). For facts to be included in the final set of 12 pairs (24 facts) that were used with children: (1) each ‘intuitive’ fact had to be rated above 50%, on average, (2) each ‘counterintuitive’ fact had to be rated below 50%, on average, and (3) for each animal, its ‘intuitive’ fact had to be rated as significantly more probable than its ‘counterintuitive’ fact (all  $|t_s(49)| > 5.25$ ,  $ps < .001$ ). The 12 pairs of facts that fulfilled *all* of these criteria were used in the current study; these facts are presented in Appendix A.

The intuitiveness of the 24 facts within these 12 pairs was also examined with a sample of 111 children ages 4.00-8.99 years, from Nashville, Tennessee, U.S. and Toronto, Ontario, Canada. For each fact, children saw a picture of the animal and were asked to judge whether the animal could produce, experience, or survive the purported phenomenon (e.g., “Could this animal live 10 years without eating?”), and then rated their certainty, (e.g., “Okay, you think this animal [could/could not] live 10 years without eating. Are you very, very sure or just a little sure?”). For each fact, responses could range from “very sure that the animal could not X” (scored 0%) to “very sure that the animal could X (scored 100%). Overall, children demonstrated greater belief in the ‘intuitive’ items ( $M = 62\%$ ,  $SD = 17\%$ ) versus the ‘counterintuitive’ items ( $M = 39\%$ ,  $SD = 19\%$ ),  $t(110) = 14.33$ ,  $p < .001$ . This further validates the items’ categorization as (relatively) intuitive vs. counterintuitive.

***Children’s Book Choices.*** Stimuli included 12 pairs of books, designed to appear like non-fiction informational books, typical of what children might find in a library or classroom.

Each pair pertained to a different animal. Within a pair, book covers were graphically identical (aside from the title), with the same color scheme, graphics, and real animal photograph (we did not include fantastical graphics, as such cues might sway children's possibility judgments; Corriveau & Harris, 2009). Example book covers are presented in Figure 1. One book in each pair was described as including a fact that is consistent with children's intuitions; the other book was described as including a fact counter to children's intuitions. The researcher began the session by showing children the spines of all 12 book pairs, stacked sideways, and invited children to select one pair. For the selected pair, the researcher laid the two books face-up on a table, and introduced them: e.g., "These books are about olms." (the placement of books—left vs. right—was counterbalanced across participants). The researcher briefly described the book on the left (e.g., "This book is about how olms can live 10 years without food"; a novel idea children find highly counterintuitive; Shtulman, 2009), and then the book on the right (e.g., "This book is about how olms can live their whole lives underwater"; a novel but intuitive fact). Children only saw the *covers* of the books when deciding which one to read. This process was repeated until no book pairs remained. Researchers promised to later read the chosen books, which were placed face-down in a pile; unchosen books were placed in a box. Each child earned a *Preference for Counterintuitive (PFC)* score, equal to the number of decisions to read books with belief-inconsistent (counterintuitive) information (range: 0-12). At the end of each study session, the researcher offered to read each of the selected books to the participant.

***Correlates of Book Choices.*** For exploratory purposes, we designed questionnaires that asked parents which books they would choose to read to their children, asked about their children's intellectual humility, and asked about their children's engagement with media about wildlife. All but four parents (98%) completed these questionnaires, in part or in full.

**Parents' Book Choices (PBC).** Parents read about the 12 pairs of books (and their corresponding facts), and chose the book in each pair that they would read with their child. Scores ranged from 0 to 12 counterintuitive book choices. This measure was added to our protocol soon after data collection had begun, and thus data are unavailable for the first 12 participants.

**Intellectual Humility (IH).** Brief measures of children's intellectual humility (IH) were not available when this study was designed, and young children may be unable to self-report on their own IH. Thus, we measured children's IH with a 6-item parent questionnaire adapted from a questionnaire validated to measure adults' IH (Leary et al., 2017; see supplementary materials). Each item described a manifestation of IH (e.g., "Likes finding out new information that differs from what he/she already thinks is true."), and parents reported how much that statement was true of their child, using a 5-point scale ("Not at all True" to "Extremely True"). The IH scale has excellent internal consistency in Nashville (Chronbach's  $\alpha = .89$ ) and Toronto (Chronbach's  $\alpha = .82$ ). An IH score averaged across the six items. Of the parents who responded to the questionnaire, all but one provided data on children's IH.

**Wildlife Media (WM).** Three questions gauged how often children engaged with educational wildlife-themed, (1) "TV or movies for children (ex. Octonauts, Wild Kratts)", (2) "TV or movies for adults (ex. National Geographic, March of the Penguins)", (3) "books or magazines (ex. National Geographic, Ranger Rick)." To each question, parents could respond "Rarely or never" (scored 1), "2-3 hours per month" (scored 2), "2-3 hours per week" (scored 3), or "1 hour or more every day" (scored 4). These items have good internal consistency in Nashville (Chronbach's  $\alpha = .70$ ) and Toronto (Chronbach's  $\alpha = .70$ ). A WM score averaged across the three questions.

## Results

### Age-related Trends in Book Selection

Initial analyses revealed that age-related trends for book selection were essentially identical among children in Nashville and children in Toronto, and thus we present data here collapsed across study site. Supplementary Materials include analyses presented by study site. Overall, children preferred to read books with relatively ‘counterintuitive’ content over books with comparatively ‘intuitive’ content 64% of the time—a rate which was significantly above chance (50%;  $t(173) = 10.68, p < .001$ ). To evaluate age-related patterns in children’s preference for the counterintuitive books, we first conducted a regression analysis to test for curvilinear age-related patterns (see Supplementary Materials). We found no curvilinear patterns, no differences between the study sites, and no interactions between age and study site. Thus, our final regression analysis predicted children’s book selection from children’s Age alone ( $F(1, 172) = 54.84, p < .001, R^2 = .24$ ), revealing a significant age-related increase in children’s preference for the counterintuitive books,  $\beta = .05, t(172) = 7.41, p < .001$ . The same age-related trend was identified with a planned (pre-registered) ANOVA treating age as a categorical (median-split) variable, and with a multi-level logistic regression including each of the 12 book choices nested within participant (see Supplementary Materials).

To further evaluate age-related trends in children’s selection of CI books, the resulting fitted regression equations were used to conduct General Linear Hypothesis tests against chance (50%) at ages at the 5<sup>th</sup> percentile (3.80 years), 33<sup>rd</sup> percentile (5.23 years), 66<sup>th</sup> percentile (7.00 years), and 95<sup>th</sup> percentile (8.76 years), using the `-test-` command in STATA. At 3.80 years, children’s selection of CI books did not differ from chance (51%;  $F(1, 172) = .08, p = .78$ ). By 5.23 years, children’s selection of CI books was significantly above chance (58%;  $F(1, 172) =$

37.10,  $p < .001$ ). Children's selection of CI books grew increasingly greater than chance thereafter: 7.00 years (68%;  $F(1, 172) = 202.10, p < .001$ ); 8.76 years (77%;  $F(1, 172) = 162.99, p < .001$ ).

### **Correlates of Book Selection**

A secondary, exploratory aim of the current study is to evaluate potential correlates of children's selection of CI books—children's parent-reported IH, parents' book choices (PBC), and children's engagement with wildlife media (WM). On average, parents chose to introduce their children to the CI books 56% of the time ( $SD = 26\%$ ), and parents rated their children's IH close to the mid-point of the scale ( $M = 2.91, SD = .72, \text{range: } 1.00\text{-}4.83$ ). Parents' reports of children's engagement with WM averaged 1.97 ( $SD = .64; \text{range: } 1\text{-}4$ ), where 2.00 is "2-3 hours per month." Supplementary Materials include descriptive statistics for each of these three measures.

Bivariate correlations between children's Age, children's CI book choices, PBC, and Parents' reports of children's IH and WM are reported in Table 1. Age-related increases were found in PBC, and children's IH, but age was unrelated to WM. None of these variables was significantly associated with children's decisions to read CI books.

We tested the possibility that PBC and children's IH (the two variables significantly associated with age) might partially account for the age-related increase in children's CI book choices. In the first step of a multiple linear regression analysis, Age was (expectedly) positively related to Children's CI books Choices,  $\beta = .51, t(155) = 7.45, p < .001$ . In the second step, PBC and children's IH were not related to children's book choices ( $R^2 \text{ change} = .00, F(2, 153) = .39, p = .68$ ) and Age remained strongly associated with children's book choices,  $\beta = .53, t(153) =$

7.32,  $p < .001$ . Thus, neither of these variables significantly accounted for the age-related increase in children's preference for books with CI content.

### **General Discussion**

We examined U.S. and Canadian children's preferences to engage with informational media that contains either intuitive or comparatively counterintuitive factual content. Children ranging from 3- to 8-years were presented with pairs of books about animals. Books introduced novel facts that (according to older children and adults) were either relatively intuitive or relatively counterintuitive. For each pair of books, children chose which book the experimenter would read to them. Whereas 3-year-olds demonstrated no preference to be read books with "counterintuitive" or "intuitive" content, 5-year-olds demonstrated a preference for the "counterintuitive" books, and this preference grew stronger with increasing age. This age-related trend was essentially identical among children in Nashville, Tennessee, US and children in Toronto, Ontario, Canada

Data on U.S. and Canadian children's intuitions about the possibility of each of the "intuitive" and "counterintuitive" facts—data which were used to validate our categorization of these stimuli as comparatively 'intuitive' vs. 'counterintuitive'—can be ushered to help interpret this pattern. With increasing age, differences in children's relative belief in the 'intuitive' facts vs. the 'counterintuitive' facts increased—children's belief in the plausibility of the 'intuitive' items increased with age and their disbelief in the plausibility of the 'counterintuitive' items was stable across age (see Supplementary Materials). Consistent with previous studies on children's possibility judgments (e.g., Lane et al., 2016; Shtulman, 2009) these data suggest that children's intuitions about these phenomena strengthened and became more differentiated with age. By implication, 3-year-olds' apparent lack of preference to engage with book content that older

children and adults consider to be “counterintuitive” does not reflect their lack of interest in the counterintuitive; rather, the strength of 3-year-olds’ intuitions about paired facts were comparatively equivalent and thus paired facts were equally interesting. As children’s intuitions about animals’ capacities strengthened across development, what facts remained *counter-intuitive* stood out more, and became more attractive. In other words, the current findings suggest that these children’s information seeking preferences changed over development as they gained more knowledge about the world. This interpretation of our results is consistent with work with adults demonstrating that as adults become more familiar with environmental regularities, they increasingly allocate their attention to more complex aspects of that environment (Forest et al., 2022).

Note that all of the facts presented in these books were novel and that none of the facts were truly impossible. Conceivably, younger children might have been more prone to selecting counterintuitive facts if the relative difference between the two facts was even more stark. For instance, had we paired *mundane* facts about *familiar* animals with counterintuitive facts about those same animals, the youngest participants *might* have also gravitated towards the ‘counterintuitive’ facts. Additionally, had we paired counterintuitive facts about novel animals (“Olms can live 10 years without food”) with truly impossible facts about those animals (“Olms can live by eating lightning”), the youngest participants *might* have also gravitated towards those ‘counterintuitive’ facts. Indeed, 4-year-olds can distinguish between improbable and impossible phenomena when they are forced to choose which ones “cannot happen in real life” (Shtulman and Carey, 2007; see also Vondervoort & Friedman, 2017; Weisberg et al., 2013). These are possibilities that future work can test.

In advance of that future work, it is noteworthy that we found no evidence of children avoiding counterintuitive content at any age. Our youngest participants (3-4 years) were equally interested in the intuitive and counterintuitive content. Perhaps relatedly, Barnes et al. (2015, Experiment 2) found that 4- and 5-year-olds were equally interested in books with content that the authors deemed realistic (e.g., a boy with lots of siblings) and content that the authors deemed fantastical (e.g., a boy who lives on an invisible farm). In contrast, those scholars found that 4- to 5-year-olds preferred books described as “true stories” over books described as “make believe” (Barnes et al., 2015; Experiment 1). Thus, children’s apparent aversion to media that is explicitly “make believe” should not be construed as an aversion to content that is counterintuitive or fantastical.

More research is needed to understand the conditions in which children display preferences for belief-inconsistent information. For example, facts employed in the current study did not contain emotion-eliciting content (e.g., content about moral values, intergroup relations, or loved ones). Children may be more inclined to seek belief-consistent information in circumstances where obtaining belief-inconsistent information would be distressing or costly; for example, if belief-inconsistent information goes against the core beliefs or values of one’s social group. Studying biases in information seeking may therefore be a particularly fruitful avenue for research on children’s proto-political thinking (Reifen-Tagar & Cimpian, 2022). As well, it will be important to evaluate how children seek media content based on factors such as its emotional appeal and intrigue.

Turning to individual differences, we found that parents’ decisions to read the counterintuitive (vs. intuitive) books to their children and parents’ reports of their children’s intellectual humility both increased along with children’s age. However, these age-related trends



did not statistically account for the age-related increase in children's own interest in the counterintuitive books. Two tentative conclusions can be drawn from these data. First, parents' book choices might have reflected knowledge of their children's preparedness for counterintuitive information, but those choices may have not catalyzed children's own preferences. Second, older children's higher scores on our Intellectual Humility measure might reflect their greater experience with counterintuitive facts rather than their greater interest in such facts. Indeed, children's exposure to surprising information may help them develop metacognitive skills by spurring them to explicitly reflect on their uncertainty (Lapidow et al., 2021). Longitudinal work is needed to evaluate how individual children's information seeking is related to their ongoing conceptual development. Findings involving this parent-reported measure of children's IH should be considered tentative given that the measure has not been formally validated and given that parents' responses could partly reflect *their own* cognitive tendencies and dispositions.

Conceivably, one's familiarity with certain subjects—in this case, animals—may influence one's tendency to seek novel information about that subject. Perhaps individuals who are more familiar with a domain of knowledge are also more comfortable approaching counterintuitive information about that domain. We tested this possibility by including a parent-reported measure of children's exposure to media about wildlife, however this measure was unrelated to children's selection of books with counterintuitive content. This more general measure of familiarity with wildlife media does not capture children's familiarity with the specific animals in this study. Although we presumed that most of the animals introduced in this study were unfamiliar to most children in this age range, there is still likely variability in children's knowledge of these animals, and this leaves open the possibility that familiarity with

specific targets (i.e., specific animals) is indeed predictive of one's tendency to pursue counterintuitive information about those targets.

### **Conclusions**

Engagement with belief-inconsistent or counterintuitive information is a catalyst for cognitive development (Chi, 2008; Kelemen, 2019; Lane & Harris, 2014), but what constitutes the 'counterintuitive' changes across development. Early in development, when children's intuitions are arguably their least robust, children's knowledge is less enriched, and when the realm of the 'counterintuitive' is especially vast, 3- and 4-year-olds' decisions to read books about novel animals does not seem to be governed by what older children and adults consider to be 'intuitive' vs. 'counterintuitive.' Over the course of conceptual development, children's intuitions about what animals can and cannot do strengthen, and become more adult-like—our participants' belief in the feasibility of our 'intuitive' items increased with age and their disbelief in the counterintuitive items was relatively constant across the age range (see Supplementary Materials). Rather than ignoring or passing-over information that remained counterintuitive to them, children seemed to gravitate towards it. For the sake of driving conceptual development and scientific knowledge, this tendency is likely adaptive. Future work may explore the full generalizability of these findings by exploring how children seek information in other forms of media and in other domains.

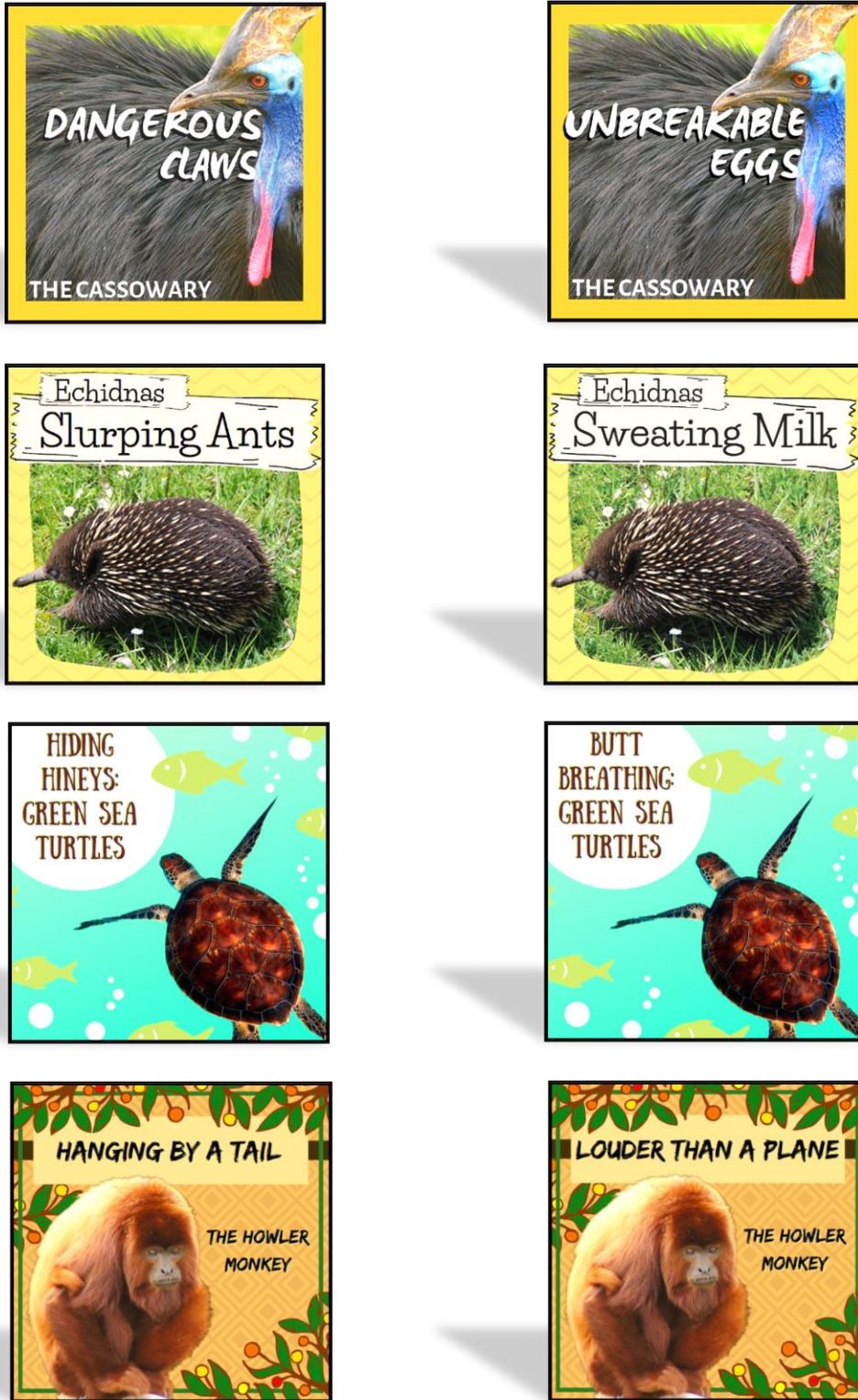


Figure 1. Example covers for four of the twelve book pairs. “Intuitive” versions are on the left, and “counterintuitive” versions are on the right.

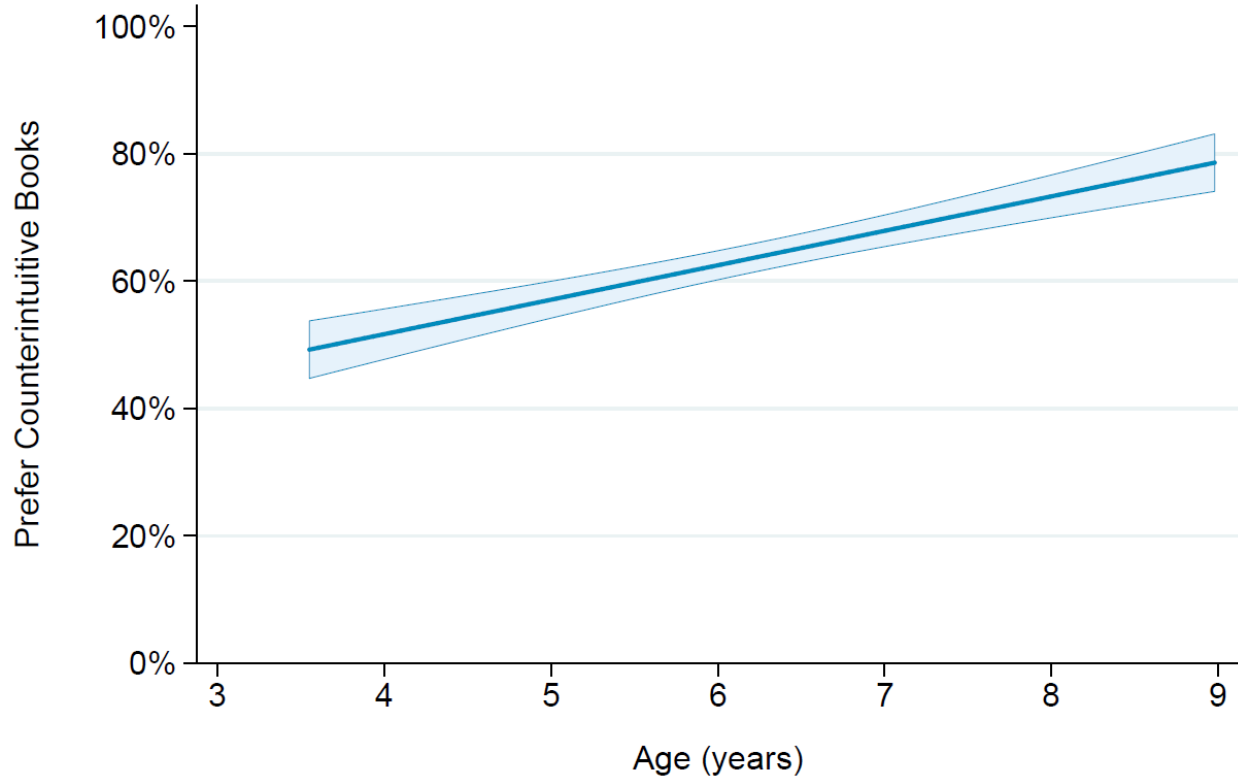


Figure 2. Fitted regression line depicting an age-related increase in children's preference for books with "counterintuitive" content. Shaded region represents a 95% confidence interval.

*Table 1.* Pearson correlations.

	Children's CI book selection	Parents' CI book selection	Intellectual Humility	Engagement with Wildlife Media
Age	.492***	.213**	.208**	.004
Children's CI book selection	---	.084	.065	-.018

\*\* $p < .01$  ; \*\*\* $p < .001$

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**Appendix A**  
**Book Pair Facts**

<b>Animal</b>	<b>Intuitive</b>	<b>Counter-intuitive</b>
Cassowaries	can protect their nest using their sharp claws	can make eggs so strong, someone could stand on them
Dorcas Gazelles	can dig holes to find food underground	can live without ever drinking water
Echidnas	can catch food with their long, sticky tongues	can sweat milk from their skin }
Giant African Snails	can crawl upside down using their sticky foot	can sleep for three years without waking up
Green Sea Turtles	can use their flippers and tails to protect their butts	can hide underwater by breathing through their butts
Honey Bees	can dance to let other bees know where food is	can taste flower nectar with their toes
Howler Monkeys	can hang from tree branches using their tails	can make noises that are louder than a jet plane
Olms	can live their whole lives underwater	can live 10 years without food
Peregrine Falcons	can make their homes on tall buildings	can fly faster than a race car
Shoebill Storks	can clack their beaks to say hi to other storks	can use their beaks to eat whole crocodiles
Thorny Devils	have scales that can protect them from the sun	have scales that can move water to their mouth
Wandering Albatrosses	can float on their bellies in the ocean	can fly around the whole world without stopping