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The Roles of Intuition and Informants' Expertise in Children's Epistemic Trust

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Abstract

This study examined how children's intuitions and informants' expertise influence children's trust in informants' claims. Three- to 8-year-olds (*N*=192) watched videos in which experts (animal/biology experts or artifact/physics experts) made either intuitively plausible or counterintuitive claims about obscure animals or artifacts. Claims fell either within or beyond experts' domains of expertise. Children of all ages were more trusting of claims made by informants with relevant, as opposed to irrelevant, expertise. Children also showed greater acceptance of intuitive rather than counterintuitive claims, a differentiation that increased with age as they developed firmer intuitions about what can ordinarily happen. In summary, children's trust in testimony depends on whether informants have the relevant expertise as well as on children's own developing intuitions.

In seeking to understand the world, two sources of information are critical—our own knowledge and others' knowledge. Other people possess information about phenomena that we might not have the time, skill, or tools to directly access. Thus, acquiring knowledge from the "testimony" of others is critical, as is the ability to identify suitable informants (Harris, 2012). In this study, we ask whether children are more trusting of claims made by informants with relevant expertise. Additionally, we examine how children's own prior intuitions influence their trust in testimony. Children are taught about things ranging from the relatively intuitive—e.g., animals or objects with familiar, normative biological and physical properties—to the counterintuitive—e.g., solid objects that float in mid-air with the aid of helium, animals with extraordinary perceptual capacities, like echolocation. Accordingly, we also ask how the intuitiveness of a claim—whether it is consistent with or conflicts with children's intuitions—influences children's trust in testimony.

Young children understand that some people are better informed about particular domains. For example, 4-year-olds appreciate that a mechanic knows more about cars than a doctor, whereas a doctor knows more about illness than a mechanic (Lutz & Keil, 2002). Young children also apply this understanding of expertise to their trust in testimony (Koenig & Jaswal, 2011; Kushnir, Vredenburgh, & Schneider, 2013; Nguyen, 2012; Sobel & Corriveau, 2010). For example, they are more willing to accept claims about birds provided by eagle experts and claims about vehicles provided by bicycle experts (Landrum, Mills, & Johnston, 2013). In the current study, we examine children's trust in claims about animals and artifacts presented by either animal experts or artifact experts.

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In most recent studies of children's sensitivity to informants' knowledge, two different informants made conflicting claims about the same entity or phenomenon, and children were asked to endorse one of the informants' claims. This paradigm might provide a sensitive test of whether children can apply their understanding of expertise but it does not reflect how children typically learn from others. Information is usually presented by one informant at a time and children can either accept or reject the informant's claim. Accordingly, in the current study, each claim was presented by one informant, and children could either accept or reject that informant's claims.

When learning from an informant, children's own knowledge and intuitions also play important roles. Preschoolers often reject testimony that runs counter to their first-hand perceptions—for example, they reject claims that objects are different in color or identity from what they have just seen for themselves (Clément, Koenig, & Harris, 2004; Koenig & Echols, 2003; Jaswal, 2004; Lane, Harris, Gelman, & Wellman, 2014). Indeed, young children show greater skepticism the more the testimony conflicts with their prior knowledge. For example, they are more willing to accept counter claims about the identity of ambiguous as compared to prototypical objects (Chan & Tardif, 2013). Children might be skeptical not just toward counterintuitive claims about object identity, but also toward counterintuitive claims about what could be real or what could happen. However, no study (to our knowledge) has examined whether children take informants' expertise into account when presented with such claims. We assessed children's acceptance of claims about the existence and capacities of novel entities with properties that violated their assumptions about what most entities in a given domain (i.e., animals or artifacts) are capable of. We will refer to these claims as "counterintuitive." Children also received "intuitive" claims that did not violate their assumptions about what most entities in a given domain are capable of. We compared children's acceptance of both types of claims.

Some research suggests that young children are particularly skeptical toward counterintuitive possibilities (Woolley & Ghossainy, 2013). For example, Shtulman and Carey (2007) asked children to rate whether improbable phenomena (e.g., someone drinking onion juice or finding an alligator under their bed) could really happen. Preschoolers typically reported that these events were impossible, but by 8 years children reported that many of them were possible. Thus, preschoolers in the current study might display greater skepticism than older children toward experts' counterintuitive claims

Children's intuitions often strengthen over the course of development, thereby influencing their acceptance of counterintuitive claims. For example, Lee and colleagues (2002) told children a story in which a girl told her mother that a ghost had jumped out of her book and broken a glass. The oldest children (5–6 years) were more likely than younger children (3–4 years) to infer that it was actually the girl, not the ghost, who broke the glass. Importantly, this age-graded increase in skepticism was mediated by children's increasing skepticism about ghosts. Older children were more certain that ghosts are not real and so were less likely to accept the girl's claim. Thus, we also assessed the strength of children's pre-existing intuitions about the counterintuitive phenomena. This allowed us to examine whether the strength of those intuitions predicted children's acceptance of counterintuitive claims.

In summary, we manipulated both the *experts* who offered claims (relevant vs. irrelevant experts), as well as the *intuitiveness* of the claims (intuitive vs. counterintuitive), and assessed children's acceptance of those claims. Children learned from artifact experts and animal experts who offered claims that were either within or outside their domain of expertise, and the claims were either intuitively plausible or counterintuitive.

We predicted that, generally, children would be more receptive to intuitively plausible than to counterintuitive claims. Our method allowed us to test three alternative developmental hypotheses regarding children's acceptance of counterintuitive claims. One possibility was that our findings would parallel those demonstrating that older children are more willing to entertain the possibility of improbable phenomena (Shtulman & Carey, 2007); thus, older children would be more accepting of counterintuitive testimony than younger children. A second possibility, based on Shtulman and Carey's (2007) finding that younger and older children in this age range are equally skeptical about impossible phenomena, is that younger and older children would be equally unwilling to accept counterintuitive testimony. A third possibility is based on the finding of Lee et al. (2002) that older children are more skeptical about "counterintuitive" phenomena; thus, older children would be less accepting of counterintuitive testimony. Finally, we expected that children across our age range would more strongly endorse claims made by informants with relevant (vs. irrelevant) expertise because even young preschoolers can differentiate between the knowledge held by artifact and animal experts (e.g., Lutz & Keil, 2002). Nevertheless, we speculated that the impact of relevant expertise might be pronounced for counterintuitive claims.

Method

Participants

Participants included 198 children (89 boys, 109 girls) ranging from 3 to 8 years in age, who were visiting a science museum. Most families lived in the Northeast U.S., and were of middle- to upper-middle socioeconomic status. Participants represented a variety of racial and ethnic backgrounds, but were predominately Caucasian. Six children were excluded from analyses because they were notably distracted or ended the interview session early, resulting in a sample of 192 children. To examine developmental trajectories, children were divided into three groups: 3–4 year-olds (M = 4.11, Range: 3.28–4.98, n = 64), 5–6 year-olds (M = 5.81, Range: 5.05–6.80, n = 66), and 7–8 year-olds (M = 7.75, Range: 6.90–8.97, n = 62).

Procedure

The interview involved three stages. It began with an *expertise understanding* task, which assessed children's basic understanding of artifact and animal experts. This was followed by the *trust in expert testimony* tasks, in which two animal experts and two artifact experts claimed that animals or artifacts possessed either intuitive or counterintuitive capacities. Finally, to assess children's *pre-existing* intuitions about counterintuitive capacities, they were asked whether phenomena that they had not heard experts mention (i.e., phenomena that children had not been told could, in fact, occur) could really occur.

Expertise Understanding—Drawings of an animal and an artifact expert were shown to the child. For a description of the experts' introductions, see Appendix S1. In two presentation orders (one a reversed version of the other), children were asked four questions, patterned after those used by Lutz and Keil (2002); e.g., "Who knows more about which animals can see very far?" (see Appendix S1 for all questions). For each question, children earned one point by pointing to the relevant expert, for a maximum score of 4.

Trust in Expert Testimony Tasks—Children were presented with eight claims about novel entities; one intuitive claim and one counterintuitive claim, offered by each of four experts: 1 male artifact expert, 1 female artifact expert, 1 male animal expert, and 1 female animal expert. One artifact expert presented claims within his/her domain (about novel artifacts); the other artifact expert presented claims outside of his/her domain (about novel animals). The same was true for the two animal experts. Thus, both of the two focal factors —expertise and intuitiveness—were manipulated within subjects. All claims and a description of the experts' attire are presented in Appendix S1. The experimenter introduced each expert using identical language to that used in the initial *expertise understanding* tasks. Following this introduction, for each expert, children watched two videos in which the expert offered claims about novel entities. The orders in which the experts and entities were presented, the gender of experts, and the intuitiveness of each entity (i.e., intuitive vs. counterintuitive version, see Table S1) were counterbalanced across participants.

Following each video, children were asked to judge the *reality* of the entity: "Do *you* think [entity] is real or not real? Are you very, very sure or just a little sure that [entity] is real/not real?" Next, they were asked to judge the feasibility of the entity's *capacity*: "Do *you* think [entity] can [claimed capacity], or not? Are you very, very sure or just a little sure that [entity] can/can't [claimed capacity]?" For an example, see Appendix S1. For both *reality* and *capacity* questions, children's answers were subsequently coded on a 4-point scale: 0 = very sure not real/capable; 1 = little sure not real/capable; 2 = little sure real/capable; 3 = very sure real/capable.

Pre-existing Intuitions about Counterintuitive Capacities—Children's pre-existing intuitions about the feasibility of the entities' counterintuitive capacities were assessed at the end of the interview. This assessment targeted four entities for which children had previously received no counterintuitive testimony (for an example, see Appendix S1). For each entity, children were asked about the feasibility of its capacity. Answers were scored using the same 4-point scale as used for the *trust in expert testimony* tasks.

Effect of images—A secondary question concerned the effect of visual evidence on children's trust. Even young preschoolers interpret photographs as accurate representations of reality (DeLoache, 1991). For half of the participants, the expert held a picture of the entity when it was not performing its purported capacity throughout his or her testimony. For the other half, the expert held this image initially, but when mentioning the entity's capacity, held an image of the entity performing its purported capacity.

Results

Expertise Understanding

Preliminary analyses indicated that children in each age group accurately attributed knowledge to the animal and artifact experts at levels significantly above chance: 3–4 year-olds: $M = 3.42$, $SD = .91$; 5–6 year-olds: $M = 3.79$, $SD = .60$; 7–8 year-olds: $M = 3.84$, $SD = .58$; ts > 12.50, ps < .001. Thus, even the youngest children understood what knowledge these types of experts possess.

Trust in Expert Testimony

In what follows, belief ratings ranging from 0–.75 will be referred to as *strong disbelief*, .76–1.50 as *modest disbelief*, 1.51–2.25 as *modest belief*, and 2.26–3.00 as *strong belief*. Children's trust in informants' claims did not systematically vary by children's gender or experts' gender, consistent with prior work demonstrating that informants' gender does not strongly influence U.S. children's epistemic trust (Shenouda & Danovitch, 2013). Moreover, collapsing across entities, children showed equal trust in claims made by animal experts and artifact experts. Thus, these factors will not be considered further. In general, children were more inclined to believe claims about animals ($M = 1.98$, $SD = .65$) than artifacts ($M = 1.71$, $SD = .65$), $t(191) = 6.49$, $p < .001$.

Because different factors might influence children's belief in entities' existence versus their purported capacities, the influence of each experimental factor on children's belief in (i) the reality of the entities, and (ii) the entities' capacities was examined in two separate, 4-way mixed-effects ANOVAs of 3 (Age group: 3–4, 5–6, 7–8 years) X 2 (Image of Capacity: Present, Absent) X 2 (Expertise: Relevant, Irrelevant) X 2 (Intuitiveness: Intuitive, Counterintuitive).

The analysis for children's belief in the *reality/existence* of the entities revealed significant effects of Expertise ($F(1, 188) = 14.44$, $p < .001$, $\eta_p^2 = .07$) and Intuitiveness ($F(1, 188) = 22.09$, $p < .001$, $\eta_p^2 = .11$); as well as a significant interaction between Age and Intuitiveness ($F(2, 188) = 4.08$, $p < .05$, $\eta_p^2 = .04$). There were no other significant interactions.

The main effects of expertise and intuitiveness were consistent with our predictions. Children reported stronger belief in the existence of the entities introduced by relevant ($M = 1.98$, $SD = .66$) as opposed to irrelevant experts ($M = 1.81$, $SD = .78$). Also, children reported stronger belief in the existence of the intuitive ($M = 2.00$, $SD = .70$) as opposed to counterintuitive entities ($M = 1.78$, $SD = .76$). Despite this variation, children exhibited modest belief across all four conditions, significantly above neutral belief levels of 1.50 (Ms = relevant-expert/intuitive: 2.08; irrelevant-expert/intuitive: 1.92; relevant-expert/counterintuitive: 1.87; irrelevant-expert/counterintuitive: 1.70; ts(191) > 3.00, ps < .01).

The interaction of Age X Intuitiveness is illustrated in Figure 1. Post-hoc analyses indicated that 3–4 year-olds believed equally in the reality/existence of intuitive and counterintuitive entities, but children ages 5–6 years and ages 6–7 years believed more strongly in the

intuitive than the counterintuitive entities, *p*s < .01 with Bonferroni correction. Thus, intuitiveness exerted a greater effect on older children's belief.

The ANOVA for children's belief in the entities' capacities produced a similar pattern. It revealed significant effects of Expertise ($F(1, 188) = 8.67$, $p < .01$, $\eta_p^2 = .04$) and Intuitiveness ($F(1, 188) = 154.38$, $p < .001$, $\eta_p^2 = .45$), as well as a significant interaction between Age and Intuitiveness ($F(2, 188) = 19.67$, $p < .001$, $\eta_p^2 = .17$), and a marginally-significant interaction between Expertise and Image $F(1, 188) = 3.70$, $p = .056$, $\eta_p^2 = .02$). There were no other significant interactions.

The main effects of expertise and intuitiveness were again consistent with hypotheses—children reported stronger belief in the capacities of entities when they were introduced by relevant ($M = 1.87$, $SD = .72$) as opposed to irrelevant experts ($M = 1.73$, $SD = .79$); and stronger belief in intuitive ($M = 2.16$, $SD = .63$) as opposed to counterintuitive capacities ($M = 1.44$, $SD = .95$). We evaluated children's level of belief for each of the four combinations of expertise and intuitiveness. Children exhibited strong belief in the intuitive capacities that were presented by relevant experts ($M = 2.26$, $SD = .74$) and modest belief when they were presented by irrelevant experts ($M = 2.06$, $SD = .78$); both significantly above neutral belief levels (1.50), *t*s(191) > 10.00, *p*s < .001. However, children exhibited modest *disbelief* in the counterintuitive capacities when presented by relevant experts ($M = 1.48$, $SD = 1.03$) and by irrelevant experts ($M = 1.40$, $SD = 1.07$); though children's ratings did not differ significantly from neutral belief levels (1.50).

The interaction of Age X Intuitiveness is illustrated in Figure 2. Further analysis of this interaction (with Bonferroni correction) showed that 3–4 year-olds believed in the intuitive capacities more than the counterintuitive capacities, $p < .05$. However, for the two older groups, the magnitude of this difference was even greater: children ages 5–6 years and ages 7–8 years believed in the intuitive capacities much more than the counterintuitive capacities, *p*s < .001. Thus, the intuitiveness of entities' capacities influenced the youngest children's beliefs but exerted a greater influence on older children's beliefs.

The marginally-significant interaction between Image and Expertise is illustrated in Figure 3. When photographic evidence was present, children showed greater belief in entities' capacities when claims were presented by relevant as compared to irrelevant experts ($p < .001$); but this effect of expertise was not statistically significant when photographic evidence was absent.

Intuitions about Counterintuitive Capacities

The interaction between age and intuitiveness, illustrated in Figures 1 and 2, is open to two interpretations. It might reflect developmental change in children's receptivity to counterintuitive as compared to intuitive testimony. Alternatively, it might reflect developmental change in the strength of children's pre-existing intuitions rather than their receptivity to counterintuitive testimony writ large. The assessment of children's pre-existing intuitions about counterintuitive capacities—conducted at the end of the interview—can help to test these two possibilities.

As illustrated in Figure 4, in answering these questions, children in each age group showed disbelief, scoring significantly below neutral levels (1.50), *t*s < −4.90, *p*s < .001—validating our categorization of these capacities as "counterintuitive" for children in this age range. Importantly, however, there was also an age-graded decrease in children's belief (i.e., increased disbelief) that these capacities were possible, $r(190) = -.45$, $p < .001$, when considering age as a continuous variable. On average, the youngest children were "a little sure" that such things are not possible whereas the oldest children were "very, very sure". For these questions, children also believed that the biological phenomena ($M = .76$, $SD = .78$) were more likely than the physical phenomena ($M = .60$, $SD = .71$), $t(191) = 2.72$, $p < .01$, paralleling the domain difference found for children's trust in testimony.

Figure 4 shows this age-related difference in pre-existing intuitions juxtaposed with the age-related difference in children's belief in testimony about the counterintuitive entities' capacities, collapsed across informant expertise. Note that the developmental trends are largely parallel, with the influence of testimony (i.e., the difference between pre-existing beliefs and belief in testimony) similar across the three age groups. A 3 (Age group) X 2 (Belief: Pre-existing, Testimony) mixed-effects ANOVA confirmed these conclusions—there were main effects of age ($F(2, 189) = 19.16$, $p < .001$, $\eta_p^2 = .17$) and of belief ($F(1, 189) = 125.62$, $p < .001$, $\eta_p^2 = .40$) but no interaction between these two factors, $F(2, 189) = .10$, $p = .90$, $\eta_p^2 = .00$. Moreover, in multiple regression analyses (with trust in claims about entities' capacities as the criterion), age (as a continuous variable) went from being a highly significant predictor in the first step ($\beta = -.28$, $t = -4.00$, $p < .001$) to marginal significance in a second step that additionally included children's pre-existing intuition scores ($\beta = -.14$, $t = -1.91$, $p = .06$). Children's pre-existing intuitions scores were significantly related to children's trust in this second step, and accounted for significant change in the statistical model—$R^2_{change} = .07$, $F_{change}(1, 189) = 15.54$, $p < .001$. Thus, the increasing strength of children's pre-existing intuitions largely accounted for the age-graded increase in children's skepticism toward informants' counterintuitive claims.

Discussion

Presented with claims about novel entities and their capacities, 3- to 4-year-olds showed greater belief in claims made by informants who had relevant expertise—an animal expert who made claims about novel animals or an artifact expert who made claims about novel artifacts. These findings join those of recent studies in demonstrating that young children have an initial understanding of expertise (e.g., Lutz & Keil, 2002), and also *apply* that understanding when evaluating informants' testimony (Koenig & Jaswal, 2011; Kushnir et al., 2013; Landrum et al., 2013; Sobel & Corriveau, 2010). However, in most prior studies, children heard claims that did not conflict with their intuitions. Our findings show that informants' expertise also influences children's evaluation of counterintuitive claims.

The effects of informants' expertise, although robust, were modest in size. This might be attributable to several factors. First, recall that a single informant presented each claim in the current study. Prior work has shown that children demonstrate selective trust much more often when presented with conflicting claims by two informants rather than by a single informant (e.g., Vanderbilt, Heyman, & Liu, 2014). The two-informant method might

provide a more sensitive test but is likely less ecologically valid—in everyday interactions, children typically learn from a single informant rather than from two informants who make conflicting claims.

Another, more speculative reason for the modest effects of expertise concerns the setting. The current study was conducted at a science museum—a place where children are surrounded by strangers (museum staff) who are knowledgeable about the artifacts and animals on display—and so children might have assumed that informants in our study had wide-ranging knowledge, making their claims trustworthy even when they fell outside their domain of expertise. If so, this would dampen the impact of expertise. Such dampening might also occur if the study were conducted in other pedagogical contexts, like schools. These speculations inspire intriguing questions about how context might influence children's trust in 'local' experts; for example museum staff, school teachers, or church clergy. For example, in the school setting, children might take for granted that teachers are expert about everything that they present—after all, children are going to school specifically to learn from these teachers. Thus, children might be especially receptive to their teachers' claims in the school context. It would be intriguing to examine children's trust in non-local experts, for example their trust in their teachers' claims made outside of the school context, or their trust in other individuals (e.g., substitute teachers) in the school context. Nevertheless, it is important to note that we found significant effects of informants' expertise in the museum context, even among preschoolers. Indeed, there was an effect of expertise when children judged claims about counterintuitive as well as intuitive entities.

Finally, it might be argued that informants' expertise played only a modest role in the current study because young children's default is to trust in testimony (e.g., Jaswal, Croft, Setia, & Cole, 2010). However, other evidence suggests that children's trust is quite context-specific rather than a wide-ranging default (Harris, 2012; Lane & Harris, 2014).

The intuitiveness of informants' claims profoundly influenced children's beliefs. Overall, children across the age range of 3- to 8-years were more accepting of intuitive claims than counterintuitive claims. Children's skepticism toward counterintuitive claims was more marked in the older groups. However, additional analysis revealed that this age-graded increase in skepticism did not reflect an increased skepticism towards testimony per se. When reasoning about the possibility of various counterintuitive capacities (about which children heard no testimony) older children were more skeptical than younger children; and children's changing intuitions about such capacities fully accounted for the statistical relation between age and children's trust in claims about counterintuitive capacities. Moreover, the strength of testimony, relative to children's pre-existing intuitions, was nearly identical for children across the three age groups. Thus, older children's stronger intuitions about entities' capacities led them to find claims asserting unexpected capacities to be even more counterintuitive, and this accounted for their greater skepticism toward such claims.

The current findings are consistent with those of Lee et al. (2002) as well as Chan and Tardif (2013): the strength of children's pre-existing intuitions has a marked influence on their acceptance of contradictory information. Indeed, in the current study, children's belief in counterintuitive capacities did not exceed neutral levels even when such information was

provided by relevant experts. Future research should examine what factors lead children and adults to develop *strong* beliefs in phenomena that are counterintuitive. Still, it is important to note that children expressed less doubt in informants' claims about entities' counterintuitive capacities, relative to their pre-existing assessment of such capacities. By implication, children were prepared to revise their degree of skepticism in light of informant testimony. The degree to which children engaged in such belief revision was consistent across the age groups.

The presence of photographic evidence did not clearly influence children's trust. A marginally-significant interaction effect indicated that children were least receptive when experts presented claims about the capacities of entities outside their expertise while holding photographic evidence of those capacities. Such photographic evidence might highlight a mismatch between the experts' attire and the nature of the capacity (e.g., a mechanic holding a picture of an exotic animal jumping extremely high), thereby increasing children's skepticism. However, we hesitate to over-interpret this marginally-significant interaction. It will be worthwhile for future research to probe whether visible evidence combines with verbal testimony to change children's beliefs.

Children were less skeptical about the counterintuitive capacities of animals as opposed those of objects; this pattern was found for their trust in testimony about these entities and for their pre-existing intuitions. This distinction may be a product of children's prior exposure to information about animals that vary dramatically in their capacities—bears hibernate for months, fleas can jump many times their height. Future research should examine how such knowledge of the animal kingdom might influence children's receptivity to counterintuitive testimony. The participants in the current study were primarily from middle and upper-middle socioeconomic backgrounds living in the Northeastern United States. To evaluate the generalizability of the current findings, future work should also be conducted with different populations, in which children potentially have different amounts of daily exposure to different types of experts.

In summary, children's trust in testimony is a function of their own prior intuitions and informants' expertise. From a young age, children are more skeptical of claims provided by informants without relevant expertise, and are more skeptical of claims that are inconsistent with their own intuitions. As children's intuitions become stronger with age, so does their resistance to counterintuitive claims.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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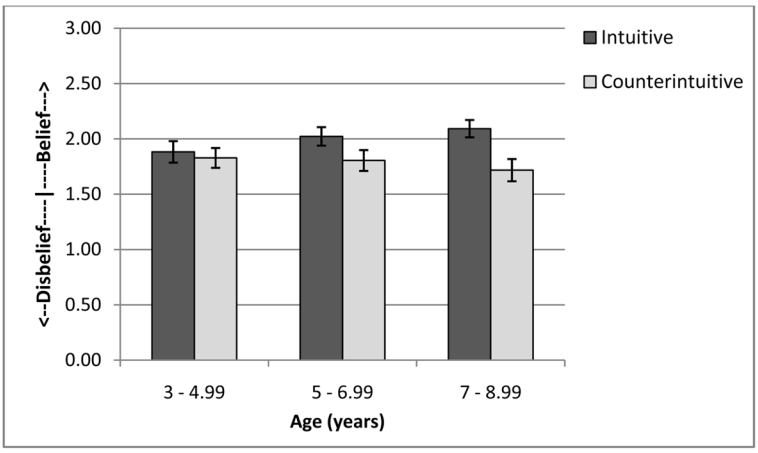

Figure 1.
Effect of testimony's intuitiveness on children's judgments about entities' existence, per age group. Error bars represent +/− 1 standard error of the mean.

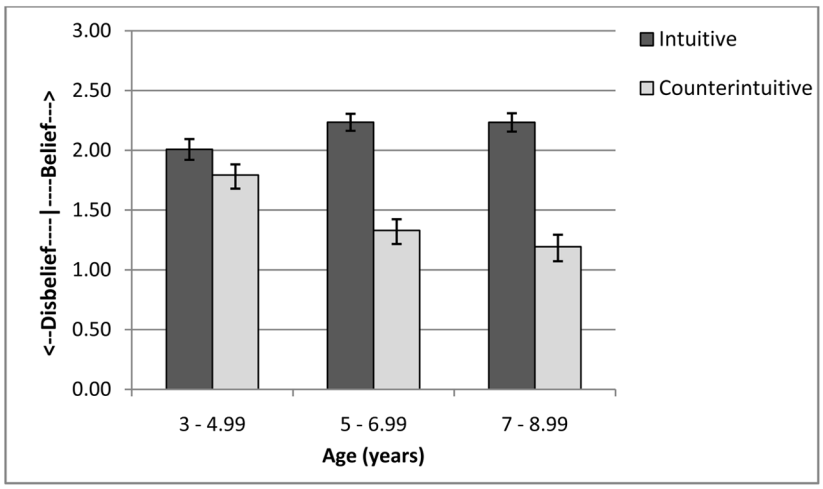

Figure 2.

Effects of testimony's intuitiveness on children's judgments about entities' capacities, per age group. Error bars represent +/− 1 standard error of the mean.

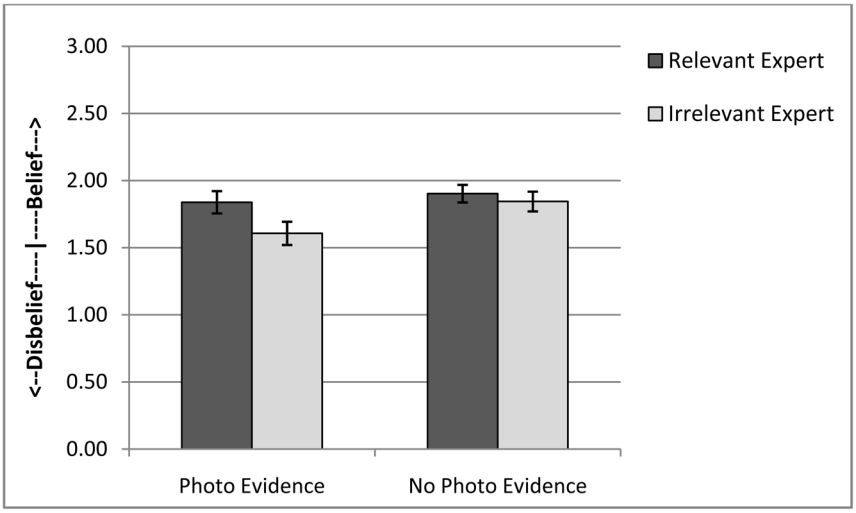

Figure 3.

Children's trust in relevant and irrelevant experts' claims about entities' capacities, when photographic evidence was present and when photographic evidence was not present. Error bars represent +/− 1 standard error of the mean.

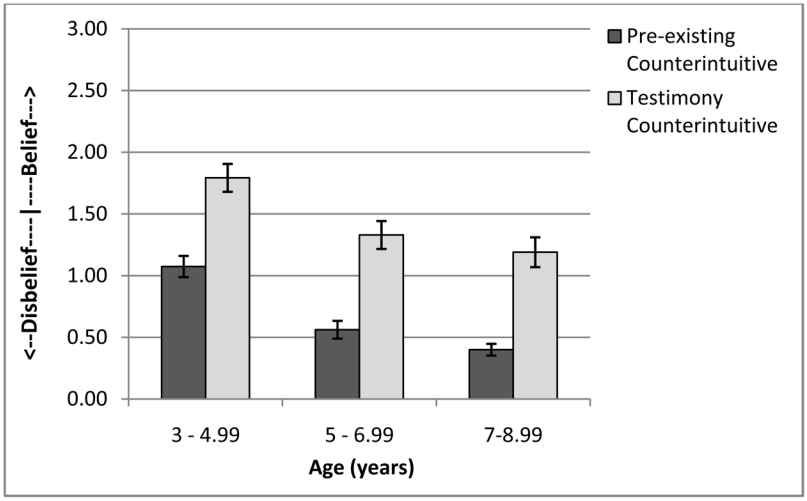

Figure 4.

Children's pre-existing intuitions about entities' "counterintuitive" capacities as compared to their trust in testimony about entities' "counterintuitive" capacities, per age group. Error bars represent +/− 1 standard error of the mean.