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Interactions Between Knowledge and Testimony in Children's Reality-Status Judgments

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Abstract

In two studies we attempt to capture the information processing abilities underlying children's reality-status judgments. Forty 5- to 6-year-olds and 53 7- to 8-year-olds heard about novel entities (animals) that varied in their fit with children's world knowledge. After hearing about each entity, children could either guess reality status immediately or listen to testimony first. Informants varied in their expertise and in their testimony, which either supported or refuted the entities' existence. Results revealed that children were able to evaluate the fit between the new information and their existing knowledge; this information then governed their decision regarding whether to seek testimony. Testimony had the strongest effect when new information did not conflict with, but was also not representative of, children's knowledge.

One of the most important sources of information about the world is the testimony of other people (Harris, 2012). Harris and Koenig (2006) identify science and religion as key domains in which the ability to learn through first-hand observation is limited, and thus, in which testimony plays a key role. A critical step in our reaction to new information is assessing how that information fits with our existing beliefs about the world. Specifically, when testimony makes an existence claim, either about an entity or event, the issue of reality status becomes paramount. In both scientific and religious contexts, children and adults encounter existence claims about novel entities. For example, children are taught in school about a particular species of dinosaur, whereas adults may hear on the news about the discovery of a new tropical frog. In churches and other religious venues, both children and adults are introduced to religion-specific beings such as angels and demons. In all these cases, we form beliefs about the existence or reality status of these entities largely on the basis of testimony.

Yet testimony must be considered critically and carefully, as some people are more trustworthy or more knowledgeable than others. Thus, as argued by Sperber and colleagues, humans must practice "epistemic vigilance" toward new information, both its source and its content (Sperber, Clément, Heintz, Mascaro, Mercier, Origgi, & Wilson, 2010). Regarding the nature of the source, research shows that even very young children can identify

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²Approximately 10 children received each of the first three orders. Due to time constraints in data collection, however, approximately four children received each of the remaining three orders.

trustworthy sources (e.g., Harris, 2012), and consider factors such as benevolence (Mascaro & Sperber, 2009), past accuracy (e.g., Koenig & Harris, 2005), and competence (Clément, Koenig, & Harris, 2004) in deciding from whom to learn. Young children also understand that certain people know more about certain topics than others (Danovitch & Keil, 2004; Lutz & Keil, 2002). Regarding reality-status judgments specifically, two studies suggest that children may consider some people better sources of information about reality status. Gilpin and Woolley (2013), show that by age 6 children begin to consider adults better sources of reality status information than children, and Lane and Harris (2015) show that 3- to 7-year-olds have stronger beliefs in entities introduced to them by people with relevant rather than irrelevant expertise.

We know less about the processes underlying children's evaluation of content in reality-status judgments. The basic ability to distinguish real from not real is present by the age of 3 (e.g., Bunce & Harris, 2013; Woolley & Wellman, 1990), but the ability to properly determine the reality status of both familiar (Prentice & Gordon, 1987; Principe & Smith, 2008; Sharon & Woolley, 2004) and novel entities (Boerger, Tullos, & Woolley, 2009; Woolley, Boerger, & Markman, 2004; Woolley & Van Reet, 2006) continues to develop into adulthood. In discussing the steps that underlie assessment of reality status, Woolley (1997) proposes that both adults and children engage in the process of *belief consistency detection*. That is, in deciding whether something is real or not, we think about whether the properties of the entity fit with or are consistent with our understanding of how the world works. Lee, Cameron, Doucette, and Talwar (2002) provide empirical evidence of this process in young children. They had an experimenter tell children that a ghost jumped out of a book and broke a glass. They found that, regardless of age, children who knew that ghosts were not real were more likely to disbelieve the experimenter. These children had identified and evaluated an inconsistency between what they heard and what they knew about the world and used this inconsistency to make a decision regarding the truthfulness of the experimenter's claim. Lane and Harris (2015) also provide evidence of this ability. They told children about novel entities with properties that either violated or did not violate assumptions about the general capabilities of that class of entities, and found that, by the age of 5, children believed more in intuitive than in counterintuitive entities. Finally, as children get older, they appear to become more interested in the implications of such inconsistencies regarding fantastical beings, as shown by Baxter and Sabbagh's (2005) work on children's conversations about Santa Claus. They found that younger children asked mostly descriptive questions about Santa (e.g., what does his wife look like?), whereas older children attempted to resolve ambiguities with their questions (e.g., how does he get all the way around the world in one night?).

In the present set of studies, we assessed the extent to which children can detect such inconsistencies by asking them to judge the reality status of novel entities that varied in how well they fit with children's world knowledge. The novel entities were animals that were possible and typical, possible and atypical (improbable), or impossible. Research shows that 4- to 6-year-olds are poor at differentiating impossible from improbable events (Shtulman & Carey, 2007). That is, they consider improbable events, such as a person drinking onion juice, equivalent to impossible events, such as a person walking through a wall. The ability to differentiate these improves significantly between the ages of 4 and 8.

How might the process of belief consistency detection interact with the use of testimony in assessing reality status? In a theoretical analysis of how children might use testimony to assess reality status, Bergstrom, Moehlmann, and Boyer (2006) suggest that, “To the extent that a certain piece of cultural knowledge is compatible with spontaneous assumptions, we would expect the child to pay little attention to source reliability. By contrast, information that violates early developed principles should trigger at least some search for additional evidence, including evaluation of the sources” (pp. 534–535). This suggests that children will use and evaluate testimony most when information conflicts with basic principles.

Given the many ways the existence of fantastical beings violates such basic principles, the prevalence of beliefs in such beings thus is somewhat paradoxical. Shultman and Carey (2007) suggest that, “serious testimony from a credible adult... may be sufficient to convince children of the actuality of (these) fantasy characters *if children have not identified a reason as to why such characters could not exist in the real world*” (p. 1030, italics added). From this, we might expect testimony to play its most critical role not when information contradicts the child’s knowledge, as suggested by Bergstrom et al.’s account, but instead when the child has not (yet) identified a reason that an entity should not exist, that is, when reality is still possible. Thus, serious testimony from a credible adult might be most effective when a child *lacks* a reason to reject the entity. Presumably, if children have identified such a reason, then even serious testimony from a credible adult may not be convincing. In the current studies, we present children with entities that vary in the extent to which they violate basic principles (i.e., we provide reasons they should or should not exist), and children are asked to judge reality status. By providing children with information that we expect will instill varying levels of doubt in the entities’ existence, we hope to explore the conditions under which testimony is resisted or ignored versus when it is necessary or even sufficient for belief.

In the same way that Shultman and Carey (2007) hypothesize that credible adults may provide particularly compelling testimony, the testimony of an expert could also provide particularly strong reality-status evidence, compared to that of a non-expert. By the age of 4, children can differentiate domains of expertise in the minds of familiar experts (e.g., a doctor and a mechanic; Danovitch & Keil, 2004; Lutz & Keil, 2002; Sobel & Corriveau, 2010); some work even shows that 3-year-olds can use expertise in deciding from whom they prefer to obtain information (Koenig & Jaswal, 2011). Research also shows that, by the age of 6, children are able to determine when to answer a question themselves and when to seek information from an appropriate expert (Aguiar, Stoess, & Taylor, 2012). Thus a final question we address is the role of expertise in children’s reality-status judgments. We expect that children’s consideration of informant expertise, much like their information seeking, will depend on the type of entity being judged. Specifically, children should be most likely to consider the expertise of the speaker when judging the reality status of entities that are possible yet atypical.

In summary, our overarching goal is to address how children integrate their existing beliefs with information from testimony to make reality-status judgments. Within this larger goal we have three sub-goals: (1) to assess whether consistency between new information and children’s existing beliefs about the word affects their reality-status judgments, (2) to probe

whether this consistency also affects their decisions about whether to seek testimony, and (3) to assess how the content and source of testimony affects children's reality-status judgments.

Study 1

Method

Participants—Participants were 15 5- to 6-year-olds (mean age = 5;10, range = 5;0–6;11; 10 boys and 5 girls), and 28 7- to 8-year-olds (mean age = 7;4, range = 7;1–8;8; 13 boys and 15 girls).¹ Participant ethnicity was 79.1% White non-Hispanic, 16.3% White Hispanic, 2.3% Asian or Pacific Islander, and 2.3% more than one race. Five additional children were tested but excluded due to procedural error.

Materials—Stimuli consisted of 6 colored cards, each with an animal name on one side and a description of the animal on the other. There were two boxes, one labeled “real” and one labeled “not real,” each with slits in the top to fit the cards. There were also laminated photographs of the two informants – a zookeeper and a chef.

Procedure—The experimenter told children that she was working on a project that had two components: (1) finding the names of real animals that people had never heard of, and (2) making up pretend animal names. The experimenter explained that she wrote the names on index cards and put them in boxes, but that she had dropped the cards and they had gotten all mixed up. After indicating which box was for real animal names and which was for pretend, the experimenter asked the children to help her put the cards back in the correct boxes, and she explained that two people would help them – a zookeeper (the expert) and a chef (the non-expert; see Appendix A for exact wording). The experimenter presented participants with photographs of the informants and gave a brief explanation of their respective jobs. Children were first asked to point to each box and to each informant, and then were asked four check questions, two appealing to the expertise of each of the experts (see Appendix A for questions). If children answered incorrectly they were corrected and then asked the next question.

For the main task, three entity-types were presented to children: (1) possible-typical, (2) possible-atypical, and (3) impossible. For possible-typical entities, the description rendered the entity typical of familiar animals, for example, a wigtip, which was described as being “kind of like a bird. It lives in a nest.” Possible-atypical entities were designed to be potentially real but atypical, for example a binbad, which is “kind of like a rabbit. It eats bugs.” Descriptions of the impossible entities involved violations of what children know about animals, for example, a jarpat, which “is kind of like a lion. It eats nails.” (See Table 1 for a complete listing of all stimuli.). To construct these, we generated six novel animal names, and for each novel animal name we generated one instance of each of the three properties (possible-typical, possible-atypical, or impossible). From these, we created five

¹The uneven age distribution is a result of time constraints on data collection. Study 1 was a student Honors thesis, and data collection ceased abruptly at the end of the semester. When we returned to the study some months later, rather than filling out the cell for the younger children we opted to conduct Study 2 using more tightly controlled stimuli.

animal-property combinations for each type of trial (see Table 1). Each child received two of the five possible combinations per trial type.

After hearing each description, children were given the option of either guessing the animal's reality status before listening to the testimony or just listening ("Do you want to guess first if it's real or pretend, or just listen to what the people say?"). Children who opted to guess first made their guess, then heard the testimony, and then were asked to make a final decision by placing the card in either the real or pretend box. Children who opted to just listen heard the testimony and then made a final decision by placing the card in the box. For each entity-type, on one trial children heard the zookeeper claim the entity was real and the chef claim it was pretend, and on the other trial this was reversed, with the chef claiming the entity was real and the zookeeper claiming it was pretend. Thus, there were six unique pairings of entity-type (possible-typical, possible-atypical, or impossible) and type of informant claim (expert says "real" or non-expert says "real") which were used to create each of the six trial types. Six random orders of these trial types were generated and these random orders determined the order of the first five trials.² Because we were concerned that hearing an expert state that an impossible entity was real might undermine his expertise, the impossible trial on which the expert stated the entity was real was always presented last. The novel animal names (e.g., calak) and real animal associates (e.g., "kind of like a horse") were presented in a fixed order, but were paired with different properties (e.g., "it lives in the jungle") according to each random order. Order of speakers was alternated within subjects.

Results

The first question concerned whether children chose to guess the reality status of the entity based on the description alone or skip directly to the testimony before making the final reality-status decision. If children are capable of assessing the fit between the new knowledge and their own beliefs about the world, then the type of entity should affect this decision. Since information in the possible-typical trials is highly consistent with children's knowledge (e.g., a lion that roars), we expected that they would be fairly likely to make a guess on these trials. We expected that when information conflicted with children's knowledge about the world (e.g., a lion that eats nails), it would be especially clear to them that the entity was not real. Hence we predicted that children should be even more likely to choose to make an initial guess about the reality status, without first hearing testimony, on the impossible trials. Children's knowledge should be least definitive on the possible-atypical trials (e.g., a lion that swims underwater), because these entities neither conflict nor are entirely consistent with common knowledge. Therefore, we expected they would not have a clear sense of the entity's reality status and so would be highly unlikely to make a guess on these trials and instead opt to hear testimony. However it was also expected that entity-type may interact with age: If the younger children do not differentiate possible-atypical (improbable) from impossible, and consider them both equally impossible (as shown by Shtulman & Carey, 2007), then only the older children should choose to guess more often on the impossible trials; the younger children should respond similarly on possible-atypical and impossible trials.

Results revealed that, overall, children chose to guess first on 60% of the trials. Children were more likely to guess on impossible trials ($M = 1.51$ out of 2, $SD = 0.67$) than on both possible-atypical ($M = 1.07$, $SD = 0.70$) and possible-typical trials ($M = 1.00$, $SD = 0.76$). A 2 (age group: younger, older) $\times$ 3 (entity-type: possible typical, possible atypical, impossible) analysis of variance (ANOVA) on children's choices to either guess first or to skip to the testimony revealed a significant main effect of entity-type on children's decisions, $F(2, 82) = 7.18$, $p = .001$, $\eta_p^2 = .15$. There were no age differences or interactions involving age; post-hoc tests revealed that children in both age groups treated the possible-typical and possible-atypical entities differently from the impossible entities, $t(42) = 3.69$, $p = .001$, Cohen's $d = 0.71$, $t(42) = 3.10$, $p = .003$, Cohen's $d = 0.64$, respectively. Children's initial reality-status guesses varied by item-type, with children guessing "real" 72% of the time for possible-typical, 24% for possible-atypical, and 9% of the time for impossible items. Initial guesses for possible-typical items differed significantly from initial guesses for possible-atypical items, $t(87) = 5.14$, $p < .001$, Cohen's $d = 1.09$, and for impossible items, $t(106) = 8.77$, $p < .001$, Cohen's $d = 1.66$. Initial guesses for possible-atypical items also differed significantly from initial guesses for impossible items, $t(109) = 2.14$, $p = .04$, Cohen's $d = 0.41$.

Recall that, following their choice to guess or listen, all children heard the testimony. Thus, our second question concerned how children would judge the reality status of the novel entities after hearing the testimony. For the impossible trials, if children rely primarily on their knowledge, then they should judge the entities as pretend regardless of the informants' claims. That is, children should be equally likely to disregard both the expert's and the non-expert's claims, as they know the entity is not real. However, if testimony competes with knowledge, then the testimony of the expert should have some sway over children's decisions, even on these trials where they should be certain that the entity is impossible. For the possible-typical trials, children were primarily expected to judge these entities as real, and so should also rely very little on the testimony. That is, for the most part children should judge these entities as real regardless of what each informant says. Again, however, testimony might also exert some influence, as children's lack of personal experience with these entities might engender some skepticism (Woolley & Ghossainy, 2014). Finally, we expected to see the greatest effect of testimony on the possible-atypical trials. Because children's knowledge is less definitive here, their judgments should more closely mirror the testimony of the expert, with children judging the entities as real more often when the expert says they are real than when the non-expert says they are real. Alternatively, if younger children do not differentiate possible-atypical (improbable) from impossible then their responses on these trials should mirror responses on the impossible trials.

As shown in Figure 1, children appeared to use both knowledge and testimony in their reality-status judgments. Regarding entity-type, children were most likely to respond that the entity was real on the possible-typical trials (58%), compared to the possible-atypical (34%) and impossible trials (19%). Regarding the informants, children were more likely to respond that the novel entities were real when the expert claimed that they were (51%) versus when the non-expert did (22%). Because our outcome variable was dichotomous, we used a binary logistic regression to examine these effects statistically. Candidate models were assessed by Akaike information criterion (AIC) values. AIC takes into account the trade-off between

complexity of a model (i.e., the number of parameters in the equation) and goodness of fit of the model for the dataset (Bozdogan, 1987). The model with the lowest AIC value was selected as the best fit, and it included: entity-type, age group, informant, age $\times$ entity-type interaction, and entity-type $\times$ informant interaction, $\chi^2(5) = 66.60$, $p < .01$, Nagelkerke $R^2 = .311$. (See Table 2 for more information about the prediction formula generated by the logistic regression analysis.)

Figure 1 shows the nature of the entity-type $\times$ informant interaction. On the possible-typical trials, children tended to say that the entities were real more often when the expert said they were real (68%) than when the non-expert said they were real (49%). However, this difference was not statistically significant ($p = .126$, two-tailed Fisher's exact test, Cramer's $V = .19$). On the possible-atypical trials, as expected, children were significantly more likely to respond that the entities were real when the expert said they were real (54%) than when the non-expert said they were real (14%), $p < .001$, two-tailed Fisher's exact test, Cramer's $V = .42$. On the impossible trials, children were also more likely to judge the entities as real when the expert claimed that they were real (33%) than when the non-expert said they were real (5%), $p = .002$, two-tailed Fisher's exact test, Cramer's $V = .36$. Finally, age group and entity-type also interacted: older children's reality-status judgments differed significantly across entity-type, with children most likely to claim "real" for possible-typical entities (61%), compared to possible-atypical entities (30%), $p = .002$, two-tailed Fisher's exact test, Cramer's $V = .30$, and impossible entities (13%), $p < .001$, two-tailed Fisher's exact test, Cramer's $V = .50$, whereas younger children's reality-status judgments, although in the same direction, did not differ significantly.

Discussion

Results from our first question indicated that 5- to 8-year-old children are able to consider the fit between new information and their own knowledge in deciding whether to seek further information about reality status. Specifically, children chose whether to make a guess on their own about the reality status of the novel animals or to listen to testimony. When children heard about novel animals that violated their world knowledge, they were significantly more likely to make an initial guess about reality status than when they heard about animals whose properties did not violate their knowledge. When information did not violate their knowledge, children were less likely to venture a guess and preferred instead to proceed directly to hearing from the informants. These findings are consistent with our prediction that testimony may play a more critical role when reality is still possible.

These results are important for three primary reasons. First, they are informative about how children make the distinction between reality and non-reality (Woolley, 1997). We will discuss this further in the General Discussion. Second, they replicate Aguiar, et al.'s (2012) demonstration that, by age 6, children can determine when to seek expert testimony, and extend this to show that children can utilize these metacognitive abilities to evaluate reality status. Third, they reveal that 5- to 8-year-old children are able to differentiate between improbable and impossible entities. Because Shtulman and Carey (2007) found that 4- to 8-year-olds experienced difficulty differentiating improbable from impossible events, we expected that the younger group might treat the impossible and the possible-atypical

(improbable) entities similarly. The fact that they did not indicates that they are differentiating them on some level. One explanation for the difference between our findings and those of Shtulman and Carey is that they studied events (e.g., drinking onion juice, opening a window with one's mind) whereas we studied entities (novel animals); it may be that children find it easier to reason about improbable entities than about improbable events. Another possibility is that it is easier for children to reason about animals than other sorts of things; the domain of animals is one with which many children have considerable experience and knowledge (DeLoache, Bloom Pickard, & LoBue, 2011). A third possible explanation is that our measure tapped implicit knowledge whereas Shtulman and Carey's assessed explicit beliefs.

Results from our second question indicated that children consider and coordinate both the type of information and the testimony they receive in determining reality status. In general, children were most likely to respond that possible-typical novel entities were real. To come to this conclusion, children had to evaluate the fit between the new information and their existing knowledge about the world. Children also were more likely to agree with experts than with non-experts regarding the reality status of the novel entities. These findings are consistent with findings from Lutz and Keil (2002) and others (Danovitch & Keil, 2004; Koenig & Jaswal, 2011; Landrum & Mills, 2015; Sobel & Corriveau, 2010) showing that children differentiate domains of expertise, and along with the findings of Lane and Harris (2015), extend this work to show that children can use expertise information to determine whether or not something is real. Most interestingly, type of entity interacted with informant type, with the expert-nonexpert difference greatest for the possible-atypical entities. These are the entities for which, if children are considering the fit between the new information and their knowledge, expertise was expected to be most important to consider. Finally, there appeared to be development in children's evaluation of the novel information, in that older children differentiated the three types of entities more so than did younger children. Although this could potentially indicate increased evaluation of the fit between new information and existing knowledge with age, the smaller relative number of younger children argues for caution in interpreting this result.

Study 2

The purpose of the second study was two-fold. The primary purpose was conceptual. Although the results of Study 1 indicate that children are sensitive to informant expertise and prefer an expert (zookeeper), the unique contribution of the testimony from each source is not clear, as both sources were always presented simultaneously for each item and were always in opposition (i.e., when the expert stated "real," the non-expert stated "not real" and vice-versa). Landrum and Mills (2015) argue that, although most of the studies on children's understanding of expertise pit one expert against another, it is equally critical to determine what children believe about each expert independently. In fact, research by Vanderbilt, Heyman, and Liu (2014) on children's inferences about informants with differing histories of accuracy indicates that children often make judgments on the basis of relative rather than absolute reliability. It may be that expertise operates in the same way. Thus, in Study 2, we were interested in assessing whether children would continue to privilege the expert's

testimony over the non-expert's testimony if they were separated such that children only received one source of testimony on each trial.

In addition, we made two methodological improvements in Study 2. First, in Study 1, the wording used to manipulate the plausibility of the entities might have sometimes been misleading. For example, a child introduced to a trakel that is “kind of like an elephant” and that “has a trunk” may actually reason that since the only real animals they know of possessing a trunk are elephants, trakels must not be real. We addressed this issue in Study 2 by using more general animal categories (e.g., fish) that children were likely to understand as consisting of various subcategories. Then, rather than describe the novel animal as “kind of like a __,” we stated to children that each animal was “a kind of __.” Second, rather than making assumptions about children’s beliefs about the possibility of each entity-type, in Study 2, the descriptions for the entities were chosen through pilot testing that assessed how likely children were to expect different kinds of attributes for each category of animal. For example, in piloting, children claimed that *most* fish “live in the ocean,” that only *some* fish are “as big as a car,” and that *no* fish “live on the moon.” Children's responses to these questions were used to construct items that were possible-typical, possible-atypical, and impossible, respectively.

Method

Participants—Participants were 25 6-year-olds (mean age = 6;4, range = 5;8–6;11) and 25 8-year-olds (mean age = 8;6, range = 8;1–9;0). There were 11 girls and 13 boys in the 6-year-old group and 9 girls and 16 boys in the 8-year-old group. The majority of participants were White non-Hispanic (70%), 14% were more than one race, 8% were White Hispanic, 6% were African American, and 2% were Asian or Pacific Islander. One additional participant was tested but excluded due to procedural error. Sample size was based on representative sample sizes used in published research on young children’s cognitive development. In addition, 11 children (mean age = 8;8, range = 4;10–12;11) were pilot-tested for the purpose of stimulus construction.

Materials—The stimuli consisted of 16 cards with names of novel animals. There were two boxes, one labeled “Real” with a photograph of a watermelon, and one labeled “Not Real” with a drawing of an anthropomorphic dancing carrot. A desktop computer was used to present the testimony using SuperLab software. For the expert, a picture of a male zookeeper was used, and for the non-expert a picture of a male chef was shown. One of two male voices was paired with each picture and counterbalanced across participants.

Procedure—Children were told they would play a game about animals they had never heard of before, some of which were real and some not, and that their task was to figure out which was real. They were told that the experimenter would first give them a clue about what each animal was like and that eventually they would hear what someone else thought before they decided whether the animal was real or pretend. On the computer, children were introduced to Zookeeper Bob who “takes care of animals at the zoo,” and Chef John who “cooks food at a restaurant.” The session began with eight warm-up trials in order to familiarize children with the format of the game (four trials) and to introduce them to the

expert and non-expert (four trials). (See Appendix B for exact wording used by the experimenter.)

Children were then introduced to a virtual spinner that was positioned between the zookeeper and the chef on the computer. They were told that during the game, the arrow on the spinner would decide which person would help out on each trial. The experimenter explained that the spinner sometimes points to the zookeeper and sometimes to the chef. The experimenter then demonstrated one trial in which the arrow spun around and landed on the zookeeper and another in which it landed on the chef.

On each of twelve trials, the experimenter told children the name of a novel animal and described its associated property. There were three types of novel animals: possible-typical (e.g., “A galah is a kind of monkey that climbs trees”), possible-atypical (e.g., “A calak is a kind of fish that is as big as a car”), and impossible (e.g., “A goulán is a kind of snake that eats lightning”). Twelve novel animal names were randomly paired with these descriptions (see Table 3). Children could then choose to guess first whether the animal was real or pretend, or skip straight to hearing the testimony of the informant. On half of the trials the informant was the chef, and on the other half, the zookeeper. Each informant claimed the entity was real for half of the trials and not real for the other half. After listening to the testimony, children placed the animal name card in either the “real” or the “not real” box. Random orders were generated for the first eleven trials. As in Study 1, the trial in which the expert claimed the impossible entity was real was always last.

Results and Discussion

As in Study 1, we first assessed whether children chose to make a guess about the reality status of the entity before hearing testimony or whether they preferred to skip directly to the testimony. Overall, children chose to guess on 82% of the trials.³ As in Study 1, children appeared more likely to guess when the novel entity was impossible ($M = 3.68$ out of 4, $SD = 0.59$) than when it was possible-typical ($M = 3.12$, $SD = 0.98$) or possible-atypical ($M = 3.04$, $SD = 0.97$). A 2 (age) $\times$ 3 (entity-type) analysis of variance (ANOVA) on children's choices to either guess first or just listen revealed a main effect of entity-type, $F(2, 96) = 9.51$, $p < .001$, $\eta_p^2 = .17$. Planned comparisons between the groups revealed that children were more likely to guess for impossible entities than for possible-typical, $t(49) = 3.51$, $p = .001$, Cohen's $d = 0.69$, or possible-atypical entities, $t(49) = 5.17$, $p < .001$, Cohen's $d = 0.80$. As in Study 1, children's initial reality-status guesses (for those trials on which they chose to guess) varied by entity-type, with children guessing “real” most often for possible-typical entities (84% of trials), next for possible-atypical entities (27% of trials), and least often for impossible entities (3% of trials). Initial guesses for possible-typical items differed

³This was a higher percentage than in Study 1. In pilot testing we found that almost all children opted to listen first, rather than guess, and we deduced that being able to manipulate the spinner on the computer was too attractive an option for children to resist. Thus, we made efforts to increase the attractiveness of guessing by taking away the option to click the spinner (it was controlled by the experimenter), and by posing the option to guess first using casual wording that made it clear to children that their guess was being made in a context of low pressure to be correct (“In a moment, we'll see what the people on the computer have to say, but before we do, are you thinking it *might* be real or *might* be pretend or are you just not really sure yet?”). In the end, it seems we overcorrected. Additionally, Aguiar, Taylor and Stoess (2012) found that children were particularly likely to think that they knew the answer to forced choice questions versus questions posed in other formats, and that children tended to answer many of the questions themselves rather than assign them to puppets. These both may have contributed to the high percentage of guesses.

significantly from initial guesses for possible-atypical items, $t(306) = 12.17, p < .001$, Cohen's $d = 1.38$, and for impossible items, $t(338) = 26.94, p < .001$, Cohen's $d = 2.85$. Initial guesses for possible-atypical items also differed significantly from initial guesses for impossible items, $t(334) = 6.74, p < .001$, Cohen's $d = 0.71$.

We next assessed the effects of entity-type (possible-typical, possible-atypical, impossible), testimony type (real, not real), and expertise of the informant (expert, non-expert) on children's final reality-status judgments after hearing the testimony. Because our outcome variable was dichotomous, we conducted a binary logistic regression including each of these predictors and their interactions. This analysis revealed that expertise did not significantly contribute to the variance in the dichotomous outcome variable when it was included in the model (Wald = 2.67, $p > .10$). Thus, we averaged the responses across the expert and non-expert trials to yield a new outcome variable that ranged from 0 to 1, with 1 representing "real" judgments. As shown in Figure 2, children judged the possible-typical entities as real most of the time and the impossible entities as not real most of the time. As in Study 1, the greatest effect of testimony appeared to be on the possible-atypical items. Results of an entity-type (possible-typical, possible-atypical, impossible) $\times$ testimony (real, not real) $\times$ age (6 years old, 8 years old) ANOVA confirmed these patterns, revealing significant main effects of both entity-type, $F(2, 96) = 90.27, p < .001, \eta_p^2 = .65$, and testimony, $F(1, 48) = 41.16, p < .001, \eta_p^2 = .46$, which were qualified by a significant interaction between the two, $F(2, 96) = 9.02, p < .001, \eta_p^2 = .16$.

Post-hoc comparisons revealed that for the possible-typical trials children were significantly more likely to claim that an entity was real when they heard testimony that it was real ($M = .85, SD = 0.29$) than when they heard that it was not real ($M = .57, SD = 0.38$), $t(49) = 4.37, p < .001$, Cohen's $d = 0.82$. Similarly, for the possible-atypical trials children were significantly more likely to claim that an entity was real when they heard testimony that it was real ($M = .55, SD = 0.43$) than when they heard that it was not real ($M = .14, SD = 0.27$), $t(49) = 6.47, p < .001$, Cohen's $d = 1.14$. Finally, for the impossible trials there was also a significant difference between responses when children heard testimony that the entity was real ($M = .13, SD = 0.28$) and when they heard that it was not real ($M = .02, SD = 0.10$), $t(49) = 2.53, p = .02$, Cohen's $d = 0.52$. Although testimony significantly affected children's reality status responses for all three entity-types, comparison of effect sizes revealed that testimony had the strongest effect on judgments about possible-atypical entities ($d = 1.14$) while it had a relatively smaller effect on judgments about possible-typical entities ($d = .82$) and the smallest effect for impossible entities ($d = .52$).

Another way to think about these data is in terms of the directional "pull" of testimony away from how children might have responded without it. In other words, which type of testimony, "real" claims or "not real" claims, was doing the work resulting in the different patterns shown in Figure 2?⁴ Although we lack testimony-free information from all participants, we have initial guesses from 81% of the children (represented by the dashed

⁴A similar analysis was not performed in Study 1 because fewer children made an initial guess, and we were thus concerned about the validity of such an analysis.

lines in Figure 2). Thus we can compare final reality-status judgments for each entity-type to the initial guesses for each entity-type.

On trials with possible-typical entities, the mean initial guess that the entity was real was .84 (see Figure 2). When the informant claimed the entity was real, the final reality-status judgment ($M = .85$) was not significantly different from this initial guess, however when the informant claimed the entity was not real, there was a significant difference ($M = .57$), $t(49) = 5.05$, $p < .001$, Cohen's $d = 1.44$. Here it appears that only the “not real” testimony led children to re-evaluate their initial guess. For possible-atypical trials, the mean initial guess was .27; the difference between this and reality-status judgments when the entity was claimed to be real ($M = .55$) was significant, $t(49) = 4.59$, $p < .001$, Cohen's $d = 1.31$, as was the difference between this and when the entity was said to be not real ($M = .14$), $t(49) = 3.43$, $p = .001$, Cohen's $d = 0.98$. For these entities, both types of testimony were powerful. For impossible entities, the mean reality-status guess was .03. When the informant claimed the entity was real, the final reality-status judgment ($M = .13$) was significantly different from this initial guess, $t(49) = 2.51$, $p = .02$, Cohen's $d = 0.72$, however when the informant claimed the entity was not real, final reality-status judgments ($M = .02$), did not differ from the mean initial guess. Here it appears that only the “real” testimony affected children's judgments. The finding that children were not swayed by testimony that a possible-typical entity was *real* nor by testimony that an impossible entity was *not real* may be partially explained by initial beliefs that were near ceiling and floor, respectively. Nonetheless, it appears that children were most susceptible to the “pull” of testimony for possible-atypical entities.

General Discussion

The results of these two studies provide new information about how children navigate an important ontological boundary – that between fantasy and reality. Our goal in conducting these studies was to capture the processes by which children assess reality status upon encountering novel information. Determining the reality status of a novel entity is rarely a simple process; children must weigh evidence (often manufactured, as in the case of common fantasy figures like Santa Claus and the Tooth Fairy), contradictory verbal information (e.g., when their best friend says unicorns are real but their older sibling says they are not), and their own ideas about what is possible and impossible. Our findings begin to illuminate the complex processes by which children utilize multiple sources and forms of information to determine the reality status of novel entities.

On our tasks, in order to determine reality status, children first needed to process the novel information and assess its fit with their understanding of how the world works. They then had to use the product of this evaluation to decide whether to make an initial guess about reality status or to seek more information. Thus children had to perform a fairly difficult metacognitive task. Finally, children had to balance this initial information with the testimony they heard, which varied in terms of whether it was from an expert or a non-expert and whether it supported or refuted the existence of the novel entity. Viewed from this perspective, it might be hard to imagine that any child would ever be able to accurately assess reality status. That they often did is truly a testament to their complex information

processing capacities. Viewing the process in this fashion may also help explain reality-status errors; the fact that these decisions can be so complex may shed some light on the fact that beliefs in cultural fantasy figures such as Santa Claus and the Tooth Fairy often persist into the early elementary school years.

More specifically, our results show that children, by the age of 6, can utilize and coordinate two types of information in making reality-status decisions: (1) the fit between new information and their existing beliefs and (2) the testimony of informants. In both Studies 1 and 2 there were main effects of entity-type, with children most likely to say that possible-typical entities were real, less likely to claim that possible-atypical entities were real, and least likely to respond that impossible entities were real. Thus, children were able to successfully assess the fit between the new information and their existing beliefs to come to a decision about reality status. These findings are in line with previous work on children's reality status decisions about novel entities. As outlined by Woolley and Ghossainy (2014), young children are often skeptical and "tend to assume that a novel entity (is) not real unless given certain information otherwise" (p. 6). They cite research showing that when children encounter novel entities with no or only irrelevant evidence in support of their existence, they rarely tend to claim that these entities exist (Tullos & Woolley, 2009). However when given supportive evidence, or when the entity is encountered in a scientific context (Woolley & Van Reet, 2006), the majority of children claim novel entities are real. In the present study, pairing entities with typical properties resulted in increased claims of existence over pairing entities with atypical or conflicting properties.

Both studies revealed main effects of testimony type as well, with children favoring that of experts over non-experts (Study 1), and appropriately utilizing claims of existence and non-existence (Study 2) in determining reality status. Most importantly, the finding in both studies of significant interactions between information type and testimony indicates that children, by the age of 6, are able to coordinate successfully these two sources of information to arrive at a principled decision. Specifically, children utilized testimony most when new information did not conflict, but was also not representative, of their existing beliefs.

On the surface, our results appear to diverge from Bergstrom et al.'s (2006) prediction that "information that violates early developed principles should trigger at least some search for additional evidence, including evaluation of the sources" (pp. 534–535). Regarding the search for evidence, when children in our study received information about entities whose existence contradicted their beliefs about the world (e.g., a lion that eats nails), they were not inclined to ask for more evidence in the form of testimony; rather they opted to guess the entity's reality status immediately. However there is an important difference between the phenomena Bergstrom and colleagues discuss and our experimental situation. Their arguments primarily center on children learning about religious beings like God and angels, and more specifically, their continued instruction, both explicit and implicit, that these beings exist. Clearly existence claims about these entities violate children's naïve theories, and so children will seek more information and also care more about who provides them with such claims. It is critical in these instances that the informant be an authority figure like a priest or a parent; children presumably would be less likely to believe in angels, for

example, if they only ever heard about them from their younger sibling. In fact, in Study 1, when children received additional evidence in the form of testimony, they were more likely to accept the existence of impossible entities endorsed by experts versus non-experts. It is also possible that our results diverge from the predictions made by Bergstrom et al. because children were expecting some of the entities to be pretend; this may have made it easier for them to categorize them as such without the need for consideration of testimony.

Our studies instead may more closely resemble the first time a child hears about a supernatural or fantastical entity, for example, while reading a book, watching a movie, or in a conversation. In this situation, our data suggest that children will, in most cases, be skeptical of the entity's existence (see Woolley & Ghossainy, 2014, for a similar argument). This is in contrast to popular claims that young children are unthinkingly credulous about such entities (e.g., Dawkins, 1995; Gilbert, 1991). Our data showed a very high degree of skepticism about the impossible entities. Even when encountering possible but atypical novel entities, children guessed only 22 (Study 1) to 24 (Study 2) percent of the time that they were real. After hearing testimony that these entities were indeed real, children still only responded about half the time in favor of their existence. This may reflect the same kind of skepticism children showed toward novel improbable events in Shtulman and Carey's (2007) research. It may require repeated testimony (e.g., as in religious enculturation), or testimony in combination with evidence of some sort (e.g., as in Santa Claus beliefs; Woolley, et al., 2004), to instill belief in impossible entities and improbable events in young children.

Our studies also addressed whether the expertise of the person offering the testimony affected children's beliefs in two types of situations, both of which are common in children's everyday lives. Children are often faced with situations in which people express different beliefs about the real existence of various beings and events, often with varying levels of expertise. Children also often encounter situations in which only one source is available, and in some of these cases expertise is lacking. Research by Vanderbilt et al. (2014) shows that children are more likely to rely on testimony from an accurate over an inaccurate speaker, but will trust the testimony of an inaccurate speaker when that is the only testimony offered to them. Our findings indicate that this is the case for expertise as well. Results from Study 1 show that children are selective and value expert testimony over that of a non-expert when both are available. This finding is consistent with that of Lane and Harris (2015), who found a modest effect of informant expertise on selective trust. In Study 2, however, when children had access to only one source, they were equally receptive to an expert and a non-expert. Expertise is clearly relative, and, when uncertain, any testimony may be better than no testimony. The fact that both informants were adults may also have played a role in their effectiveness. It would be interesting to examine whether children would utilize the testimony of other children to the same degree.

A critical remaining task is to explore the role of uncertainty in children's reactions to and judgments about atypical or improbable entities. We have made the assumption that children were most uncertain when encountering the possible-atypical entities, and that this uncertainty led them to be more receptive to testimony that contradicted their initial beliefs (see Jaswal, 2010 for a similar perspective). In future studies like this one, we plan to solicit

certainty judgments to investigate this question more directly. Regardless of children's initial (and often skeptical) reaction to novel information, the continued presence of support in the form of both direct and indirect testimony (Woolley, Ma, & Lopez-Mobilia, 2011) serves eventually to instill belief in children in a variety of beings, both natural and supernatural. Why some children believe more than others, why some children believe longer than others, and how these beliefs change as children develop are important questions for future research.

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References

- Aguiar NR, Stoess CJ, Taylor M. The development of children's ability to fill the gaps in their knowledge by consulting experts. *Child Development*. 2012; 83:1368–1381. [PubMed: 22616878]
- Baxter, JM., Sabbagh, MA. Poster session presented at the biennial meeting of the Society of Child Development. San Diego, CA: 2005 Oct. Examining young children's changing theories about Santa Claus through parent-child conversations.
- Bergstrom B, Moehlmann B, Boyer P. Extending the testimony problem: Evaluating the truth, scope, and source of cultural information. *Child Development*. 2006; 77:531–538. [PubMed: 16686786]
- Boerger EA, Tullos A, Woolley JD. Return of the Candy Witch: Individual differences in acceptance and stability of belief in a novel fantastical being. *British Journal Of Developmental Psychology*. 2009; 27:953–970. [PubMed: 19994488]
- Bozdogan H. Model selection and Akaike's information criterion (AIC): The general theory and its analytical extensions. *Psychometrika*. 1987; 52:345–370.
- Bunce L, Harris M. "He hasn't got the real toolkit!" Young children's reasoning about real/not-real status. *Developmental psychology*. 2013; 49:1494. [PubMed: 23106843]
- Clément F, Koenig M, Harris P. The ontogenesis of trust. *Mind & Language*. 2004; 19:360–379.
- Danovitch JH, Keil FC. Should you ask a fisherman or a biologist?: Developmental shifts in ways of clustering knowledge. *Child Development*. 2004; 75:918–931. [PubMed: 15144494]
- Dawkins R. Putting away childish things. *Skeptical Inquirer*. 1995 Jan-Feb;:31–36.
- DeLoache, JS., Bloom Pickard, M., LoBue, V. How very young children think about animals. In: McCardle, P., McCune, S., Griffin, J., Maholmes, V., editors. *How animals affect us. Examining the influence of human-animal interaction on child development and human health*. Washington, D. C: American Psychological Association; 2011. p. 85-99.
- Gilbert DT. How mental systems believe. *American Psychologist*. 1991; 46:107–119.
- Gilpin, A., Woolley, JD. Poster presented at the biennial meetings of the Society for Research in Child Development. Seattle, WA: 2013 Apr. Children's use of testimony to determine reality status.
- Harris, PL. *Trusting what you're told: How children learn from others*. Cambridge, MA: The Belknap Press/Harvard University Press; 2012.
- Harris PL, Koenig MA. Trust in testimony: How children learn about science and religion. *Child Development*. 2006; 77:505–524. [PubMed: 16686784]
- Jaswal VK. Believing what you're told: Young children's trust in unexpected testimony about the physical world. *Cognitive psychology*. 2010; 61:248–272. [PubMed: 20650449]

- Koenig MA, Harris PL. The role of social cognition in early trust. *Trends In Cognitive Sciences*. 2005; 9:457–459. [PubMed: 16137918]
- Koenig MA, Jaswal VK. Characterizing children's expectations about expertise and incompetence: Halo or pitchfork effects? *Child Development*. 2011; 82:1634–1647. [PubMed: 21790541]
- Landrum AR, Mills CM. Developing expectations regarding the boundaries of expertise. *Cognition*. 2015; 134:215–231. [PubMed: 25460394]
- Lane JD, Harris PL. The roles of intuition and informants' expertise in children's epistemic trust. *Child Development*. 2015; 86:919–926. [PubMed: 25425347]
- Lee K, Cameron C, Doucette J, Talwar V. Phantoms and fabrications: Young children's detection of implausible lies. *Child Development*. 2002; 73:1688–1702. [PubMed: 12487487]
- Lutz DJ, Keil FC. Early understanding of the division of cognitive labor. *Child Development*. 2002; 73:1073–1084. [PubMed: 12146734]
- Mascaro O, Sperber D. The moral, epistemic, and mindreading components of children's vigilance towards deception. *Cognition*. 2009; 112:367–380. [PubMed: 19540473]
- Prentice NM, Gordon DA. Santa Claus and the Tooth Fairy for the Jewish child and parent. *The Journal Of Genetic Psychology: Research And Theory On Human Development*. 1987; 148:139–151.
- Principe GF, Smith E. The tooth, the whole tooth and nothing but the tooth: How belief in the tooth fairy can engender false memories. *Applied Cognitive Psychology*. 2008; 22:625–642.
- Sharon T, Woolley JD. Do monsters dream? Young children's understanding of the fantasy/reality distinction. *British Journal Of Developmental Psychology*. 2004; 22:293–310.
- Shtulman A, Carey S. Improbable or impossible? How children reason about the possibility of extraordinary events. *Child Development*. 2007; 78:1015–1032. [PubMed: 17517019]
- Sobel DM, Corriveau KH. Children monitor individuals' expertise for word learning. *Child Development*. 2010; 81:669–679. [PubMed: 20438467]
- Sperber D, Clément F, Heintz C, Mascaro O, Mercier H, Origgi G, Wilson D. Epistemic vigilance. *Mind & Language*. 2010; 25:359–393.
- Tullos A, Woolley JD. The development of children's ability to use evidence to infer reality status. *Child Development*. 2009; 80:101–114. [PubMed: 19236395]
- Vanderbilt KE, Heyman GD, Liu D. In the absence of conflicting testimony young children trust inaccurate informants. *Developmental Science*. 2014; 17:443–451. [PubMed: 24444426]
- Woolley JD. Thinking about fantasy: Are children fundamentally different thinkers and believers from adults? *Child Development*. 1997; 68:991–1011. [PubMed: 9418217]
- Woolley JD, Boerger EA, Markman AB. A visit from the Candy Witch: Factors influencing young children's belief in a novel fantastical being. *Developmental Science*. 2004; 7:456–468. [PubMed: 15484594]
- Woolley JD, Ghossainy M. Revisiting the fantasy-reality distinction: Children as naïve skeptics. *Child Development*. 2014; 84:1491–1495.
- Woolley JD, Ma L, Lopez-Mobilia G. Development of the use of conversational cues to assess reality status. *Journal Of Cognition And Development*. 2011; 12:537–555. [PubMed: 22241965]
- Woolley JD, Van Reet J. Effects of context on judgments concerning the reality status of novel entities. *Child Development*. 2006; 77:1778–1793. [PubMed: 17107460]
- Woolley JD, Wellman HM. Young children's understanding of realities, nonrealities, and appearances. *Child Development*. 1990; 61:946–961. [PubMed: 2209198]

Appendix A

Study 1 Protocol

Introduction

“Today you will be playing detective! Here’s how it works. Part of my job at UT is to find the names of animals – real animals – that people have never heard of. When I find one, I

write it on a card, like this (show blank card) and put it in a ‘real animal’ box. Another part of my job is to make up pretend animals. When I make up a pretend animal I write it on a card, and I put it in the ‘not-real’ box. Well, you know what happened? One day, some workers came to move the boxes and they dropped the boxes on the floor. All the cards spilled out, and the piles got all mixed together on the floor! I need your help to help sort the cards back into two boxes, one for real things and one for things that are not in real life. Can you help me?

Luckily, we have two people who can help us today. Here is one person (show picture) – Bob – he is a Zookeeper - he helps take care of animals. Here’s the other person (show picture) -- Chef Peter, he makes food at a restaurant. For each animal we will ask the Zookeeper and the Chef to tell us what they think. Listen carefully to what they say! After you listen you can put the card in the real box or the pretend box.”

Check questions

1. Which box is for real things/ not real things?
2. Who is this person (Zookeeper)? What does he do?
3. Who is this person (Chef)? What does he do?

Warm-up trials

“Before we talk about animals I am going to ask you some questions about what Zookeepers and Chefs might know.”

1. Who would know about how to make a pie (the zookeeper (point) or the chef (point)?

That’s right/Actually, the chef would know how to make a pie.

2. Who would know where polar bears live?

That’s right/Actually, the zookeeper would know where polar bears live.

3. Who would know about how to bake a cake?

That’s right/Actually, the chef would know how to bake a cake

4. Who would know where to find a snake?

That’s right/Actually, the zookeeper would know where to find a snake.

“OK, good, so sometimes Chefs know things, and sometimes Zookeepers know things. The rest of the time today I will ask you about *new* things. Ready to start? I’m going to pull a card out of this bag, and that will tell us which one we’re going to talk about first.”

Test trials

For each trial children are told, “This one is called a X (name of novel animal). A X is kind of like a Y (name of familiar animal). It (property.)”_

Initial Guess question

“Do you want to guess first if it’s real or pretend, or just listen to what the people say?”

If guess, “OK, what’s your guess? Do you think X is real or do you think X is pretend?”

Final Guess question

“OK, what do you think – Is a X real or pretend? Does it go in the box for real animals or for not-real animals?”

Appendix B**Study 2 Protocol****Introduction**

“Today we will be playing a game of detective! We have all these cards here with the names of different animals on them. And we have two boxes here to put the cards in. Some of these animals are real animals and some are not real. We need to figure out where each card should go, in the box for real things, like watermelons, or in the box for things that are not in real life, like dancing carrots.”

Warm-up questions for boxes

Ok, so can you show me which box is for real things?

And which one is for things that are not real?

Ok, in which box would you put “monsters”?

Now, in which box would you put “giraffes”?

In which box would you put “tomatoes that talk”?

In which box would you put “trees that have leaves”?

“In this game you will hear about some animal names that you’ve never heard of before. Then you will hear a clue about what the animal is like. Sometimes you will be able to guess right away if it’s a real animal or just pretend. But other times, you might want to see what somebody else thinks.”

“So, we have two people on the computer who can try to help you. This person is Zookeeper Bob who takes care of animals at a zoo. He knows a lot about animals. This person is Chef John who cooks food at a restaurant. He knows a lot about cooking. During the game, sometimes the Zookeeper will tell us what he thinks, and other times the Chef will tell us we he thinks.”

Warm-up questions for informants

Can you show me which one is the Zookeeper? Good /Actually...

What does he do? That’s right! /Actually...

And which one is the Chef? Good /Actually...

What does he do? That's right! /Actually...

Who would know about how to make a pie? Good /Actually...

Who would know where polar bears live? Good/Actually...

OK, good, so sometimes Chefs know some things, and sometimes Zookeepers know other things. This game will be about *new* things. You will get to hear a clue about each animal and then I will let you guess, if you want, if it's real or pretend. Then you can listen to Zookeeper Bob or Chef John. At the end, you can decide which box to put the animal in, real or not real!

For each animal, this spinner on the screen will show us who will talk to us. Sometimes the spinner points to the Zookeeper and sometimes it points to the Chef.

We never know where the spinner is going to point next!

Ok, now we're ready to play the game. On the computer, we'll see which animal is first, and it will give us a clue about what the animal might be like. I will read what it says about the animal, and then, if you want, you can guess if it's real or not. Then, the Zookeeper or the Chef will tell us whether they think it's real or not real. They might be right or they might be wrong. After we hear what the person thinks, you can decide what box you want to put the card in. Ready to start?"

Test trials

"Ok, here's the next (first) one. This one is called a X (name of novel animal). A X is a kind of Y (name of familiar animal). It (property.)"_

Initial Guess question

"Do you have an idea already about whether it's real or pretend? If you do, you can tell me now. If you don't, then we can listen to the people first. Would you like to guess first or listen first?"

"OK, let's see who we get this time... Looks like we got the X. Remember, it says that X is a kind of Y (name of familiar animal). It (property.)"_

Final Guess question

"Now that we've gotten two clues, where do you think this card should go?"

"Can you explain to me why you picked that box?"

Figure 1.

Study 1: Percent of responses that the entity was real by testimony-type and entity-type.

Error bars represent standard error of the mean.

Figure 2.

Study 2: Mean responses that the entity was real by testimony-type and entity-type. Dashed lines represent the average initial reality-status guess given by the subset of children who decided to guess before testimony. Error bars represent standard error of the mean.

Table 1

Study 1: Entity names and properties by trial-type

Name	Animal	Possible-Typical	Possible-Atypical	Impossible
goulán	monkey	(not used)	lives in snow	eats scotch tape
calak	horse	has a tail	lives in the jungle	climbs trees
jarpat	lion	roars	swims underwater	eats nails
binbad	rabbit	eats carrots	eats bugs	lives in the ocean
wigtip	bird	lives in a nest	eats honey	eats rocks
trakel	elephant	has trunk	(not used)	(not used)

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Table 2

Study 1: Logistic Regression output with reality-status judgment as the outcome (0 = not real; 1 = real)

Predictor	β	SE β	Wald	df	p	e ^{β} (odds ratio)
Constant	-.280	.409	.469	1	.494	.756
Informant (I)	.868	.420	4.265	1	.039	2.382
Entity-type (E)	-1.123	.418	7.218	1	.007	.325
Age	.315	.436	.521	1	.471	1.370
I $\times$ E	.895	.433	4.267	1	.039	2.446
E $\times$ Age	-.813	.384	4.478	1	.034	.443

Table 3

Study 2: Novel entity descriptions by trial-type

Possible-typical ^a	Possible-atypical	Impossible
Fish that lives in the ocean	Fish that is as big as a car	Fish that lives on the moon
Monkey that can climb trees	Monkey that has spots	Monkey that can run through solid walls
Snake that lays eggs	Snake that glows in the dark	Snake that eats lightning
Bird that eats bugs	Bird that has a blue beak	Bird that can become invisible

^aThe following animal names were assigned randomly, by subject, to each novel entity description: bilby, binbad, calak, civet, galah, goulán, jarpat, quokka, takin, tarsier, trakel, wigtip.