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What I don't know won't hurt you: The relation between professed ignorance and later knowledge claims

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Abstract

Testimony is a valuable source of information for young learners, in particular if children maintain vigilance against errors, while still being open to learning from imperfectly knowledgeable sources. We find support for this idea by examining how children evaluate individual speakers who present very different epistemic risks by being previously ignorant or inaccurate. Results across two experiments show that children attribute knowledge to (Experiment 1) and endorse new claims made by (Experiment 2) speakers who previously professed ignorance about familiar object labels, but not speakers whose labels were previously inaccurate. Study 2 further clarifies that children are not simply relying on links between informational access and knowledge; children rejected testimony from a previously inaccurate speaker even when she had perceptual access to support her claim. These results show that children actively monitor the reliability of a speaker's knowledge claims, distinguish unreliable speakers from those who sometimes admit ignorance, raising new questions about how such admissions factor in to children's appraisal of the scope and limits of a person's knowledge.

Keywords

cognitive development; selective trust; testimony; theory of mind; preschool; social learning

Young children's role is to learn, and we are often their teachers. It is critical that children learn from what we say, because adult testimony opens up knowledge beyond what children can directly experience. But despite the clear benefits of trust in testimony, there are also risks. One of the most obvious is the risk of being misinformed, either due to conflicts of interest or the questionable competence of a speaker (Koenig & Stephens, 2014; Lackey, 2008; Sperber et al., 2010). Recent findings indicate that children vigilantly check the content of people's messages for conflicts, and also monitor and track variations in speakers' moral behavior, consensus, and group membership (Hetherington, Hendrickson & Koenig, 2014; Mascaro & Sperber, 2009; Corriveau, Fusaro & Harris, 2009). Thus, children's early capacity for trust seems to be not only selective (letting in new information from reliable sources), but also protective (blocking out information from potentially unreliable ones).

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This raises fundamental questions about the nature of children's learning decisions: To what extent do children's analyses go beyond the surface detection of an error or aberration to detect more subtle but meaningful differences between speakers?

This question becomes especially important to consider as soon as we appreciate that the only sources we have access to as learners are imperfectly knowledgeable sources. None of the speakers we encounter will be omniscient (i.e., all-knowing) nor fully ignorant (i.e., unknowing), raising epistemological and psychological questions about how we evaluate and estimate sources who claim to know certain things, but not others. Here we examine children's epistemic predictions for speakers who have professed their ignorance, and children's epistemic evaluations of ignorant speakers who go on to make a series of knowledge claims. As we discuss below, we investigated (a) whether children make different inferences about professedly ignorant speakers in comparison to inaccurate speakers (those who provide inaccurate labels for a given set of objects), and (b) whether children would predict more ignorance from ignorant speakers initially, but not discount their subsequent professions of knowledge.

Early in development, children demonstrate a basic ability to distinguish agents, including themselves, based on the knowledge they appear to have. By 12 months, infants point more to the location of an object for an adult who is ignorant of its location than for an adult who has knowledge of its exact location (Behne, Liszkowski, Carpenter, & Tomasello, 2012; Liskowski, Carpenter, & Tomasello, 2008; O'Neill, 1996). By 16 months, they use pointing gestures in an interrogative fashion—to elicit information from appropriately knowledgeable sources (Begus & Southgate, 2012; Southgate, van Maanen, & Csibra, 2007). Even 2-year-old children can offer reports of their own knowledge and ignorance, modulate their assertions, and mark their own certainty toward a claim or assertion (Shatz, Wellman & Silber, 1983; Furrow, Moore, Davidge & Chiasson, 1992; Harris, Yank & Cui, in press).

By age 3, children decline to accept claims that enjoy an otherwise high baseline reliability, such as names for objects, when a speaker clarifies their ignorance or uncertainty about their specific claim ("Hmm, I don't really know what this is but I think it is a blicket;" Sabbagh & Baldwin, 2001; Sabbagh & Shafman, 2009; Henderson & Sabbagh, 2010). In paradigms that present two informants who differ consistently in the knowledge they profess, children show systematic preferences for more knowledgeable sources over professedly ignorant sources, and over sources who incorrectly guess but make their uncertainty clear (e.g., "Hmm, I'm not sure. I'll guess it's red"; Mills, Legare, Grant & Landrum, 2011). In work by Mills and colleagues (2011), 3- to 5-year-olds were given the opportunity to actively direct as many questions as they wanted to one of two variably knowledgeable sources. When the number of questions was tallied, children directed more questions to knowledgeable sources over ignorant ones by age 3, and to knowledge sources over plausible but inaccurate guessers by age 5. Indeed, children are generally better at recognizing the more knowledgeable informant in contrast to an ignorant source than an inaccurate one (Koenig & Harris, 2005; Mills et al., 2011). However, note that this evidence does not suggest that children harbor lasting, long-term concerns about ignorant sources (nor that they should). Evidence for children's comparative preferences leaves it unclear how children reason about single informants in isolation, and whether they harbor lasting concerns about sources who profess

ignorance about some things, but later claim to know other things (Birch, Vauthier & Bloom, 2008; Corriveau & Harris, 2009; Henderson, Graham & Schell, 2015; Jaswal & Neely, 2006; Koenig, Clèment & Harris, 2004; Koenig & Harris, 2005; Kushnir, Vredenburgh & Schneider, 2013; Pasquini, Corriveau, Koenig & Harris, 2007; Robinson, Butterfill & Nurmsoo, 2011).

Children's early epistemic practices – their conversational attributions of knowledge and ignorance, their questions about others' knowledge, their selective information-giving and gathering from variably knowledgeable sources – suggests that children have various ways to monitor and mark their own and others' ignorance. Interesting questions concern the specific kinds of inferences children make about speakers who lack knowledge. For example, consider an ignorant speaker who admits to not knowing the names of three common objects, and makes no other claims. If asked to *predict* this speaker's knowledge about two objects in the future, children typically predict that the speaker will again be ignorant (as in Koenig & Harris, 2005). However, if this previously ignorant speaker goes on to *make new claims* about three new things, how will children evaluate these new positive claims? It is not entirely clear. In fact, there are several possibilities for how any speaker's prior ignorance might relate to her current or later claims to know: among these we focus on two, that we term 'agnostic', and 'pessimistic'. On the agnostic possibility, a speaker's prior ignorance bears no relation to the validity of her later claims – for example, your prior ignorance regarding the name of a toy, a fruit or a book may say very little about the validity of your claims regarding a different toy, a different fruit or a different book. On the 'pessimistic' possibility, claims of ignorance call into question the validity of a speaker's future claims – for example, a speaker who doesn't know the words for common objects might raise more general epistemic concerns about the validity of her claims to know other words. Even more extreme examples might raise more general concerns, for example if a speaker lacks basic autobiographical knowledge (e.g., fails to know her own name, country of origin, what she had for breakfast). All told, a speaker's prior ignorance raises interesting questions – not answers – regarding whether doubt is warranted toward their current claims to know.

Evidence for the 'agnostic' possibility

In fact, there is evidence that children do not discount claims made by previously ignorant speakers. For example, Palmquist and Jaswal (2012) presented children with two sources: one who baited one of two containers with an object, while the other closed their eyes during the hiding event. In a baseline condition, when both sources sat with their hands in their laps, children credited knowledge of the object's location to the source who baited the containers. Thus, before any claims were made by either speaker, children predicted that the hiding agent would know where to look for the object. Interestingly, when the two sources went on to make conflicting claims, by simultaneously pointing to different locations, children credited both speakers with knowledge. When someone made a claim to know something – in this case, by pointing, children did not treat her prior ignorance – in this case, her lack of access – as a penalty against her current claim to know. Thus, when previously ignorant speakers make claims to know something, children might not automatically treat their prior ignorance as a basis for mistrust toward their current claims.

Further evidence for the agnostic possibility comes from research that has manipulated agents' informational access, and in line with the evidence above, this work suggests that children are agnostic about the behavior of ignorant agents. For example, Friedman and Petrashek (2009) showed that preschoolers who pass false-belief tasks do not predict that ignorance leads to "getting it wrong." By age 3, children show more suspense when observing an agent approach a situation with a false belief than an ignorant state of mind (Moll, Kane, & McGowan, 2015). Relatedly, Scott and Baillargeon (2013) found that 17-month-old infants expected an agent with a false belief to search the wrong location, but had no such expectations about the search behaviors of an ignorant agent. Thus, early in development, infants and young children may bring an agnostic or open-minded view of the relation between an agent's prior ignorance and her later behavior.

Together, these results suggest that children may make two psychological inferences about speakers: first, that lack of perceptual access can lead to ignorance about the true state of the world, and second, that knowledge claims are not automatically discounted when made by speakers who were seen to be *previously* ignorant or lacking information. So, while a person's access to information informs children's predictions regarding their behavior in a given situation, more information may be required to infer that ignorance is a dispositional state or lasting property of an individual. That is, not having knowledge of something – by itself – does not reveal much about other things a person may know or not know.

Evidence for the 'pessimistic' possibility

However, there is evidence that children may sometimes treat ignorance as signaling a risk for error. First, Krogh-Jespersen and Echols (2012) found that 24-month-olds treated new claims from previously ignorant and inaccurate speakers similarly. In one condition, children accepted novel object labels from both ignorant and inaccurate speakers; and in another condition, they did not accept second labels for familiar objects (e.g., "That's a danu" in reference to a ball) from either one. Thus, at least for 24-month-olds, a child's prior lexical knowledge appeared to be an important factor in these decisions, and if they already had a name registered for an object in their vocabulary, that lexical knowledge supported their uncertainty toward new terms from both inaccurate and ignorant sources. Second, several studies (Tenney et al, 2011; Bridgers et al, in press; Brosseau-Liard, Cassels, Birch, 2014; Kominsky, Langthorne, & Keil, 2015) show that young children show difficulty, relative to older children and adults, in rejecting information from confident but inaccurate sources, and in accepting information from uncertain but accurate ones. For instance, Kominsky and colleagues (2015) posed a set of difficult questions (i.e., regarding the exact number of blades of grass that sprouted in New York last year) to implausibly confident informants who claimed to know these facts, and to virtuously ignorant informants who said, "I don't know because it's not possible to answer that question precisely". Children from kindergarten to second grade favored the implausibly confident informants, while fourth graders and adults rejected such sources and credited more knowledge to the ignorant source. Such findings suggest a possible trajectory for this developing understanding: perhaps as toddlers, children begin by treating all forms of ignorance and uncertainty equally, and initially rely on their own knowledge (for example, of whether objects do or don't already have a label) to accept or reject claims (Krogh-Jespersen & Echols, 2012;

Sobel & Kushnir, 2013). With more experience, and developments in understanding the ways in which people signal their variable states of knowledge, they come to appreciate the circumstances and kinds of claims for which ignorance can signal epistemic caution, humility and even expertise.

Given these considerations, we examined whether 3- and 4-year-old children – older than the toddlers discussed above, but still much younger than the school-age children who show a more subtle understanding of ignorance – distinguish and learn differently from speakers who profess their ignorance and those who prove consistently inaccurate. A source who professes her ignorance about certain things (a) does not claim to know, (b) is specific about what she doesn't know; and (c) certainly does not make any false claims. Thus, ignorant speakers are making explicit their epistemic limits, and in doing so, their professions of ignorance clarify that deception is not likely to be their problem, nor are inaccurate beliefs. By professing their ignorance, ignorant speakers make no unreliable claims to knowledge, and do not present information that conflicts with reality or the child's own knowledge. Inaccurate speakers, on the other hand, claim to know things when they clearly do not, present direct evidence against the reliability of their claims, and thereby call into question their subsequent reliability. If children are optimizing opportunities to learn while minimizing risks in their decisions to trust, they may treat prior inaccuracy as a risk for error but not penalize claims made by previously ignorant speakers.

We investigated these questions in the current study, using a single-speaker, between-subjects design. This design begins with a history phase in which an individual speaker behaves in a consistent manner toward three familiar objects, then moves to a test phase in which children are first asked *to predict* what the speaker will know about a new but similar set of objects *before claims are made*, and second, *to endorse claims or attribute knowledge* to speakers *after claims have been made*. In Experiment 1, children were assigned to either Accurate, Ignorant or Inaccurate conditions; and in Experiment 2, children were assigned to either an Ignorant or Inaccurate condition. Thus, children were presented with only one speaker to consider throughout the experiment, depending on condition. Given our interest in whether children would make different inferences about professions of ignorance in comparison to blatant unreliability, our focal comparisons concern children's evaluations in the Ignorance and Inaccurate conditions across both experiments.

In the history phase, children saw a single speaker with a series of three familiar objects (i.e., ball, cup, book). She labeled these objects accurately in the Accurate condition (Experiment 1 only), inaccurately in the Inaccurate condition, or professed her ignorance, "I don't know what that's called," in the Ignorant condition (Experiments 1 and 2). To examine whether children favor agnostic or pessimistic relations between prior ignorance and later claims, we assessed the relations between children's predictions *before* claims were made, and their endorsements and knowledge attributions to speakers *after* claims were made. To assess these relations, we first measured children's *predictions* regarding speakers' knowledge of a new set of familiar object labels before new testimonial claims were made. Given the history phase in which neither the ignorant and inaccurate informant provided accurate labels for familiar objects, children have no reason to expect that either agent will know other familiar object labels. In contrast, the history phase should lead them to expect further accuracy from

the accurate informant. Second, upon receiving a set of positive, novel claims from each speaker (e.g., regarding novel object names, functions, and causal properties), we measured whether children would *attribute knowledge* to the source (e.g., "Does she know what this is called?" in Experiment 1) and whether children would *endorse* the claims made by the source (e.g., "What is this called?" in Experiment 2). If ignorance warrants pessimism toward later claims, we expect *predictions of further ignorance* from ignorant speakers before they make claims, *and low levels of endorsements* of their later knowledge claims. However, if ignorance does not count against a speaker's later claims, we expect *predictions of ignorance* before claims are made, *coupled with high rates of endorsements* toward their later knowledge claims.

Experiment 1

Method

Participants—Forty-six preschoolers (M = 4 years, 4 months, SD = 4.0 months, Range = 3 years, 8 months – 4 years, 11 months) were recruited as a convenience sample from local preschools in a small, university town. They were predominantly non-Hispanic white and middle-class. Three additional children were excluded from the sample; one for non-compliance, two for being non-native English speakers. The stopping rule was 16 per condition, but changed due to exclusions and mis-assignments.

Procedure—Children were randomly assigned to the Accurate (N=18), Inaccurate (N=14) or Ignorant (N=14) condition. Due to exclusions and assignments, the sample fell just short of stopping rules of 16 per condition. Events were presented on a laptop computer placed on a small table between the child and experimenter.

History phase: Children were told they were going to play a game called "What does Elaine know." They watched a video with Elaine and a confederate sitting at a table. For each of three common objects (ball, book, cup), the confederate held the object saying, "Look what I have! Do you know what that is called?" Depending on condition, Elaine labeled it accurately ("I know what that is. That's a ball/book/cup"), inaccurately ("I know what that is. That's a chair/shoe/telephone") or professed ignorance about its label ("I don't know what that is called").

Knowledge questions: After the history phase, the experimenter introduced the knowledge questions, described below, by saying "I'm going to ask you about some other things Elaine might know." No feedback was provided, and child's first response was recorded.

Familiar Label Predicions: Children were shown pictures, one at a time, of a banana, a hammer and a dog, counterbalanced. As they saw each picture, the experimenter asked, "Do you think Elaine knows what this is called?"

Novel Label/Function/Property Knowledge Endorsements: We included three types of knowledge claims – object labels, object functions, and object causal properties, all of which enjoy high base rates of reliability and are relatively common in prior studies of testimonial learning (see Mills, 2013; Sobel & Kushnir, 2013 for reviews). Children saw three videos of

Elaine and the confederate sitting at the table (counterbalanced). Items for the label and function questions were a lint brush and a martini strainer, counterbalanced across participants. The function of the lint brush was "washing the table" and the function of the martini strainer was "blowing bubbles." Elaine stated the function accompanied by the appropriate action for the use of that object.

Novel Label: The confederate asked Elaine what an unfamiliar object (e.g. the martini strainer) was called. Elaine stated: "I know what that is. That's a Dax." The experimenter then asked the child: "Does Elaine know what this is called?"

Novel Function: The confederate asked Elaine about the function of the other novel object (e.g. the lint brush). She stated and performed its function (e.g. "I know what that is for. That's for washing the table.") The experimenter asked: "Does Elaine know what this is for?"

Novel Property: The confederate asked Elaine which of two objects would have the causal property of activating a toy "detector." Elaine pointed to one object (side counterbalanced) stating, "This one makes the toy go." The experimenter then asked: "Which one makes the toy go?"

Results

There were no effects of question type or order on children's responses, thus we summed the number of endorsements ("Yes" or analogous responses) to a score between 0 and 3 for each set. A 2 (Question Set: Familiar, *Novel*) × 3 (Speaker: Accurate, Inaccurate, Ignorant) Repeated Measures ANOVA revealed a main effect of Speaker ($F(2, 43)=23.50$, $p<.001$, Partial $\eta^2=.52$) and a main effect of Question Set ($F(1,43)=7.12$, $p=.011$, Partial $\eta^2=.14$) and a significant interaction ($F(1,43)=4.56$, $p=.016$, Partial $\eta^2=.17$). The results are shown in Figure 1 below.

The nature of the interaction is revealed by follow-up comparisons between speakers, as well as comparisons to chance (1.5/3, or 50% endorsement). As expected, children who saw the Accurate speaker predicted her knowledge of Familiar Labels at higher rates than those who saw the inaccurate ($t(30) = 6.94$, $p<.001$, Cohen's $d=2.53$) or ignorant ($t(30)=4.43$, $p<.001$, Cohen's $d=1.62$) speaker. Children also endorsed the accurate speakers' knowledge of Familiar Object Labels at rates higher than chance (M=2.78; $t(17) = 9.88$, $p<.001$ Cohen's $d=.67$), the inaccurate speakers' knowledge at rates below chance (M= .79; $t(13) = -2.54$, $p=.025$ Cohen's $d=.22$) and the ignorant speaker at chance (M= 1.36; $t(13) = -.44$, *ns*) and not differently from the inaccurate speaker ($t(26)$, 1.33, *ns*).

These results suggest that, in the absence of further information from the speaker, children predicted her knowledge of other familiar object labels based on their history. Pairwise comparisons show that children credited familiar label knowledge to the Accurate speaker more than the Inaccurate speaker ($t(30) = 4.62$, $p<.001$, Cohen's $d=1.69$) but credited familiar label knowledge to the inaccurate and ignorant speakers claims at equal rates ($t(30) = .65$, *ns*). This pattern shifts, however, after hearing speakers' claims about novel objects. Critically, children were more likely to endorse novel object claims from the ignorant

speaker than the inaccurate one ($t(26)=3.39$, $p=.002$ Cohen's $d=1.32$). Children also endorsed both accurate and ignorant speakers' claims at rates higher than chance (Accurate condition: M=2.67; $t(17) = 8.33$, $p<.001$, Cohen's $d=.64$; Ignorant condition: M=2.50; $t(13) = 4.38$, $p=.001$ Cohen's $d=.69$) but not so for the previously inaccurate speaker (M=1.14; $t(13) = -1.09$, *ns*).

Experiment 2

Experiment 1 shows that, after hearing new testimonial claims from a previously ignorant speaker, children endorsed her knowledge about those claims. After hearing new claims from a previously inaccurate speaker, however, children denied that she had knowledge. Thus, children are neither at risk of discounting potentially useful testimony from people who admit that they are ignorant, nor are they at risk of trusting an inaccurate speaker's claims, even when they are stated with confidence.

In Experiment 2, we put this to a more stringent test. We used the same basic design with a few changes. First, we made a minor, but important, change to the test question. Instead of asking children to endorse Elaine's claims by endorsing her knowledge (e.g. "Does she know what this is called?") we asked children to endorse her claims directly ("What is this called?"). Replicating our results with these questions would provide a stronger test of our main question since in the Ignorant condition, it would confirm that children are willing to endorse the content of Elaine's claims. Additionally, in the Inaccurate condition, it would require children to reject the content of Elaine's claims, even when they have no alternative information to draw upon (e.g. no label they can endorse instead). It would go a step further in establishing whether children will learn new things from previously ignorant, but not from previously inaccurate, speakers.

The second main change was to include an additional case in which the speaker had visual access to the location of a hidden object, and made a testimonial claim as to its location. These hidden object location trials serve two purposes. First, unlike claims about labels, functions, and object properties, claims about object locations rely mainly on relevant perceptual access, which we held constant across conditions. If, as suggested by past research (Brosseau-Liard & Birch, 2011; Koenig & Stephens, 2015) access equalizes the playing field and leads children to rely less on a speaker's past history of accurate or inaccurate testimony, there should be no difference found among speakers. But, if children treat evidence of ignorance differently than evidence of inaccuracy then they should trust the ignorant informant, but continue to show lack of trust for the inaccurate one, even when both have equal perceptual access.

This second change had further methodological advantages. In our single-speaker paradigm, the only recourse on Novel Label and Novel Function trials for children who were inclined to reject claims was to say, "No," "I don't know," or stay silent (we included a yes/no follow up question in these cases). But the Hidden Object Location trials had two response choices (two boxes, different colors), which afforded children who were inclined to reject the speaker's claims an opportunity to respond by endorsing the alternative location. This was

particularly useful for interpreting responses in the Inaccurate condition, where we predicted that many children would be inclined to reject the speaker's claims to know.

Method

Participants—Thirty-two predominantly non-Hispanic white and middle-class preschoolers (M = 4 years 3 months, SD = 4.7 months, Range = 3 years, 8 months – 5 years) were recruited as a convenience sample, based on a stopping rule of 16 per condition. No additional children were excluded from the sample.

Procedure—Children were randomly assigned to the Inaccurate (N=16) or Ignorant (N=16) condition. The set up and history phase were identical to Experiment 1. After the history phase, two familiar object predictions were again presented first, followed by 6 novel claims.

Familiar Object Predictions: Children saw two familiar objects, a banana and a dog, counterbalanced. They were asked to predict Elaine's knowledge, as in Experiment 1, "Do you think Elaine knows what this is called?".

Novel label, novel function, and hidden object location endorsements: Children saw videos counterbalanced in two sets of three (one label, function, and location question in each set, two total of each).

Novel Label and Novel Function: For the label questions, the objects were an avocado peeler and a round bristled sponge with a knobby handle. For the object functions, the objects were the the lint brush for "cleaning" and the martini strainer for "blowing bubbles" used in Experiment 1. The the test question asked children to endorse Elaine's claims directly (e.g. What is this called/for?). Children were coded as endorsing Elaine if they produced the same label or function. They were coded as rejecting Elaine's claims if they did not. For children who did not respond spontaneously, the Experimenter followed up with a yes/no question about Elaine's knowledge (as in Experiment 1). Only one child in the Ignorant condition had to be prompted in this way and only on one (Novel Label) trial. The remainder of the prompts occurred in the Inaccurate condition after a lengthy silence with no response. All but three children needed prompting in this way at least once. We coded silence followed by a "no" response as non-endorsement (most cases), and silence followed by a "yes" response as endorsement (one child on one trial).

Hidden Object Locations: The table was set with two colored boxes, one to the right and one to the left of Elaine. The confederate showed Elaine a toy and then put up a screen in front of the two boxes so they were hidden from the child but visible to Elaine. After removing the screen, the confederate asked, "Where is the toy?" Elaine stated, "It's in the [blue] box" (side counterbalanced) with her eyes centered towards the camera. The experimenter then asked the child, "Where is the toy?" Children's points to the stated location were coded as endorsements of Elaine's claims. No prompts were necessary on Hidden Object Location trials in either condition, as all children responded either by stating the name of the color of box or pointing to one box or the other.

Results

There were no effects of order or individual items within Question Type, therefore we summed endorsements of Elaine's knowledge to a score between 0 and 2 for each Question Type. A 4 (Question Type: Familiar Object /Novel Label/Novel Function/Hidden Object Location) X 2 (Condition: Inaccurate, Ignorant) Repeated Measures ANOVA revealed a main effect of Condition (F (1, 30)=61.71, p<.001, Partial η^2=.67) and an interaction between Condition and Question Type (F(3,90)=4.01, p=.01, Partial η^2=.12).

The results are shown in Figure 2. Replicating Experiment 1, children's predictions about familiar object knowledge were similar regardless of whether the informant was ignorant or inaccurate (*Mann Whitney U* = 93.5, *ns*). As before, there was a difference between conditions after hearing claims about novel labels and functions; children's endorsements were significantly higher for the ignorant than the inaccurate speakers new claims for both Novel Labels (*Mann Whitney U* = 16.0, p<.001) and Novel Functions (*Mann Whitney U* = 28.5, p<.001). They were also above chance for the ignorant informant (Novel Labels: 16/16 on both trials, binomial tests p<.001; Novel Functions, 15/16 and 16/16 respectively, binomial tests p<.001). Endorsements of the inaccurate informant were at or below chance for Novel Labels (2/16 for "toma," binomial test p=.002, and 7/16 for "mido," binomial *ns*) and the combined distribution was significantly different from chance, tending towards non-endorsement (2 children endorsed both labels, 5 endorsed one, 9 did not endorse either; $\chi^2(2) = 8.38$, p=.015). Endorsements of the inaccurate informant were at or below chance for Novel Functions (2/16 for "blowing bubbles," binomial test p=.002, and 9/16 for "cleaning," binomial *ns*) and the combined distribution was not different from chance (3 children endorsed both functions, 6 endorsed one, 7 did not endorse either; $\chi^2(2) = 3.93$, *ns*).

When informational access was held constant, children endorsed the ignorant informants' claims of hidden object locations more often than those of the inaccurate informant (*Mann Whitney U* = 51.0, p=.001) and at above chance levels (14/16 endorsed her location on both trials, 2/16 endorsed the opposite location on both trials, binomial tests, p=.002). Responses in the inaccurate condition were at chance for each trial (5/16 and 6/16 respectively, binomial tests *ns*). Interestingly, the pattern across both trials suggests that children were inclined to consistently prefer the opposite location; 9/16 children who heard an inaccurate speaker guessed that the object was hidden in the opposite location from where she claimed it to be on both trials, 3 did so on at least one trial, at 4 endorsed her location both times ($\chi^2(2) = 9.35$, p=.009).

General Discussion

The potential of testimonial learning rests in learners' ability to selectively filter erroneous or misleading claims, while not missing opportunities to learn from people who are well-intentioned but not perfectly knowledgeable. Here we add to a growing body of evidence that children realize this potential through their active appraisal of other's claims to knowledge. Across 2 studies, we found that preschool children treated professions of ignorance differently than inaccurate claims. Based on the speaker's prior histories, children predicted that both the previously ignorant and previously inaccurate speaker would not

necessarily have knowledge of more common object names. However, after hearing each speaker confidently make a set of new claims, children endorsed the knowledge (Experiment 1) and claims (Experiment 2) of the previously ignorant speaker but not the previously inaccurate one. Experiment 2 clarified that children were not simply relying on links between informational access and knowledge; they rejected testimony from a previously inaccurate speaker even when she had the requisite perceptual access to support her claim. These results together demonstrate that while preschoolers anticipate knowledge differences in line with past behavior, children also appreciate the differential significance of professed ignorance and prior inaccuracy when evaluating a speaker's subsequent claims.

More specifically, the results suggest that at least by preschool age children do not automatically bring a pessimistic view to ignorant speakers. If that were so, we would have expected to see similar treatment given to both the previously ignorant and inaccurate speakers (i.e., rejecting information from both), and distinct from the patternof acceptance given to claims made by the accurate speaker. We would also have seen children's endorsements and knowledge attributions to the ignorant speaker fall in line with their modest predictions for her. However, in contrast, we found that children were as willing to endorse claims made by the professedly ignorant speaker as they were the accurate speaker. After predicting that the Ignorant speaker would not likely know new things, children didn't penalize her by discounting her later claims to know. Thus, children attribute knowledge to, and learn from, people who have never shown evidence of being accurate, and who plainly admit to gaps in their knowledge. Furthermore, children were consistently unwilling to endorse an inaccurate speaker's claims, whether they were claims to know labels, functions, or even claims about locations of objects based on her perceptual access to information.

These findings clarify the nature of children's selective preferences for knowledgeable over ignorant speakers in standard two-speaker tasks of selective learning (Koenig & Harris, 2005). On prior accounts, children's early and robust preference for accurate over both inaccurate and ignorant informants was taken to suggest that children treat both inaccurate and ignorant sources as "unreliable" (p. 1274). However, the current findings clarify that children bring quite different interpretations to ignorant and inaccurate sources, and help specify children's *comparative* preference for more knowledgeable sources: Three- and four-year children would rather endorse knowledge claims from someone who has a clear record of making true claims over someone whose record is unclear (e.g., the ignorant), or who has a clear record of unreliability (e.g., the inaccurate). But when considered independently, ignorant speakers are not treated as 'unreliable models' when they claim to know something, whereas inaccurate speakers are indeed unreliable informants.

Our findings lend support to the idea that children make fairly nuanced judgments about the potential risks that speakers present. This is in line with new work showing that children discredit those who withhold or provide less than complete information (Bonawitz, Shafto, Gweon, Goodman, Spelke & Shulz, 2010; Dunfield, Kuhlmeier & Murphy, 2013; Gweon, Pelton, Konopka, & Schulz, 2014; Katsos & Bishop, 2011). In work by Gweon and collegues (2014), when children found that a toy afforded four functions, and then watched a teacher demonstrate only one of those functions to a nearby student, they rated that teacher as less helpful and less worthy of trust in the future than one who demonstrated a single

function for a single-function toy. This work on willful withholding, and "sins of omission" clarifies that children make inferences about sources of information based not only on what speakers say, but on what they do not say. In light of the current research, it also implies that in certain contexts people who willfully withhold information may be seen as problematic or uncooperative; however, if your omission is explained by your professed ignorance, you may not be so discredited.

In further support of this idea, prior work shows that occasional admissions of ignorance in one domain, in particular when followed by demonstrations of knowledge or skill in another, are also not treated by preschoolers as markers of unreliability or other problems. Rather, in this context, admissions of ignorance may provide a useful signal to the boundaries of a person's knowledge and expertise (Keil, 2010; Lutz & Keil, 2002; Kushnir et al, 2013; Sobel & Kushnir, 2013). Our current findings suggest an interesting extension of this work: Children may be able to infer domain-specific lack of expertise from evidence that admissions of ignorance "cluster" in a domain familiar to the child. For example, children may take admissions of ignorance in one domain as evidence that a speaker lacks knowledge of that local domain but not others, and visa versa. Further studies are needed to examine how children place boundaries in their assessments of others' ignorance.

Our findings combined with prior work also point to a possible trajectory for these developments. Perhaps initially, toddlers (Krogh-Jespersen & Echols, 2012) are uncertain about information from ignorant sources. Their capacity to doubt information relies on being able to apply their own prior lexical knowledge to their claims. When the objects are novel, they trust both informants, and when the objects are familiar, they doubt both. As we found in our familiar object prediction trials, 3- and 4-year-olds were agnostic about ignorant speakers given no affirmative claims to know, but were willing to accept new claims from ignorant speakers (but no new claims from previously inaccurate ones). After 5 years of age, children begin to distinguish between knowable and unknowable *topics*, and only later give credit to those who appropriately claim ignorance about difficult topics, distinguishing well-calibrated uncertain speakers from badly calibrated confident ones (Kominsky et al, 2015; Tenney et al, 2011). It may be that a good deal of exposure to knowledge as it is expressed across agents is required to support children's understanding that certain types of knowledge are implausible (Kominsky et al., 2015), as are certain types of ignorance.

In turn, the current findings may present a more general theoretical opportunity. As listeners, what informs our judgments about whether a previously ignorant speaker should be mistrusted is a set of background metacognitive assumptions that frame our observations of particular instances of ignorance, and that generate inferences toward later claims that we observe. Without that background information – a metacognitive account or theory about the kinds of things people know and how they know them – ignorance by itself does not provide listeners with reason to doubt speakers when they do claim to know something. If this is right, then future work that presents different types of ignorance to young children, and clarifies the conditions under which ignorance licenses mistrust and those that do not, will inform the nature of children's background metacognitive theory.

We would caution, however, that our results do not warrant a conclusion that all ignorance is (or should be) considered unproblematic. As alluded to previously, there may be a broader set of considerations that children (or adult) listeners take into account when deciding whether to trust subsequent information from ignorant sources. These considerations include (a) what a listener is being asked to assess; (b) the nature of the speaker's prior ignorance, and (b) the current claims being made. As discussed, the ignorant speaker who claims to not know her own name, or what she had for breakfast, or the names of her children raises concerns (to our ears) about her competence generally, her memory more specifically, and perhaps her mental well-being. And in such cases, because the professed ignorance violates certain expectation of what agents should know (or should not *not* know), we might doubt her subsequent claims, especially further autobiographical ones. Or consider a speaker who is presented with two pictures, of a ball and shoe, and is asked to point to the ball. Professing ignorance in response to a recognition question like this might raise more serious concerns about the speaker, than one who failed to recall a name for something (as in the current study). In general, future studies that asked children to consider various forms of ignorance will help clarify the conditions under which claims are discounted, and the kinds of metacognitive inferences about others' perception, memory and reasoning that might lead to such penalties.

Given our variable and constantly changing epistemic limits as human speakers, and given that no one can claim to know all things nor nothing, the best sources among us are those who calibrate – and who calibrate well. In fact, the more a source carefully clarifies all that they are uncertain about, the more reasonable it becomes reasonable to think their own epistemic criterion for claiming to know something is exceptionally high, leading listeners to trust them even more than those who modulate their assertions less regularly. As adults we have in our repertoire an additional "protective" view of ignorance, different from a pessimistic or agnostic one, in which we consider certain claims of ignorance as signaling a speaker's appropriate caution. Extant evidence does not indicate that preschoolers have this protective view. Because we found no evidence for *higher* acceptance rates toward ignorant speakers than accurate speakers, we are not claiming that in our study children interpreted ignorance as a sign of a virtuous or well-calibrated speaker. But this does not deny the possibility that in some instances, even younger children may in fact do so (although see Tenney et al, 2011 for an opposing view).

A strength of single-speaker paradigms is that it allows us to see how children evaluate singular claims from various informants. While this method clarifies children's ability to reject singular statements from inaccurate sources, it leaves open what children would do if they were given an 'opt-out' option in the form of a neutral alternative. For example, after familiarizing children with an Ignorant speaker, a test phase that presented the same Ignorant speaker along with a new Neutral informant would indicate how far children would keep preferring the Ignorant source over a randomly sampled, neutral person. If children would discredit the ignorant speaker if they had an alternative, they may prefer to select any neutral source over the previously ignorant one. If they bring an agnostic view, they might be equally willing to endorse either source. On the other hand, if they bring a protective or virtuous view to the ignorant source, they may persist in selecting her over the alternative.

Thus, our understanding of children's interpretation of ignorant sources would benefit from methods that combine single-speaker with dual-speaker methods.

At equal doses of ignorance and inaccuracy, children may treat ignorance as more of a *situational* constraint on testimony, a constraint that places limits on what someone will likely claim to know. In contrast, inaccurate speakers – when their errors cannot be explained by limitations in access, their knowledge of English or playful intentions – invite attributions of character, or *dispositional* inferences of incompetence (Stephens & Koenig, 2015). Admissions of ignorance may mark more temporary or situational differences in speaker knowledge that serve to clarify epistemic differences regarding the current topic being discussed (Lee & Cameron, 2000; O'Neill, 1996; Sabbagh & Baldwin, 2001), and that signal uncertainty without violating basic agreements between speakers and listeners that communication be relevant and cooperative (Grice, 1975; Wilson & Sperber, 2002). The conditions under which children entertain dispositional versus situational explanations for inaccuracy and ignorance, and how flexibly they do so in different contexts, characterize central questions for models of testimonial learning.

The evidence presented here has relevance to situations common in children's everyday lives: encounters with adults who want to provide good information but sometimes lack knowledge. Individual children's experiences with such adults may vary; some may admit ignorance, but others may attempt to provide information anyway, with or without cues that signal uncertainty in their claims to know. Repeated experience with the testimonial claims of familiar caregivers, teachers, and other adults presumably enable children to make lasting inferences about the epistemic gains of seeking information from these sources. If professed ignorance is not problematic for young children in short-term encounters, this raises questions about how professed ignorance functions in the context of long-term relationships. Children often have a choice to actively seek testimony, to explore and observe independently of social influences, or to integrate or test testimony in light of other types of evidence. It is perhaps for this reason that there is a lot to be gained from simple admissions of ignorance or uncertainty. In the right circumstances, it does not signal epistemic problems, and it may invite and motivate children to discover the answers in other ways.

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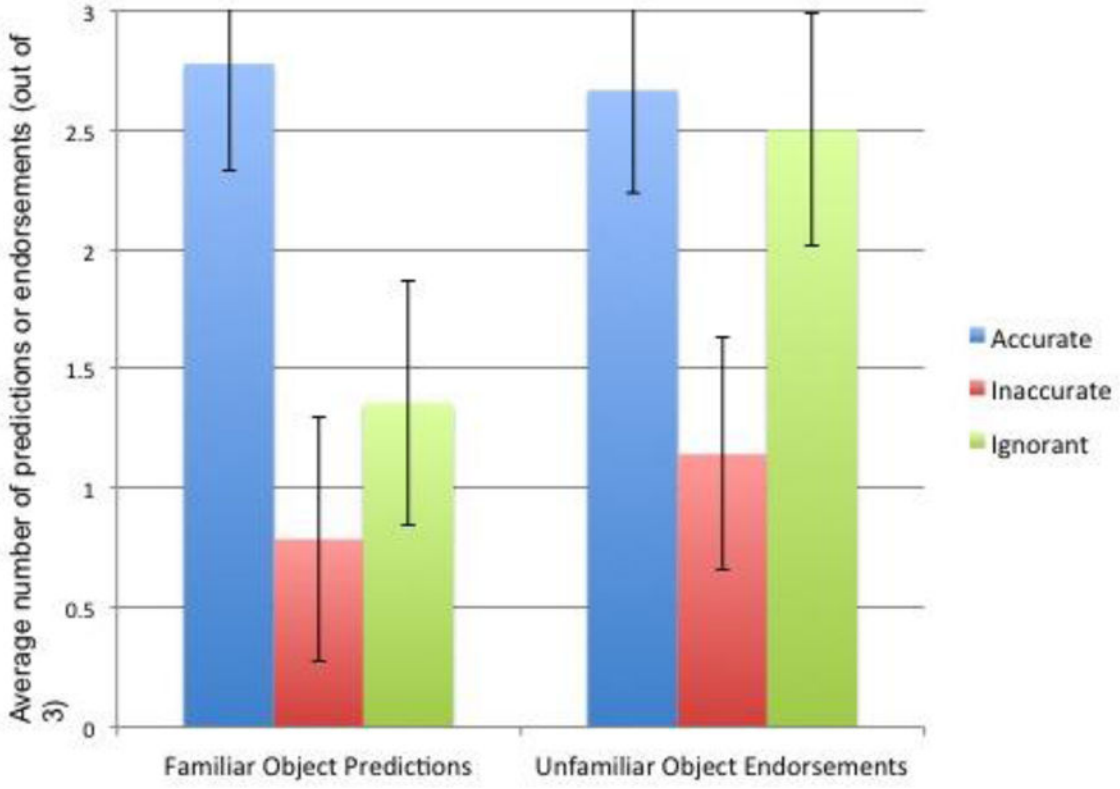

Figure 1.

Average number of predictions or endorsements (out of 3) for each type of question in Experiment 1. Bars represent 95% confidence intervals.

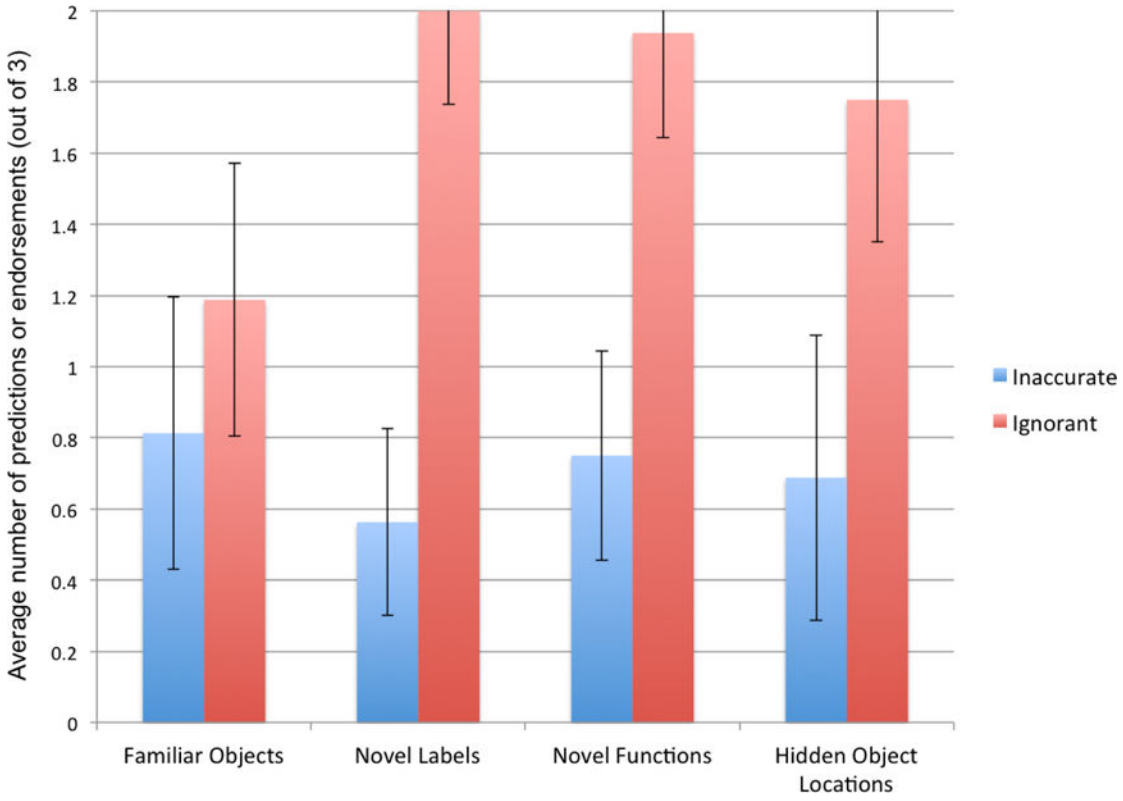

Figure 2.

Average number of predictions or endorsements (out of 2) for each type of question in Experiment 2. Bars represent 95% confidence intervals.