Preschoolers’ Theory of Mind Knowledge Influences whom They Trust about Others’ Theories of Mind

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Abstract (Word Count = 153)

Two experiments examined whether particular aspects of social cognitive knowledge predicted how preschoolers would treat informants who displayed a more or less developed understanding of that knowledge. In Experiment 1, children’s own success on false belief measures correlated with the extent to which they endorsed information generated by a confederate with a more developed sense of false belief over a confederate with a less developed sense of false belief. In Experiment 2, preschoolers were assessed for whether they possessed a more action based or mental state based understanding of pretense. They were then presented with informants who displayed each kind of knowledge. Children’s own knowledge again correlated with which informant they believed was a reliable source of knowledge about novel pretend actions. These results not only extend findings in the “trust in testimony” literature beyond word learning, but also potentially reveal another mechanism by which children learn from others – they might trust others’ information about a specific piece of knowledge based on examination of their own knowledge of that domain.

Keywords: testimony, trust, theory of mind, preschoolers
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A significant number of studies now show that children are not wholly credulous of information garnered from others. Children as young as 2 are capable of selecting appropriate sources by tracking speakers’ history of past accuracy (e.g., Clement, Koenig & Harris, 2004; Koenig, Clement, & Harris, 2004; Koenig & Harris, 2005; Koenig & Woodward, 2010). Young children are also sensitive to informants’ expertise (Koenig & Jaswal, 2011; Sobel & Corriveau, 2010), informants’ confidence (Sabbagh & Baldwin, 2001), how familiar the informant is (Corriveau & Harris, 2009), whether the informant is their age or in their social group (e.g., Jaswal & Neely, 2006; Kinzler, Corriveau, & Harris, 2011), and whether there is consensus among informants (Corriveau & Harris, 2010). Such judicious skepticism can affect language development (e.g., Koenig & Harris, 2005) and learning in various domains involving unobservable events (e.g., Harris & Koenig, 2006; Harris, Pasquini, Duke, Asscher, & Pons, 2006). Some have argued that this selectivity is primarily responsible for children’s rapid and veridical cultural learning (e.g., Bergstrom, Moehlmann, & Boyer, 2006; Mascaro & Sperber, 2009).

It is clear children have a robust toolbox from which to draw when faced with situations in which they must judge whether to accept another’s testimony. To use many of these tools, however, children must employ their existing knowledge (e.g., Lee, Cameron, Doucette & Talwar, 2002). Often when children calculate an informant’s accuracy, there are clear right and wrong answers. For example, in Koenig et al.’s (2004) original procedure (and many others), children see a set of known objects and two informants, one who generates appropriate labels for
each object (i.e., calls a duck a ‘duck’) and one who generates a clearly inappropriate label (i.e.,
calls the same duck a ‘cup’). These experiments depend on the participant knowing the labels of
the familiar objects to establish the informants’ different levels of accuracy.

While the conventional labels of certain objects might be well-known to preschoolers,
many other pieces of knowledge are still developing. Such knowledge could be the basis of
evaluating an informant’s prior accuracy. For instance, adults tend to have more general
knowledge than young children; thus, as long as a child believes that adults generally know more
than children, s/he should think that an adult is a more reliable source of knowledge, all other
things (e.g., history of accuracy) being equal. As children’s beliefs change, their ability to assess
others as sources of knowledge changes (Fitneva, 2010). For example, when a child realizes that
children have more access to certain pieces of knowledge than adults (e.g., about toys), they
deem children more reliable in those domains (VanderBorght & Jaswal, 2009). Thus, it is
reasonable to expect that as children’s knowledge, which is used to establish accuracy, changes,
their judgments of others’ accuracy should change as well.

In this paper, this claim is explored through two well-known developments in children’s
social cognition: their false belief knowledge and their understanding of pretense. Many studies
demonstrate that children’s understanding of false belief develops between the ages of 3 and 4,
from one in which the child cannot dissociate his/her belief state from the actual state of the
world to one in which children can represent beliefs that are different from reality (e.g., Perner,
1991; Wellman, 1990; Wellman, Cross, & Watson, 2001). Between the ages of 3 and 6, children
move from an understanding of pretense as action based to one that involves specific
understanding of the interrelation among pretense and other mental states (e.g., Lillard, 2001;
Richert & Lillard, 2002).
TRUST ABOUT THEORY OF MIND

The goal of the present investigation is not to consider whether children’s developing social cognitive knowledge affects their trust in others’ testimony, as other investigations have (e.g., Lucas, Lewis, Pala, Wong, & Berriedale, 2013; Pasquini Corriveau, Koenig, & Harris, 2007; Robinson & Nurmo, 2009). Rather, a more specific hypothesis is being tested—that children’s understanding of false belief (in Experiment 1) and pretense (in Experiment 2) will affect how they evaluate the accuracy of others who show either the same or different understanding of that particular mental state. If this hypothesis is true, it would suggest that children’s own understanding of information is one of the ways in which they go about judging others’ accuracy. Given the well-established change in knowledge for both false belief and pretense understanding as well as the many reliable measures for assessing both, testing this question using these two aspects of theory of mind was particularly fitting.

**Experiment 1**

Children’s understanding of false belief was assessed using a standard unexpected contents measure (Gopnik & Astington, 1988; Perner, Leekham, & Wimmer, 1987). Their ability to represent multiple possibilities or interpretations of objects was assessed using appearance-reality (AR) and visual perspective taking (VPT) tasks, which typically correlate with performance on standard false belief tests (Bigel & Dugas, 2009; Doherty & Perner, 1998; Flavell et al., 1986; Gopnik & Astington, 1988; Wellman et al., 2001). While the AR and VPT measures were inspired by existing work, they were created specifically for this study. Because it was hypothesized that performance on the false belief task, not these other two measures of theory of mind ability, would influence their interpretation of others’ false belief knowledge, measures that that had similar representational complexity to the false belief task, but were not specifically about another’s belief states, were required.
Children were then presented with two informants who expressed different ideas about how a character who held a false belief would act (using stories based on the standard Wimmer & Perner [1983] unexpected transfer false belief measure). If children behave as hypothesized, that is, if the child’s own false belief knowledge indicates to them which informant is accurate, children who succeed on the false belief measure will treat the informant who understands that the character’s false belief is different from reality as accurate, whereas children who fail the false belief measure will treat the other informant as accurate. Critically, only this specific knowledge, and not a broader understanding of mental representation (as indicated by performance on the appearance/reality and VPT measures), should predict children’s use of the informants’ information. Thus, the relation between children’s performance of the false belief measure and which informant they select should hold even after controlling for their performance on these other two measures.

Children’s judgments of which informant was more trustworthy was assessed using two questions standard in the “trust in testimony” literature: children selected which informant they would ask for information (the ask question) and then which informant they thought gave the correct information (the endorse question). Although we expect children to choose the same informant for both these questions, previous research suggests this is not always the case, particularly for 3-year-olds (e.g., Pasquini et al., 2007; Sobel & Corriveau, 2010). Thus, we felt it prudent to include both.

Method

Participants. The final sample was composed of 40 children (21 girls, 19 boys, \( M = 51.68 \) months, range = 41 - 58 months). Ten other children were tested, but not included in the final sample. Three of these children were excluded because of experimental error, one failed the
control question in the procedure (see below), and six were unable to complete the procedure. The majority of children were non-Hispanic Caucasian, but a range of ethnicities and races were represented. No formal measure of SES or parental education was taken. Children were recruited from a local children’s museum and databases of area families maintained by the authors. All children received a small prize for their participation.

**Materials.** The *Theory of Mind* assessment involved three measures. A 32-count Crayola crayons box that was filled with a set of small (approximately 3 cm long) toy horse figurines was used for the *Unexpected Contents* task. A novelty rock made of sponge material (approximately 11 cm x 6.5 cm x 6 cm) was used for the AR task, and two pictures of a turtle were used for the VPT task, taped together onto a 13.97 x 21.59 cm single card. On one side of the card, the turtle’s shell was visible. On the other side, the turtle’s underside was visible.

The *Training* phase of the reliability procedure involved four sets of four pictures (mounted on cards with the same measurements as above). In each set, there were two distinctly colored containers on each side of the picture. The containers were the same in each set, but differed between sets. Within each set, the first card depicted a child character putting an object (different across the sets) into one of the containers. The second card depicted an adult character opening that particular container and removing the item. The third card depicted the adult character placing the item into the other container. The fourth card depicted the child character standing between the two containers. Gender of the child character, gender of adult character, and side of original object placement were counter-balanced. Figure 1 depicts one such set.

A cardboard occluder (43.18 cm x 55.88 cm) and three sets of two pictures were used in the *Test* phase of the reliability procedure (again mounted on cards of the same size). Each card depicted two distinctly colored containers on opposite sides that were the same within a set, but
differed across the sets (and from all the familiarity sets). The first card in each set depicted a child character standing between the two containers with an object. The second card in each set depicted the same child standing between the two containers with no object. The object changed between sets. Figure 2 depicts one such set.

**Procedure.** Children were tested in a university laboratory, their preschool, or in a closed-off space in a local children’s museum. The testing session consisted of a theory of mind assessment followed by training and test procedures.

**Theory of Mind Assessment.** There were three measures in the pretest, administered in a random order. In the *Unexpected Contents False Belief* task, the experimenter started by asking the child a name of a friend his/her own age with whom s/he played. The experimenter then showed the child a crayon box and asked what s/he thought was in the box, to which the child typically responded “crayons”. The box was opened to reveal that there were horse figurines inside. The experimenter put the horses back in the box and closed up the box. The experimenter first asked the *other* question: “Your friend (friend’s name) has never seen this box before. If (friend’s name) came into the room and saw the box here all closed up like this, what would (friend’s name) think was in the box?” This was followed by the *self* question: “Before I showed you what was in this box, what did you think was in the box?” Finally, the experimenter asked the *control* question: “What’s really in the box?” Children received 1 point each for answering the other and self questions correctly, so they could receive a score of 0 - 2. If children failed the control question, they were not included in the final analysis. One child was excluded for this reason.

In the VPT measure (based on Flavell, Everett, Croft, & Flavell, 1981), children were shown each side of the card with the turtle pictures on it. They were told that one side was a
picture of the turtle’s back and the other side was a picture of the turtle’s tummy. The card was then held vertically between the experimenter and child, so that the child viewed one side while the experimenter viewed the other. Children were asked whether they saw the turtle’s back or tummy, and were asked whether the experimenter saw the turtle’s back or tummy. The card was then flipped over and children were asked the same questions again. Children were coded as passing if they responded correctly to all of the test questions (i.e., indicated that when they saw the turtle’s back, the experimenter saw the tummy and vice versa). Thus, this measure not strictly a Level 1 or Level 2 VPT task; rather, it had elements of both.

In the AR measure (based on Flavell, Green, & Flavell, 1986) children were shown a sponge-rock. They were first asked what it looked like, and if they did not respond that it looked like a rock, the experimenter stated that s/he thought it looked like a rock. The experimenter then indicated that the object was a sponge. S/he squeezed it to reveal its malleability and gave the object to the child to confirm this information. After the experimenter took back the object, s/he asked, “What does this look like to you?” After children responded, they were asked, “And what is this really?” Children were coded as passing the AR measure if they stated that the object looked like a rock, but really was a sponge. One child did not provide any answers to the AR measure, but did complete the rest of the procedure, so was treated as not passing in the analyses.

**Reliability Procedure, Training phase.** A second experimenter (blind to the results of the theory of mind assessment) then introduced the child to two novel informants, saying, “Before we get started, I want you to meet two of my friends. This is my friend (A) and this is my friend (B).” The informants were both female and sat on either side of the experimenter. One informant was the more developed false belief informant and one was the less developed false belief informant.
The experimenter told the child that s/he was going to tell some stories with some pictures and ask her friends some questions about the pictures. Each story was similar to an “unexpected transfer” false belief procedure (Wimmer & Perner, 1983). The child and the informants were told about a child character who leaves a desirable that object in one location, which is then moved to a second location by a parent unbeknownst to the child. For instance, for the cards shown in Figure 1, the experimenter said, “This is Sarah, and Sarah loves to paint. Sarah has a paintbrush. Sarah wants to put her paintbrush away so that she can paint with it later. Sarah puts her paintbrush into this blue box. Then she goes to do her homework.” The experimenter then flipped to the next card, and said, “Sarah’s mother comes into the room. Sarah’s mother opens up the blue box, and she takes the paintbrush out of the blue box.” The experimenter changed to the next card, saying, “Sarah’s mother puts the paintbrush into this purple basket. Then she goes to work.” The experimenter flipped to the final card of the set, and says, “Sarah comes back into the room. Sarah wants to paint, so Sarah is going to look for her paintbrush. Where will she look for her paintbrush?”

The experimenter asked each informant this question, one at a time, counterbalancing who was asked first. The more developed false belief informant answered with the location where the child placed the object (i.e., where the child character should believe the object was, in this case, “the blue box”). The less developed false belief informant answered with the location where the parent moved the object (i.e., where the object really was, in this case, “the purple basket”).

Children heard four of these stories and sets of questions, with the more developed false belief informant always providing information in a manner consistent with her appreciating the character’s false belief and the less developed false belief informant always responding with the
actual state of the world. Child participants were never shown what happens next in the story. In order to determine which confederate was accurate, they had to use their understanding of the false belief presented in the story. If they recognized that the character held a false belief, then they should treat the more developed false belief informant as responding accurately to the question. If they failed to recognize that the character held a false belief, then they should treat the less developed false belief informant as responding accurately.

**Reliability Procedure, Test phase.** Children then heard three test stories. At the beginning, the child was told, “Now we’re going to do something a little bit different. I am going to tell you some stories that are a lot like the stories I just told you, except this time, I am going to show part of the stories to you, and show part of the stories only to my two friends over here. Then I am going to ask you and my friends some questions about the stories.” Each test story started similarly to the training stories. Children were introduced to a child character who had a desired object with two locations in which the object could be hidden. For example, using the pictures shown in Figure 2, the experimenter said, “This is Suzy. Suzy has a coin. Suzy wants to put her coin away so that she can spend it later. Suzy is either going to put her coin into this red tin or this purple sack.”

The next part of the story was occluded from the child, but visible to the experimenter and informants. The experimenter said, “Now, this next part of the story I am going to show only to my two friends over here.” She placed an occluder between herself and the child, so that children could not see the picture, but it remained visible to the experimenter and informants. The experimenter then continued with the story, which was analogous to the training stories, except that the experimenter only used deictic phrases to indicate the location of the object at any time. For instance, “Suzy puts her coin into this one. Then, she goes to meet up with her friends.
Then, Suzy’s dad comes into the room. Suzy’s dad opens up this one, and takes the coin out of this one. Suzy’s dad puts the coin into this other one. Then he goes to make dinner.” The experimenter frequently looked at the two informants, who were looking at the cards, and asked, “See?” during page flips, and the informants responded by nodding to demonstrate that they could, in fact, see what location she was indicating. During this stage of the procedure, the child participant could not tell which container originally or currently housed the object.

The experimenter then removed the occluder, having flipped the second card in the set to the top position, and showed the child participant the second card. The experimenter indicated that the character had come back and wanted her object (e.g., “Suzy comes back into the room, and Suzy wants to spend her coin, so Suzy is going to look for her coin.”).

Children were then asked two test questions. For the ask question, the experimenter said, “I’m going to ask one of my friends where Suzy will look for her coin. Who should I ask where Suzy will look for her coin?” After children generated a response, the experimenter turned to that informant and asked where the character would look for her object. The informant indicated one of the two depicted locations. The other informant was then asked, and she indicated that she thought the character would look in the other location. Locations were randomly determined prior to the start of the procedure. The experimenter then asked the child the endorse question: “Now, where do you think that Suzy will look for her coin?” For both the ask and endorse question, children could respond verbally or point to the appropriate informant or location. Children were given a score of 1 for each time they chose the more developed false belief confederate in response to an ask or endorse question, resulting in a possible range of 0 – 3 for each question.

**Results**
The results of the theory of mind assessment, the reliability procedure, and the relation between the two will be considered in turn. One-tailed tests were used for this last analysis because it was specifically hypothesized that children who passed the others’ belief question would rely on the more developed false belief confederate and children who failed this measure would rely on the less developed false belief confederate. Boys and girls did not differ in their responses to any of the measures, so this variable was not considered further.

Children’s average score on the unexpected contents measure was 1.08 out of a possible 2 ($SD = 0.78$). Forty-three percent of children passed the AR measure while 82% of children passed the VPT measure. Performance on unexpected contents and AR were no different from chance, but overall the sample performed better than chance on the VPT measure, Binomial test, $p < .01$. This pattern of performance potentially reflects that our VPT measure required slightly less representational knowledge than a standard Level 2 VPT measure (and might be more akin to a measure between a Level 1 and Level 2 VPT task). Performance on the VPT and AR tasks did not correlate with their performance on the false belief measure and none of these measures were correlated with age (See Table 1), even though such correlations are often found (see references above). Such null results might indicate that the sample of children in this experiment was unusual. However, the mean performance on the false belief measure for this age group is consistent with other published accounts (e.g., Wellman et al., 2001), thus it is more likely that these results are due to the small age range tested or the restricted range of each of the scores.

Responses to the test questions did not differ among the three ask questions, nor did differ among the three endorse questions, both Cochran’s $Q(2, N = 40)s < 1.61$, both $ps > 0.44$. However, responses on the ask and endorse questions were not correlated, $r(40) = -0.18$, $p = 0.24$, suggesting that children might have responded to them differently. As a result, the
summation of responses to the six ask and endorse questions were analyzed first and then the ask and endorse questions were analyzed separately.

A significant correlation was found between false belief understanding and the overall scores on the ask and endorse questions, \( r(38) = 0.40, p = 0.01 \). A partial correlation between children’s false belief score and their score on the ask/endorse questions, controlling for age and performance on the AR and VPT measures (entered separately), was also significant, \( r(35) = 0.39, p = 0.016 \). When the ask and endorse questions were analyzed separately, a slightly different pattern of results emerges. As shown in Table 1, the only significant correlation was between the false belief scores and the endorse questions. This correlation remained significant when age, AR and VPT scores were partialed out, \( r(35) = 0.42, p = 0.01 \). These analyses suggest that children’s existing false belief understanding predicts which informant they would endorse.

A Kruskal-Wallis one-way analysis of variance showed that when the ask and endorse scores were combined, there were differences among the three groups created by analyzing children’s false belief score, \( \chi^2(2, N = 40) = 7.20, p = 0.01 \). Overall, children who scored 0 on the false belief measure chose the more developed false belief confederate on 38% of the questions, less often than children who scored 2 (who did so on 55% of the questions), Mann-Whitney \( U = 28.00, z = -2.88, p = 0.006, r = 0.46 \). Children who scored 1 chose the more developed false belief confederate on 50% of the questions. Children who scored 0 on the false belief measure chose the more developed false belief confederate less often than chance, \( t(10) = -2.19, p = 0.027 \) (one-tailed), Cohen’s \( d = 0.66 \). However, children who scored 2 or 1 both performed at chance levels, \( t(13) = 1.30, p = 0.109 \) (one-tailed), Cohen’s \( d = 0.35 \) and \( t(14) = 0.00, p = 1.00 \), respectively. One-sample t-tests were used for this analysis instead of non-parametric \( \chi^2 \) Goodness-of-Fit tests because the sample does not meet the assumptions of these latter tests. The
effect sizes presented suggest that these are medium effects (following Cohen, 1992), which are relatively robust.

However, considering the ask and endorse questions separately, the differences among the three groups were only significant for the endorse questions, Kruskal-Wallis $\chi^2(2, N = 40) = 7.20, p = 0.027$. Children who scored 0 on the false belief measure endorsed the more developed false belief confederate less often than chance (mean of 1.00 out of 3 or 33%, $t(10) = -1.85, p = 0.046$ (one-tailed), Cohen’s $d = 0.56$). Children who scored 2 on the false belief measure chose the more developed false belief confederate more often than chance on these questions (mean of 1.86 out of 3 or 62%, $t(13) = 2.02, p = 0.032$ (one-tailed), Cohen’s $d = 0.54$). Children who scored 1 chose the more developed false belief confederate no differently from chance (mean of 1.40 out of 3 or 47%, $t(14) = -0.52, p = 0.60$).

Finally, these results were specific to the false belief measure. All analyses were repeated for AR and VPT scores, but none of these results were significant.

Discussion

Preschoolers were presented with stories in which a character held a false belief and observed informants stating their beliefs about whether the character would act in a manner consistent with holding that belief state or in a manner consistent with the actual state of events in the story. Children’s own understanding of false belief correlated with the extent to which they endorsed the more developed false belief confederate as opposed to the confederate who displayed a less developed sense of false belief. This relation held even when the child’s age and performance on other theory of mind measures related to their developing mental representation knowledge was taken into account. However, this effect was only found when the endorse question was included (either by itself or in combination with the ask question), but not for the
ask question alone. That said, these data do suggest that children might interpret the same information differently, depending on how they construe the accuracy of the information.

It is also curious that scores on the ask and endorse questions were uncorrelated and that children’s false belief performance predicted which informant they endorsed, it did not predict who they asked. It is possible that children in this experiment were more likely to ask an informant they believed was not knowledgeable to gain more information about that person or just because it was fun to watch an adult produce a wrong answer, but knew not to use the information that individual generated. But, differences in performance in the ask and endorse questions are not uncommon (e.g., Pasquini et al., 2007; Sobel & Corriveau, 2010), especially with 3-year-olds. It may be that young children find the ask question difficult to understand. Aguiar, Stoess, and Taylor (2012) found that 4- and 5-year-olds, but not 6-year-olds, had trouble selecting an appropriate informant when questions were difficult. The fact that our sample was comprised entirely of 3- and 4-year-olds might explain why children were at chance on the ask question. Additional research using simplified language would help distinguish between these possibilities.

Many studies, like those cited above, do not report whether responses on the ask and endorse questions were correlated. Moreover, there are other cases in which researchers analyze the summary of the ask and endorse scores, sometimes without reporting whether they are correlated (e.g., Doebel & Koenig, 2013) and sometimes reporting that they are (e.g., Corriveau, Kinzler, & Harris, 2013). Replicating and expanding the results of the present experiments is a necessary step to understanding whether the reported differences are the result of chance or a systematic aspect of children’s selective trust. Moreover, within the selective trust literature, we
would advocate more of a systematic investigation of the potential differences between these two types of commonly-used questions.

A potential limitation of this work is the assessment of a single domain of knowledge. In Experiment 1, children’s existing false belief knowledge informed whom they believed was a reliable source, given evidence of individual’s views about others’ false beliefs. In Experiment 2, another facet of children’s developing theory of mind is used: their knowledge of pretense. In Experiment 2, the same unexpected contents measure is used during the assessment part of the procedure, but unlike Experiment 1, children’s false belief understanding is not expected to predict how they interpret others’ knowledge of pretending.

A second potential limitation is that children were not asked which informant they believed was a more reliable source of information (an explicit judgment question, which is commonly asked before the ask and endorse questions in experiments on selective trust, see e.g., Koenig & Harris, 2005). As such, while these data suggest that children treated the informants differently based on their false belief knowledge, we have no explicit measure of the child’s beliefs about which informant is more reliable. This question was included in Experiment 2.

**Experiment 2**

Although there is debate over whether very young children understand pretense as requiring mental representation (see e.g., Friedman & Leslie, 2007; Leslie, 1987; Lillard, 1993a), there is clear evidence that preschoolers often respond inaccurately to questions about the role of mental states in pretending. Most preschoolers have a more action based understanding of pretending, in which they equate pretending with behaving like or appearing like an entity, regardless of that person’s other mental states (Lillard, 1993b, 1996, 1998, Sobel, 2004, 2007; Sobel & Lillard, 2002), even though they can pretend appropriately (e.g., Harris & Kavanaugh,
1993) and recognize when another person is pretending just from behavioral cues (e.g., Lillard & Witherington, 2004; Ma & Lillard, 2006; Nishida & Lillard, 2007). By age 6 - 7, the majority of children begin to respond based on the individual’s mental states (Richert & Lillard, 2002).

The goal of Experiment 2 was to replicate the basic finding from Experiment 1, assessing and testing children’s knowledge of pretense instead of their knowledge of false belief. Three-six-year-old children’s beliefs about whether pretending is based on a person’s actions or mental states were assessed. Older children were included in this experiment because it is not until age 6 that a mental state based understanding of pretense is reliably achieved. Then two informants, one displaying an action based understanding of pretending and one displaying a mental state based understanding, were introduced. It was hypothesized that children’s knowledge about the relations among pretending, action, and mental states would relate to which informant they trust to learn about novel pretend actions and that performance on the false belief measure would not so relate.

Method

Participants. The final sample was composed of 40 children (25 boys, 15 girls, $M = 58.45$ months, range = 36 - 80 months). An additional 11 children were tested, but their data were not included in the final sample (nine refused to answer at least one of the questions during the procedure, two because of experimental error during the testing session). The sample was largely non-Hispanic Caucasian (77%, 9% minority, 14% declined to answer) and had well-educated parents (51% had at least some graduate school, 22% had a college degree, 11% had a high school diploma or some college, 16% declined to answer). Children were recruited and compensated as in the previous experiment.
**Materials.** For the *Unexpected Contents* task, children were shown a standard Band-Aids box that contained crayons or stickers. During the *Understanding of Pretense* assessment, two laminated colored line drawings (each 20.33 cm wide x 14 cm tall) depicting a girl engaging in various actions that gave her the appearance of an animal and a male doll figure (30.5 cm tall) were used. During the *Training* phase, three troll dolls (15.25 cm tall) were used (e.g., Lillard, 1993b; Sobel, 2009).

**Procedure.** Children were tested in a quiet space in a laboratory room or at a local children’s museum by a single experimenter. Children again first completed a standard unexpected contents false belief task, which was administered and coded as in Experiment 1. Only one child answered the control question incorrectly, but her data are included in the analyses reported below because excluding it does not change any result. The remaining procedure was divided into an *Understanding of Pretense* assessment and then *Training* and *Test* phases of the reliability procedure.

**Understanding of Pretense assessment.** The *Understanding of Pretense* assessment consisted of three established measures presented in a one of three predetermined orders and assessed whether children had an action based or mental based understanding of pretense. The first measure examined whether children understood pretending involved intentional action (following Lillard, 1998). Children were shown a male doll and were told, “I have a doll and I’m going to show it to you, and I’m going to ask you whether or not it is pretending. So, this doll is Tom - Tom is just wiggling around on the floor. He’s not trying to be a worm – he’s just wiggling. But he looks like a worm – worms wiggle like that.” Children were asked two memory check questions: whether worms wiggle and whether Tom was trying to be a worm. If children did not answer these questions correctly, the procedure was repeated. Finally, the test question,
“Is Tom pretending to be a worm?” was asked. Children were scored as passing if they said Tom was not pretending.

The second measure examined whether children recognized pretense involved the brain (following Lillard, 1996). Children first answered four warm-up questions (with feedback) about whether they needed their mouths to engage in various actions (i.e., eat, hop, give a kiss, and dance), and then if they knew where their brain was. Children were then asked (without feedback) whether they needed their brains to pretend, think, jump, and walk. Children were scored as passing if they said the brain is required to pretend.

The third measure examined whether children understood pretending involved awareness of one’s own appearance or actions (following Sobel, 2004). Children were told a story illustrated by two colored line drawings: “This is Susan. Susan is playing in the mud. She gets all dirty playing in the mud. Now she is finished. She is all dirty. She has mud on her face and clothes and looks like a tiger. See, tigers look just like that. But Susan doesn’t know that she has mud on her face and clothes. She doesn’t know that she looks like a tiger.” Children were asked two memory check questions: whether Susan looks like a tiger and whether she knows she looks like a tiger. If children answered incorrectly, the procedure was repeated. Children were then asked the test question, “Is Susan pretending to be a tiger?” Children were scored as passing if they said Susan was not pretending. Thus, the possible range for scores on this assessment was 0 – 3.

**Reliability Procedure, Training phase.** Immediately after the pretense assessment, the experimenter invited two adult informants to sit on either side of her as in the previous experiment. Children were told, “I am going to tell my friends some stories and ask them whether they think these troll dolls are pretending. Let’s see what they say.” Following Lillard
(1993b), the experimenter showed the child and informants a troll doll who was acting like an animal, but who had no knowledge of that animal. For example, “Here’s Moe. Moe is hopping up and down. He looks like a kangaroo. Kangaroos hop just like that. But Moe is from the Land of the Trolls, and there are no kangaroos in the Land of the Trolls. Moe doesn’t know what a kangaroo is, or that they hop.” The experimenter then asked each informant whether Moe was pretending to be a kangaroo. One informant, the mental state based informant responded “no” to this question. The other informant, the action based informant, responded “yes” to this question. Children heard three of these stories (see Table 2 for details) with the mental state and action based informants always responding in the same manner. The order of the stories and whether the experimenter asked the action based or mental state based informant first was counter-balanced.

**Reliability Procedure, Test phase.** Immediately following the training, children were asked which informant they thought “knows more about pretending” (the explicit judgment question). Then, children were told they were going to learn how to pretend some new things. For each pretend action, the experimenter introduced a novel term (e.g., “surnit”) and asked the child, “You can ask one of my friends to show you how to pretend to be a X. Who do you want to ask?” (the ask question). After the child’s chosen informant pretended by performing a novel action, the experimenter asked the other confederate to pretend, and s/he performed a different novel action. The child was then asked to demonstrate the novel pretend action him/herself (the demonstration question) and to pick which of the confederates pretended better (the endorse question). This procedure was repeated for three novel pretend actions in a counter-balanced order (See Table 2 for a description of novel pretend actions). Children were given 1 point each time they chose or performed the action exhibited by the mental state based informant. Thus,
again, the possible range for each of 4 questions (explicit judgment, ask, demonstration, and endorse) was 0 to 3.

**Results**

Children’s understanding of pretense scores will be considered first, then their responses to the reliability procedure, and then the relation between the two. As in Experiment 1, one-tailed tests were used, and because preliminary analyses indicated responses did not differ by gender, so this variable was not included in main analyses.

On the understanding of pretense assessment, 30% percent of children said that the character was not pretending on the intentionality measure, 48% said the character was not pretending on the awareness measure, and 53% stated that the character needed her brain to pretend. The distributions of correct responses on the three measures were not different, Cochran’s $Q(2, N = 40) = 4.87, p = 0.09$, so these scores were summed ($M = 1.33, SD = 0.86$, range = 0 – 3). These scores were significantly correlated with age, $r(38) = 0.47, p = .002$, but not with false belief performance (See Table 3).

Children received four scores in the reliability procedure: explicit judgment, ask, demonstrate, and endorse. Overall, few children generated any kind of response to the demonstration question (children did not respond on 73% of the trials). As a result, responses to this question were not considered further. Children chose the mental state based informant an average of 0.40 times ($SD = 0.50$) on the explicit judgment question and 1.35 out of 3 trials ($SD = 1.00$) on both the ask and endorse questions. The ask and endorse scores were not different from one another, but unlike Experiment 1, they were correlated with one another, $r(38) = 0.51, p = 0.001$, suggesting that children responded to them in a similar manner. Thus, only the sum of the ask and endorse questions was analyzed.
Table 3 shows the bivariate correlation matrix among children’s age, pretense assessment scores, false belief scores, responses to the explicit judgment question, and their ask/endorse scores. Likely reflecting the wider age range, in this experiment, false belief scores did significantly correlate with age, $r(38) = 0.62, p < .001$. There was also a significant positive correlation between the ask/endorse score and children’s score on the pretense battery, $r(38) = 0.39, p = 0.012$. Because children’s age also significantly correlated with their performance on the pretense battery (see Table 3), to specify the unique variance of the pretense battery, a partial correlation was performed between the ask/endorse score and scores on the pretense battery, controlling for the variance explained by age and false belief score. This resulted in a significant partial correlation $r(36) = 0.33, p = 0.041$, suggesting that performance on the pretense battery did uniquely explain some of the variance in whom children trusted beyond their age and general mental state knowledge.

As in Experiment 1, this correlation was investigated further by dividing children into two groups: those who scored low (a score of 0 - 1) on the pretense battery and those who scored high (a score of 2 - 3). As predicted, children who scored a 0 or 1 on the pretense battery, indicating a more action based understanding of pretense, were significantly less likely to ask/endorse the mental state informant (and hence significantly more likely to ask/endorse the action based confederate) than children who scored a 2 or 3 on that battery, (36% vs. 57% of the time respectively), Mann-Whitney $U = 110.00, z = -2.38, p = .019$.

Children who scored a 0 - 1 on the pretense battery relied on the action based confederate more often than chance, $t(22) = -2.08, p = .024$ (one-tailed), Cohen’s $d = 0.44$. Children who scored a 2 - 3 on the pretense battery chose the mental state based confederate more often, but not significantly greater than chance, $t(16) = 1.38 p = .093$ (one-tailed), Cohen’s $d = 0.34$. This
finding, however, might be influenced by the fact that only three children scored a perfect 3/3 on the pretense battery, suggesting that the present sample might have skewed overall towards having an action based understanding.

Finally, responses to the explicit judgment question correlated with the extent to which children asked/endorsed the mental state based informant but not with the pretense assessment (see Table 3). To investigate the relation between responses to the pretense battery and the explicit judgment question further, a hierarchical linear regression on children’s ask/endorse scores was performed. The initial model contained just children’s age and false belief performance. A model with these factors and children’s response to the explicit judgment question was then considered, and then a third model with these factors as well as response to the pretest battery. Only the final model predicted a significant amount of the variance, $F(4, 35) = 3.25, p = 0.023$. Further, while responses to the explicit judgment question predicted a significant change in variance from the first model to the second, $\Delta R^2 = 0.13$, $F(1, 36) = 5.54, p = 0.024$, adding the pretense battery score also predicted a change in the variance from that model to the final one, $\Delta R^2 = 0.08$, $F(1, 35) = 3.87, p = 0.057$. Thus, it seems that children’s understanding of pretense is a better predictor of which informant they trusted than their own explicit judgments, a finding consistent with many in the developmental literature showing that children often demonstrate their knowledge implicitly before they can do so explicitly (e.g., Woolley, 2006).

Finally, these results appeared specific to the pretense battery measure. Examining these data in terms of performance on the false belief measure only yielded chance-level performance.

Discussion

Children were introduced to two informants, one who displayed an action based understanding of others’ pretending and another who displayed a mental state based
understanding. Children were then asked which of the two informants was more trustworthy regarding novel information about pretending. Children’s knowledge about the relations between action, mental states, and pretense was correlated with whom they trusted for novel pieces of information about pretending. The more children showed a mental state based understanding of pretense, the more likely they were to ask and endorse the informant who also demonstrated the more mental state based understanding.

One concern with these results, however, is that children rarely gave any response for one of the test questions – the demonstration question (“Show me how to pretend to be a X”). There are three possible interpretations. One is that, although the training information was enough to allow children to differentiate between informants on the ask and endorse questions, it was not adequate for children to learn anything about novel pretense actions. A second possibility is that only one exposure to each novel pretend action was not enough for children to learn it, and they simply could not remember what to do when asked. A third interpretation is that children were simply hesitant to engage in novel pretense (particularly pretending to be an entity they had never seen or encountered) in front of three strange adults. We would suggest this latter interpretation because, in related work, children were given the same pretense assessment and test questions, but a different training (Van Reet & Sobel, 2013). Specifically, informants were either “good” pretenders (i.e., performed a conventional action when pretending to be a known animal, such as flapping one’s arms for a bird) or “bad” pretenders (i.e., performed actions that were unrelated to such pretending, such as wiggling to be a bird, following training used by Ganea, Lillard, & Turkheimer, 2004). Children again rarely (only 19% of the time) responded to the demonstration question, indicating that even when the informants engage in a great deal of
action, children rarely imitate either informant. Future experiments should consider methods that encourage children to generate novel pretend actions.

**General Discussion**

Across two studies, children’s existing knowledge of a particular domain of social cognition correlated with the tendency to trust an informant whom displayed a more developed understanding of that knowledge. In Experiment 1, performance on a standard unexpected contents false belief measure correlated with who children trusted regarding false beliefs. The higher children scored on a standard false belief measure, the more likely they were to use information generated by the informant who displayed a more developed understanding of false belief. In Experiment 2, the extent to which children understood that judgments about pretense are based more on an individual’s mental states than his/her actions correlated with whether children relied on an informant who consistently displayed a mental state or action based understanding of pretense.

In some ways, the present studies resemble work by Fawcett and Markson (2010), who demonstrated that children as young as 2 would use whether an informant’s preferences (e.g., for one toy over another) matched their own as the basis for whether they should prefer to play with one novel object over another. These researchers suggested that very young children interpret others’ preferences quite rationally. They found that children do not think an individual with whom they share a particular preference is more knowledgeable overall, or even more knowledgeable about all desirable objects or events. They found in a subsequent study that if one shares preferences about television, that should not necessarily extend to another domain, like food. The present study expands on these findings to consider how children treat others as sources of knowledge based not on whether they match preferences, but on their existing specific
knowledge about belief (Experiment 1) or pretense (Experiment 2), but not their general mental state knowledge. This knowledge, of course, is itself developing, which suggests that as that knowledge develops, whom children trust also changes.

We suggest that children are making a rational inference when assessing whether the information they observe during familiarization is relevant to the inference they are asked to make at test. In this way, the present data also complements recent studies by Koenig (2012), who suggests that children can be sensitive to informants’ rationales for holding particular beliefs when making inferences about their testimony. The present data suggest that children evaluate others’ claims in light of their own epistemic knowledge (see Sobel & Kushnir, 2013, for a broader review of this claim).

There is, however, another possible account of the present data: that children consider how they would respond to the questions posed to the informants at training and simply choose whichever informant responds in a manner most like themselves. There is some evidence in the literature on trust in testimony that children broadly trust informants who respond or behave as they would. Children generalize informants’ lexical accuracy, which they determine based on their own lexical knowledge, to inferences about novel functions (Birch, Vauthier, & Bloom, 2008; Koenig & Harris, 2005). They also trust informants with native accents over foreign ones (Kinzler et al., 2011) and those in their same racial group more often (Chen, Corriveau, & Harris, 2013).

The present data cannot specifically differentiate between the possibility that children simply judge reliability based on similarity of response and a more rational account in which they integrate their existing (and changing) knowledge with the information they observe. It could be that knowing that an informant shares one of their beliefs, like a similar understanding
of pretense, would lead children to infer that they would share other beliefs as well, like an understanding of false beliefs. However, it could also be that (for example), in Experiment 2, children’s score on the pretense assessment would not predict their responses if they were given the test questions posed in Experiment 1. That is, knowledge of whether an individual has an action based or mental state based understanding of pretense is not indicative of their understanding of false belief. These results would be consistent with a more rational account. Several studies do show such judicious generalization from the same accuracy information (e.g., Koenig & Jaswal, 2011; Sobel & Corriveau, 2010). In each of these cases, children’s existing knowledge of the material used to establish the informants’ accuracy bears on whether children generalize that accuracy information to the inference they have to make at test.

Extensions of this work could easily differentiate such an account from the hypothesis that children simply choose informants who are more like themselves. For example, if the latter is true, children should also use superficial features, such as whether the informant and child have the same hair color, or shares the same first name, as the basis for trust in testimony. A more rational account would argue that those features would be used only if there was a reason for making an inference on that basis. Similarly, a rational account would argue that children should only be willing to generalize informants’ reliability within a domain, similar to findings by Danovich and Keil (2004).

Another way to test this more rational hypothesis would be to examine children in a microgenetic fashion, examining how the development of a particular knowledge base relates to whom they would trust. If children’s trust in others is mediated by their developing knowledge, then for instance, as children’s knowledge of false belief changes, they should come to trust the confederate who displays the more developed false belief knowledge. A second would be to
consider how children trust informants as the informants’ knowledge changes. For example, suppose one informant starts with inferior knowledge to the second, but over time comes to understand the situation better. If children recognize that this first informant now has more knowledge than the second, children should judge the first informant as a more reliable source.

Another unanswered question that deserves further attention and subsequent research is the difference in the ask question between these two experiments. In both experiments, when scores on the ask and endorse questions are combined, significant correlations between children’s assessed knowledge and whom they trusted were found. However, in Experiment 1, responses to those two questions were unrelated to each other; only the endorse question showed this pattern of results, and responses to the ask question were at chance. In Experiment 2, responses to those two questions were related and the general pattern of performance for the ask/endorse composite score replicated for the ask and endorse scores individually. Provided this pattern of results is not due to chance, it is interesting to consider what subtle differences in the ask question between Experiments 1 and 2 may be responsible for this difference. In Experiment 1, children were asked to select who the experimenter should ask, while in Experiment 2, children were asked to select the person they wanted to learn from. It could be that children only use their own knowledge to determine who to trust when they themselves are responsible for selecting whom they believe to be the reliable informant. Another possibility is that children were sensitive to the type of information the informants were providing, which differed considerably between Experiments 1 and 2. In Experiment 1, the informant simply indicated one of two fixed locations, but in Experiment 2, the informant produced a novel pretend action. Thus, in Experiment 1, it did not really matter who children asked because they could have determined the correct location based either informant: if they asked the informant they knew to be incorrect,
they could then select the informant who indicated the other location when asked the endorse question. However, this strategy would not work in Experiment 2 since there were an infinite number of possible responses the informants could have given.

From a practical standpoint, we acknowledge that children are unlikely to encounter a situation like the ones created in these experiments in their everyday learning from others (see Koenig, 2012, who makes a similar point). Because children rarely have access to a playmate’s understanding of false beliefs or pretense, their own understanding of these domains probably does not have much impact on whether they learn novel information. However, if these data reflect a more general tendency to trust those who share their beliefs beyond just social cognitive knowledge, as we suspect they do, the present results may have important implications for teaching and learning. Parents and teachers invest considerable resources in urging children to accept novel information. Yet, this information is not always accepted, despite the fact that familiar adults like parents and teachers are typically regarded as reliable sources (e.g., Corriveau & Harris, 2009; Corriveau et al., 2009). Because our data suggest that children are determining whether particular shared knowledge is relevant to future inferences, parents and teachers may be more successful if they seek to frame new knowledge in a way that matches what children already believe.

In sum, consistent with many findings in the “trust in testimony” literature, children were selective in their acceptance of novel information shown by two conflicting informants. When the informants differed in their expressed knowledge about the consequences of a false belief or the relation between pretending and mental states, children were more likely to trust the informant that shared their own belief than the informant who shared an opposite belief. This pattern was observed in children as young as 3, suggesting that the ability to determine accuracy
based on how well an informant’s information conforms to one’s existing knowledge is in place by the early preschool years.
References


Table 1

Correlations (N = 40) among Age, Ask and Endorse Scores, False Belief Measure, and Appearance-Reality and Visual Perspective Taking Performance in Experiment 1

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>Ask</th>
<th>Endorse</th>
<th>FB</th>
<th>AR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask</td>
<td>-</td>
<td>-.145</td>
<td>(.373)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endorse</td>
<td>-</td>
<td>-.157</td>
<td>(.335)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FB</td>
<td>-</td>
<td>-.197</td>
<td>(.223)</td>
<td>.074</td>
<td>.420</td>
</tr>
<tr>
<td>AR</td>
<td>.273</td>
<td>-.198</td>
<td>(.089)</td>
<td>-.045</td>
<td>.051</td>
</tr>
<tr>
<td>VPT</td>
<td>.212</td>
<td>-.242</td>
<td>(.189)</td>
<td>.187</td>
<td>-.042</td>
</tr>
</tbody>
</table>

Note. Correlational values are either Pearson r or Spearman ρ, depending on which is appropriate. Two-tailed p-values are shown in parentheses and significant correlations are denoted by an *.
Table 2

*Actions and Sounds Performed by Informants in Training and Test Phases of Experiment 2*

<table>
<thead>
<tr>
<th></th>
<th>Informant 1</th>
<th>Informant 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Training</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kangaroo</td>
<td>shake head + “no”</td>
<td>nod head + “yes”</td>
</tr>
<tr>
<td>Snake</td>
<td>shake head + “no”</td>
<td>nod head + “yes”</td>
</tr>
<tr>
<td>Dog</td>
<td>shake head + “no”</td>
<td>nod head + “yes”</td>
</tr>
<tr>
<td><strong>Test</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surnit</td>
<td>stand up, spin in circle + “he, he”</td>
<td>stand up, spin in circle + “la, la”</td>
</tr>
<tr>
<td>Koba</td>
<td>move rounded arms up and down to the side + “ping, ping”</td>
<td>tilt head side to side + “glop, glop”</td>
</tr>
<tr>
<td>Splocking</td>
<td>lift knees up and down + “bip, bip”</td>
<td>open and close hands in front of shoulders + “bip, bip”</td>
</tr>
</tbody>
</table>
### Table 3

**Correlations \((N = 40)\) among Age, Ask/Endorse Composite Score, False Belief Measure, Explicit Judgment Question, and Pretense Battery in Experiment 2**

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>Ask/Endorse Composite</th>
<th>FB</th>
<th>EJ Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask/Endorse Composite</td>
<td>.247</td>
<td>(.124)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FB</td>
<td>.618</td>
<td>(.&lt;.001)*</td>
<td>.207 (.201)</td>
<td></td>
</tr>
<tr>
<td>EJ Question</td>
<td>.299</td>
<td>(.061)</td>
<td>.376 (.017)*</td>
<td>.168 (.300)</td>
</tr>
<tr>
<td>Pretense Battery</td>
<td>.474</td>
<td>(.002)*</td>
<td>.392 (.012)*</td>
<td>.235 (.145)</td>
</tr>
</tbody>
</table>

*Note. Correlational values are either Pearson \(r\) or Spearman \(\rho\), depending on which is appropriate. Two-tailed \(p\)-values are shown in parentheses and significant correlations are denoted by an *. 
Figure 1. One set of pictures corresponding to the training stories in Experiment 1.
Figure 2. One set of pictures corresponding to the test stores in Experiment 1.