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"Who Can Help Me Fix This Toy?" The Distinction Between Causal Knowledge and Word Knowledge Guides Preschoolers' Selective Requests for Information

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Preschoolers use outcomes of actions to infer causal properties of objects. We asked whether they also use them to infer others' causal abilities and knowledge. In Experiment 1, preschoolers saw 2 informants, 2 tools, and 2 broken toys. One informant (the *labeler*) knew the names of the tools, but his actions failed to activate the toys. The other (the *fixer*) was ignorant about the names of the tools, but his actions succeeded in activating the toys. Four-year-olds (and to a lesser extent, 3-year-olds) selectively directed requests for new labels to the labeler and directed requests to fix new broken toys to the fixer. In a second experiment, 4-year-olds also endorsed a fixer's (over a nonfixer's) causal explanations for mechanical failures. They did not, however, ask the fixer about new words (Experiments 1 and 2) or artifact functions (Experiment 1). Thus, preschoolers take demonstrated causal ability as a sign of specialized causal knowledge, which suggests a basis for developing ideas about causal expertise.

Keywords: cognitive development, causal learning, social cognition, epistemic trust, accuracy monitoring

The preschool years are characterized by extraordinary changes in children's causal knowledge. During this period, children demonstrate an increasing ability to form abstract, coherent causal representations and to reason about nonobvious causal mechanisms and processes (Bullock, Gelman, & Baillargeon, 1982; Carey, 1985; Gelman, 2003; Gelman & Wellman, 1991; Gopnik & Melzoff, 1997; Kalish, 1996; Shultz, 1982). Much of early causal learning depends on evidence generated by children's direct experiences—for example, through their own exploratory play (Schulz & Bonawitz, 2007). To learn about causal phenomena that cannot be directly experienced, however, children rely on information provided by other people—for example, through conversation or instruction (Callanan & Oakes, 1992; Crowley et al., 2001; Harris & Koenig, 2006; Keil, 2010). Understanding how children learn from others, then, is important to detailing the process of causal learning.

There is growing evidence that what young children learn *from* people is influenced by what they know *about* people—in other words, by their developing social cognition. Between the ages of 3 and 5 years, children begin to realize that others can be knowledgeable or not, that knowledge can be inaccurate or incomplete (Robinson & Whitcombe, 2003; Sabbagh & Baldwin, 2001; Wellman & Liu, 2004; Wimmer, Hogrefe, & Perner, 1988), and that past accuracy is evidence of future knowledge (Birch, Vauthier, & Bloom, 2008; Jaswal & Neely, 2006; Koenig & Harris, 2005; Pasquini, Corriveau, Koenig, & Harris, 2007). A related social–cognitive achievement is the awareness that different people know different things. Thus, preschool children realize that it is possible that even knowledgeable informants can be ignorant about things in one domain but an expert in another (Koenig & Jaswal, 2011; Lutz & Keil, 2002). As a consequence, preschoolers can distinguish between good and bad sources of new information and learn selectively from those with appropriate knowledge only.

Studies showing selective trust of knowledgeable informants have mainly (with a few notable exceptions) focused on how children learn words. However, recent studies show that by the time children reach preschool age, explicit statements of others' causal knowledge have a direct impact on subsequent selective causal learning. For example, Kushnir, Wellman, and Gelman (2008) showed that introducing one informant as knowledgeable about a toy (e.g., "This person knows what makes [the toy] go") and one as ignorant ("This person does not know what makes [the toy] go") leads 3- and 4-year-olds to make inferences about the causal efficacy of objects when statistical evidence is ambiguous. Also, Buchsbaum, Gopnik, Griffiths, and Shafto (2011) showed that an informant's statements about knowledge (or ignorance) of a causal toy makes preschool children more (or less) likely to imitate causal actions faithfully. Finally, Sobel and Corriveau (2010) showed that when a person makes accurate statements about a hidden causal property of an object, 4-year-olds infer that person also knows the objects' label.

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These results resemble children's use of explicit statements of knowledge and ignorance in word learning (Sabbagh & Baldwin, 2001). However, it is important to recognize that causal learning is different from word learning in at least two ways. The first difference has to do with the type of cues that signal possession of knowledge. In word learning, many studies have shown that children can take past accuracy with words as evidence of future knowledge (Birch et al., 2008; Jaswal & Neely, 2006; Koenig & Harris, 2005; Pasquini et al., 2007). This reliance on what has been termed *verbal testimony* is robust against evidence from nonverbal gestures or symbols (Jaswal, Carrington Croft, Setia, & Cole, 2010). It is also sensible, given that learning language depends exclusively on attending to and correctly interpreting what people say. In contrast, when engaged in causal learning, children are not completely dependent on what people say—they can also observe what people do. Previous studies show that children commonly use the distinction between successful and failed actions—actions that do or do not produce a desired outcome—to infer causal properties and causal mechanisms even when no other information is available (Gopnik et al., 2001, 2004; Kushnir & Gopnik, 2005, 2007; Schulz, Kushnir, & Gopnik, 2007; Sobel, Yoachim, Gopnik, Meltzoff, & Blumenthal, 2007). Successful actions are a powerful (and indeed, necessary) cue to causation. It is quite possible that they might be an equally powerful cue to an actor's causal abilities. Thus, our first question is whether preschoolers take evidence from previously successful causal actions as a signal of further causal ability.

Second, words have the property of being commonly known by all those who speak a particular language (i.e., they are "conventional"; Diesendruck, Carmel, & Markson, 2010; Kalish & Sabbagh, 2007; Tomasello, 2003). Therefore, children need only to know that a person speaks a language to infer that she has knowledge of words, and they do not need to continually evaluate the accuracy of each new speaker they encounter. This stands in direct contrast to certain kinds of causal knowledge, in particular those that require special skills or expertise. Indeed, even infants appreciate that words are commonly known while other types of information are individual-specific. For example, 13-month olds infer that a new speaker will know the same word as a previous speaker but will not share her preferences (Buresh & Woodward, 2007; Diesendruck et al., 2010; Graham, Stock, & Henderson, 2006). Preschool children show a rudimentary understanding that causal expertise "clusters" in specific individuals (Lutz & Keil, 2002); a full understanding of the implications of expertise continues to develop as children get older (Danovitch, & Keil, 2004; Keil, 2010). Thus, our second question is whether children interpret demonstrated causal ability, as signaled by past successful actions, as an indication of specialized causal knowledge, but not necessarily other types of knowledge. If so, it may suggest that children can use past successful actions as a cue to causal expertise.

Relatedly, there is some evidence from past research that children do at times infer that word knowledge signals causal knowledge. In particular, studies have shown that children use a history of accurate labeling to infer knowledge of causal functions of novel artifacts (Birch et al., 2008; Koenig & Harris, 2005). One reason for this may be that preschoolers believe labeling objects correctly is a cue to general reliability or intelligence (or at least, general correctness). Thus, for young children, someone who knows words may be a good source of causal information as well. On the other hand, artifact functions are properties of objects that are commonly known by all members of a cultural group; that is, they are a form of conventional knowledge. In this way, they are similar to words: just as words have conventionally known meanings, artifacts have conventionally known functions. Preschoolers understand this conventional property of functions (Clark, 1990; Diesendruck, 2005; Siegel & Callanan, 2007; Wohlgelernter, Diesendruck, & Markson, 2010) and make use of this understanding when learning from others (Diesendruck et al., 2010). Thus, children should not necessarily infer that causal ability indicates understanding of common causal conventions, such as artifact functions.

In Experiment 1, we introduced 3- and 4-year-old children to two informants, two tools, and two broken electronic toys. One informant demonstrated word knowledge—he consistently knew the names of the tools but failed to fix the broken toys (i.e., failed to produce the desired causal outcome). The other informant demonstrated causal ability—he was ignorant about the names of the tools but was able to fix the toys (i.e., succeeded in producing the desired causal outcome). We then asked whether children could (a) correctly identify the informants based on their demonstrated knowledge, (b) selectively trust the informants with different types of further knowledge—preferring the "labeler" for word learning (as in previous studies) and the "fixer" for causal learning. We also asked whether children would restrict their inferences about the fixer to the ability to fix toys or to overextend them to conventional causal knowledge of artifact function. In Experiment 2, we looked for further evidence that children believed the fixer's ability to be both specialized (domain-specific) and deep (indicating knowledge of nonobvious causal mechanisms) by asking whether children endorsed a fixer's knowledge of the underlying causes of mechanical failures.

Experiment 1

Method

Participants. Participants were 44 preschoolers (22 boys)—22 were 3 years old (M = 43.6 months, SD = 3.2 months), and 22 were 4 years old (M = 55.7 months, SD = 3.7 months)—recruited from local preschools in a small university town. They were predominantly non-Hispanic, White, and middle-class.

Materials. The informants were two puppets—a monkey and a squirrel. Which puppet was designated the "labeler" and which was designated the "fixer" for each child participant was counterbalanced. The materials for the history phase were two unfamiliar electronic toys with interesting light or sound effects (a microphone and a mini video game) and two familiar tools (a screwdriver and a wrench). The materials for the fixing questions (see the following section) were two additional electronic toys (a black box with a button attached by a wire and red electronic top), neither of which was ever activated. Materials for the label and function questions were four novel artifacts (an avocado peeler, a dish soap scrubber, a tea diffuser, and a square toy).

Procedure

History phase. This part of the task established the knowledge of each informant. The experimenter introduced the child to the two informants and toys by saying, "Here are my friends Monkey and Squirrel. I brought them with me today because they know about stuff. I also brought these broken toys. I really need to fix them." In the history phase, the microphone and screwdriver were paired and shown first, and the mini video game and wrench were paired and shown second.

The experimenter brought out the first tool (the screwdriver), asked the child to label it ("Do you know what this is called?") and gave them the tool name if they did not or could not respond. The experimenter then asked the first informant (designated the "labeler") to help him fix the toy (e.g., the microphone). The informant accurately labeled the tool twice ("Can you give me the screwdriver? Can I have the screwdriver?") and then performed a fixing action (twisting the screwdriver) on the toy for approximately 30 s. After this, the experimenter tried to activate the toy, but it remained inoperative. The experimenter then turned to the second informant (designated the "fixer") and asked for help in the same way. This informant showed ignorance of the tool name twice ("Can you hand me that thing [pointed to screwdriver]? I don't know what it is called.") and then performed the same fixing action on the toy for the same amount of time. This time, when the experimenter tried to activate the toy it worked (played a song). The same procedure was repeated with the second tool–toy pair (the wrench and mini video game). The labeler labeled the tool correctly but could not fix the toy. The fixer did not know the name of the tool but fixed the toy. Note that at no point were the terms *labeler* and *fixer* explicitly used in the interview. These terms are only used here as a shorthand description of each puppets demonstrated knowledge.

Identification questions. To see if children could identify which informant had just demonstrated which type of knowledge, the experimenter asked two questions in a counterbalanced order: (a) "Can you tell me who fixed the toys?" and (b) "Can you tell me who knew the names of the tools?" After recording the child's response, the experimenter provided feedback to those children who answered incorrectly or provided no answer by saying "It was [Squirrel] who knew the names of the tools, remember?"

"Ask" questions. The experimenter placed each of the six novel objects (four novel artifacts and two novel electronic toys) on the table one at a time to ask six questions: two label questions, two fix questions, and two function questions. Questions were blocked in two sets of three, with one of each type per set presented in a Latin-square counterbalanced order. The exact wording for each type of question was as follows:

- Label questions: "I don't know what this is called. Who should we ask?"
- Fix questions: "I don't know how to fix this. Who should we ask?"
- Function questions: "I don't know what this is for. Who should we ask?"

The child's first response (labeler or fixer) was recorded, and no feedback was provided. Coding was done by the second author. A condition-blind researcher coded a random subset (36%) of the data in each age group. Agreement between coders was 100%.

Results and Discussion

We began by analyzing children's responses to the identification questions to see how well children tracked labeling accuracy and causal ability as demonstrated in the history phase. Both 3- and 4-year-old children were quite good at identifying who was the labeler and who was the fixer; 61% of children (16 of the 4-year-olds, 11 of the 3-year-olds) identified both informants correctly. Only 14% of children (6/44, three in each age group) misidentified both informants. The remaining 25% (11/44) of children identified one informant correctly (two children in each age group misidentified the fixer; six 3-year-olds and one 4-year-old misidentified the labeler). A comparison of the total number of correct identifications between age groups was not significant, $t(42) = 0.18$, *ns*, and children's identifications were significantly above chance at both ages (3-year-olds: $t(21) = 2.35$, $p = .029$; 4-year-olds, $t(21) = 3.77$. $p = .001$). Additionally, children of both ages were equally likely to identify the labeler and the fixer correctly (McNemar's tests, *ns*).

The focal analysis concerned children's responses to the "ask" questions. We first confirmed that there were no statistical differences between responses to the first and second questions of each type (label, fix, and function; all three McNemar's tests, *ns*). We therefore summed responses across the two questions of each type (label, fix, and function). The two responses received a combined score between –1 and 1, with –1 meaning that the child asked the labeler twice, 1 meaning that the child asked the fixer twice, and 0 meaning that the child asked each informant once (thus, negative average scores indicated a preference for the labeler, and positive average scores indicated a preference for the fixer). We then performed two 2 (age; 3 or 4 years) $\times$ 3 (question type; label, fix, or function) mixed analyses of variance (ANOVAs) on these scores—one for the full sample (22 children at each age), and one on the subset of children who identified *both* informants correctly (11 of the 3-year-olds and 16 of the 4-year-olds). The full-sample analysis yielded a significant main effect of question type, $F(2, 84) = 14.58$, $p < .001$, and a significant Age $\times$ Question Type interaction, $F(2, 84) = 3.19$, $p = .046$. There was no main effect of age. The subset analysis also yielded a significant main effect of question type, $F(2, 50) = 10.05$, $p < .001$, and a significant Age $\times$ Question Type interaction, $F(2, 50) = 3.18$, $p = .05$, and no main effect of age.

Since the analyses yielded comparable results, we focused next on interpreting the interaction in the full sample. Figure 1 shows the average responses by age and question type. We began by comparing the responses to the label, fix, and function questions separately within each age group. A repeated-measures ANOVA showed a significant effect of question type for 3-year-olds, $F(2, 42) = 3.88$, $p = .029$, and also for 4-year-olds, $F(2, 42) = 10.71$, $p < .001$. A comparison of the label and fix questions showed that children in both age groups were more likely to ask the labeler for new labels than to fix new broken toys—3-year-olds: $t(21) = 3.46$, $p = .002$, and 4-year-olds: $t(21) = 4.81$, $p < .001$. In addition, we compared the absolute number of appropriate requests for labels and for fixing to chance. Four-year-olds asked the labeler for new object labels, $M = -0.5$, $SD = 0.67$, $t(21) = 3.49$, $p = .002$, and the fixer to fix new broken toys, $M = 0.5$, $SD = 0.51$, $t(21) = 4.58$, $p < .001$, significantly more than chance. Three-year-olds' responses did not differ from chance for either question type.

We then looked at whether children preferred one informant to the other for questions about artifact functions. The results showed that neither age group asked the fixer about functions at above-chance levels (*t* tests, *ns*); thus, they showed no preference for

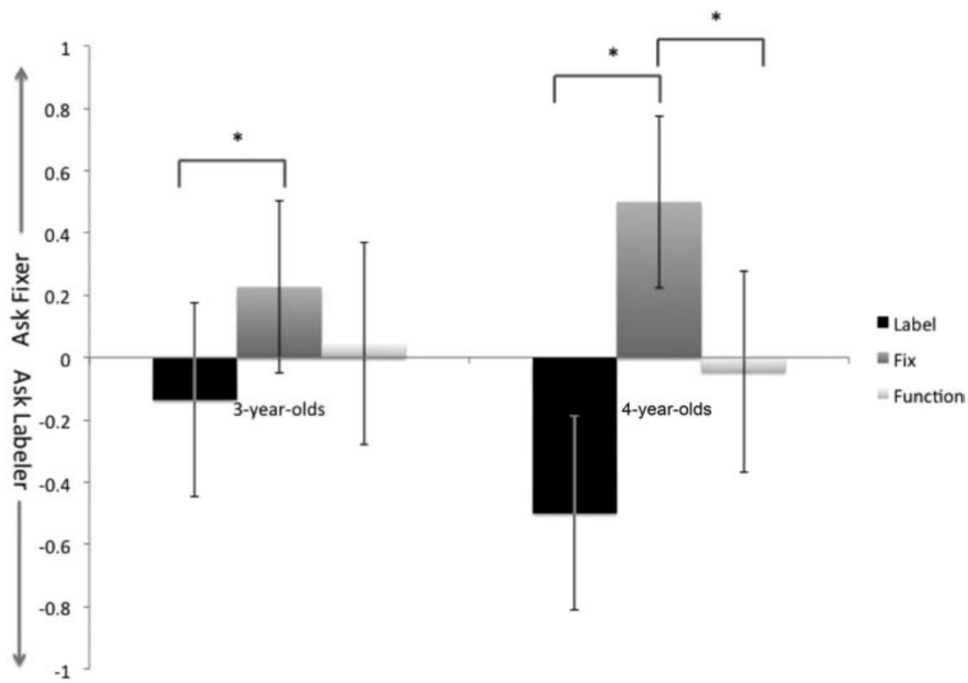

Figure 1. The results of Experiment 1. The bars represent the average responses to the two "ask" questions of each type (label, fix, and function) scored between –1 and 1. Negative numbers indicate that on average children preferred to ask the labeler and positive numbers indicate that on average children preferred to ask the fixer, and 0 indicates no preference for either informant. Error bars represent 95% confidence intervals of the mean from one-sample *t* tests, which indicate chance, above chance, or below chance performance. Asterisks indicate significant comparisons between question types within each age group (*t* tests, $p < .05$).

either informant. Comparisons between question types revealed that 4-year-olds (but not 3-year-olds) distinguished the function question from the other two questions; they asked the fixer about fixing more than about functions, $t(21) = 2.658$, $p = .015$, and were marginally more likely to ask the labeler about words than about functions, $t(21) = 1.936$, $p = .066$. This may be due to the fact that both the labeler and the fixer performed identical causal actions with the tools. The actions themselves, rather than the outcome of the actions, may have been sufficient to signal knowledge of artifact function, and successful outcomes were not necessary. In any case, this result indicates that 4-year-olds' inferences about the fixer's causal knowledge are selective to fixing and not to other more conventional forms of causal knowledge, such as artifact function.

To conclude, both 3- and 4-year-old children identified two informants with two different knowledge histories and used that information to direct requests selectively and appropriately—asking the informant with demonstrated causal ability to fix new broken toys, and asking the informant with demonstrated word knowledge about new words. There were also some developmental differences: both 3- and 4-year-olds distinguished between the two informants (i.e., they were selective in their requests), but only 4-year-olds were correct on both questions at above-chance levels, and only 4-year-olds were selective in their requests for causal information to the fixer (restricting it to fixing and not artifact function). This age difference is unlikely solely due to the ability to identify informants without corrective feedback, since eliminating the children who did not initially identify both informants did not change the overall pattern. One intriguing possibility, then, is that this age difference is domain-dependent—that 3-year-olds may be beginning to understand the difference between causal knowledge and word knowledge but that they are still uncertain of how to direct selective requests. They also may not yet appreciate the difference between specialized causal ability and conventional knowledge of artifact functions. This idea is supported by age differences found in prior related work (e.g., Keil, 2010; Sobel & Corriveau, 2010) and requires further study.

Experiment 2

The results of Experiment 1 showed that preschool children can track two contrasting histories—a history of causal ability and a history of labeling accuracy—and can use these histories to direct requests for new information selectively. Both 3- and 4-year-olds identified each informant and discriminated between them when deciding whom to ask for further information. Four-year-olds also consistently directed requests for new words to the informant who demonstrated word knowledge and directed requests to fix new broken toys to the informant whose verbal statements revealed ignorance, but whose actions demonstrated his causal ability. These results suggest that, just as successful causal actions are a critical source of information for children as they engage in causal learning (about objects and events), they may also be an important source of information for social learning (about the causal abilities of particular people).

It is important to note that 4-year-olds were not more likely to ask the fixer than the labeler about artifact function. Thus, their inferences about the fixer were selective only to fixing; they did not take his demonstrated causal abilities as an indicator that he had more knowledge of common causal conventions than the labeler. However, we do not know whether children believed the fixer's ability to be a singular talent (only to fix things) or whether they saw it as an indication of deeper causal knowledge, such as knowledge about nonobvious causal mechanisms (Gelman & Wellman, 1991; Sobel & Corriveau, 2010; Sobel et al., 2007).

Experiment 2 examines this question directly. Specifically, we asked whether children trust the fixer's expert knowledge of the unseen causes of mechanical failures. We showed children two informants, a "fixer" and a "nonfixer." In the history phase, the fixer was successful at fixing broken toys, and the nonfixer was unsuccessful (demonstrated actions and outcomes were similar to Experiment 1). During the test phase, in addition to asking about fixing new broken toys, we asked children about the fixer's knowledge of causal mechanisms. Both the fixer and nonfixer offered explanations for why an additional set of toys (distinct from those in the history phase) failed to activate. We then asked children to endorse one explanation. Moreover, to ensure that children would not necessarily prefer the fixer to the nonfixer to learn *anything* new (see discussion of such "halo effects" in Birch et al., 2008, and Koenig & Jaswal, 2011) we asked children from whom they would prefer to learn an unfamiliar object's label.

In Experiment 2, the informants were people presented on video, rather than puppets. Using videos allowed us to fully counterbalance the presentation of explanations and test stimuli. Additionally, it allowed us more control over the intonation of verbal statements—a concern based on research showing that children sometimes use confidence rather than accuracy as a cue to knowledge (Tenney, Small, Kondrad, Jaswal, & Spellman, 2011). Both of these changes were critical to ensuring that children did not endorse certain causal explanations because they sounded more believable a priori.

Method

Participants. The 16 participants were 4-year-olds (nine boys; $M = 52.9$ months, $SD = 4.6$ months) recruited from local preschools in a small university town. They were predominantly non-Hispanic, White, and middle-class.

Materials and design. The experimental materials included videos of two adults (one designated the fixer and one the nonfixer), eight novel toys, a screwdriver, and an additional novel object. Each adult on the video wore a brightly colored shirt (blue or red) for ease of identification. Videos were played using QuickTime software on a MacBook running OS $\times$ 10.6.5 (Apple Inc., Cupertino, CA). The four toys presented during the history phase were a toy boat, a toy turtle, a set of toy car keys, and a toy microphone. All toys were initially silent ("broken"), and all made noises if they were "fixed" with the screwdriver. Which adult was shown first was counterbalanced, and the pair and ordering of toys that each attempted to fix were Latin-square counterbalanced. Four more toys and one novel artifact were included in the test phase—a toy car, a toy cell phone with wheels, a toy camera, a toy that sang the alphabet, and a refillable sponge.

Procedure. Children were interviewed individually in a quiet corner of their preschool by a female experimenter, and interviews were videotaped. At the start of the interview, the experimenter sat next to the child and placed the laptop between them. Children saw four videos—two of the fixer and two of the nonfixer—with the order of the pairs counterbalanced across participants. Each adult was shown from the waist up sitting behind a table. On the table were a toy (one of the four listed previously) and a screwdriver. The experimenter introduced the videos by saying, "These are my friends," and before playing each video, she said, "I gave my friend [a/another] broken toy to fix." In each video, the adult would attempt to activate the toy, fail, pick up the screwdriver and animatedly try to fix the toy, and then try to activate the toy again. After the fixer attempted this action, the toy made a sound. After the nonfixer attempted this action, the toy remained inert. After viewing all four videos (two of the fixer and two of the nonfixer, each succeeding in fixing or attempting to fix two of the four toys) and before moving on to the test phase, children were asked to recall whether each adult had successfully fixed the toys. All the children answered these questions correctly.

In the test phase, the experimenter placed each of the test objects on the table one at a time and asked the child a series of questions. There were two ask-to-fix questions and two causal explanation endorsements, which were alternated with each other. The exact toy paired with each question was Latin-square counterbalanced. A label control question (about the refillable sponge) was included either in the middle or at the end of the series.

Ask-to-fix questions. The experimenter showed still pictures of the adults and said, "I have another broken toy here. Who should I ask to help me fix the toy?"

Causal explanation endorsements. The experimenter said, "I have another toy here. This toy is not working. Let's see what my friends think about this toy." Then children watched as each adult on the video offered an explanation for why the toy was broken. There were two sets of explanations, one set for each endorsement question. Which explanation set (Set 1: motor or batteries; Set 2: wires or gears) came first was counterbalanced; which adult offered the motor or wire explanation was counterbalanced as well.

- In Set 1, one adult said, "I think the motor has stopped moving." The other said, "I think this toy is out of batteries." Then the experimenter asked, "What's wrong with this toy? Is it the motor or the batteries?"
- In Set 2, one adult said, "I think the wires are disconnected." The other said, "I think the gears are out of sync." Then the experimenter asked, "What's wrong with this toy? Is it the wires or the gears?"

Label question. The novel object (refillable sponge) was placed on the table. The experimenter said, "I don't know what this thing is called. Who should I ask?"

The child's first response ("fixer" or "nonfixer" for all "ask" questions, and causal explanation choice for endorsements) was recorded, and no feedback was provided. Data were coded by the third author. A hypothesis-blind researcher coded a random subset (63%) of the responses, and agreement was 98%.

Results and Discussion

There were no differences between the responses to the two ask-to-fix questions or the two causal explanation endorsements (McNemar's tests, *ns*), so we summed responses across the two questions of each type. Responses to the two questions did not differ significantly from each other, $t(15) = 0.696$, *ns*. More important, as in Experiment 1, children chose to ask the fixer about fixing new toys significantly above chance, $t(15) = 4.392$, $p = .004$—on average, 1.56 out of 2 times ($SD = 0.51$). Moreover, children endorsed the fixer's causal explanations for failures significantly above chance, $t(15) = 3.416$, $p = .001$—on average 1.44 out of 2 times ($SD = 0.51$). Thus, children used the fixer's demonstrated causal ability (or the nonfixer's lack of causal ability) as an indication of specialized knowledge of causal mechanisms. This was not due to an overall bias to endow the fixer with *any* knowledge—only about half (9/16; 56%) of the children said they would ask the fixer for the label of a novel object (binomial test, *ns*). This result parallels the finding in Experiment 1; children were selective in their trust of the fixer, reliably endorsing his causal knowledge but not necessarily extending this to his knowledge of words.

General Discussion

This study demonstrates that, as in word learning, preschool children can use past history (in this case, causal ability) to distinguish between good and poor sources of causal information and that these distinctions influence how they direct selective requests to others. In Experiment 1, both 3- and 4-year-old children appropriately discriminated between a fixer's causal ability and a labeler's word knowledge in their requests for new information. In the second experiment, 4-year-olds endorsed a fixer's (over those of a nonfixer's) causal-mechanical explanations for why a new set of toys failed to work. Four-year-olds' inferences about the fixer were selective: they did not necessarily infer that the fixer had more knowledge than the labeler of causal conventions (i.e., artifact functions). They were also suggestive of a deeper inference about mechanical knowledge, as evidenced by children's endorsements of the fixer's causal–mechanical explanations irrespective of their content.

These results add to a growing number of studies that indicate how children monitor and use demonstrated knowledge in various domains outside word learning (Diesendruck et al., 2010; Einav & Robinson, 2010; Mills, Legare, Bills, & Mejias, 2010; Rakoczy, Warneken, & Tomasello, 2009). They also begin to address ways in which inferring causal knowledge might differ from inferring knowledge of words. One difference is in the type of information that can signal causal knowledge. Here we focused on one signal unique to causal learning, evidence from actions and their outcomes (Gopnik et al., 2004; Kushnir & Gopnik, 2005; Schulz et al., 2007). Our findings suggest that, for preschoolers, the same actions that provide knowledge about the causal structure of the world may also be a source of information about the causal knowledge of particular people.

Another difference is in the boundaries and scope of causal knowledge, which is often restricted to particular domains (Wellman & Gelman, 1998). It takes children many years to fully appreciate both the limits of causal expertise and the subtleties of how knowledge "clusters" in others' minds (Danovitch & Keil, 2004; Keil, 2010). Even so, our findings suggest that the beginnings of such an understanding are already present in children as young as age 3 years, and they may be initially based in part on very simple demonstrations of ability. We think it likely that, as a general rule, children's domain-specific causal knowledge plays a role in how they figure out the relationship between what others can do and what they know. Here we have demonstrated this phenomenon in the domain of physical causal knowledge. Similar demonstrations in other domains would be important to explore in future research.

Though this study emphasizes how children learn from what people *do*, it is not our intention to downplay the role of what people *say*. Many studies have shown that language—and causal-explanatory language in particular—becomes an important tool for causal learning during the preschool years. Preschoolers often ask questions, give explanations (Callanan & Oakes, 1992; Hickling & Wellman, 2001), and believe the explanations of others (Harris & Koenig, 2006). Moreover, they show some ability to distinguish good causal explanations from poor ones, and they seem to learn more from causal explanations that sound complete and plausible than those which are not (Callanan & Oakes, 1992; Frazier, Gelman, & Wellman, 2009). But preschoolers often resist revising their concrete, experience-based causal beliefs in the face of verbal testimony to the contrary (Carey, 1985; Vosniadou & Brewer, 1992). Thus, children do not blindly trust the causal explanations and instructions of others, and changing children's causal knowledge is not just a matter of telling them to believe otherwise. Here we have shown that establishing causal expertise through demonstrated ability makes children more trusting of others' causal explanations. There may be other ways in which demonstrated ability and verbal testimony interact in causal learning, all of which warrant further investigation.

This study adds to the growing number of investigations documenting children's selective social learning. Specifically, it suggests that preschool children have the capability, at least in principle, to bring their social knowledge (of people and culture) to bear on their causal and conceptual knowledge (of the physical and natural world). Whether and how they use this capability as they engage in active *social information gathering* (Baldwin & Moses, 1996) in their daily lives remains to be documented. In so doing, we may discover that children's social cognition is in large part responsible for their impressive early learning.

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