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How can I help? 24- to 48-month-olds provide help specific to the cause of others' failed actions

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Abstract

When young children see others fail to achieve a goal, they spontaneously help. But there are many reasons why someone might fail, and consequently, many ways to help. In order to help effectively, we need to understand why someone is failing, so we can address the cause. One important distinction is whether the failure is due to the agent's own actions or something external to her in the world. Here we show that 24- to 48-month-olds can use their past experience to reason about the probable cause of another person's failure and provide help appropriate for that cause. Children's help targeted the world when their prior knowledge suggested that the source of failure was external to the agent, and targeted the person's actions when this source appeared to be internal to the agent.

Keywords: social cognitive development; prosocial behavior; causal reasoning; theory of mind; helping

Introduction

Imagine a frustrated traveler at a train station, fumbling with a ticket machine. Chances are someone will offer help, but *how* this person helps might depend on the situation. If the helper sees that the traveler is inserting the bill in the wrong direction, she might kindly re-orient the bill; however, if the helper knows that the ticket machine is out of order, she might direct the traveler to another machine nearby.

Humans are remarkably helpful creatures from an early age (Tomasello, 2009). Although preverbal infants may not yet be able to offer help with ticket machines, they will pick up objects others have dropped and pass them back, and show someone struggling to reach inside a box an easier way to get in (Warneken & Tomasello, 2006). As in the ticket machine example, however, helping others is not only a decision of *whether* to help, but also a decision of *how* to help.

The decision of how to help is sometimes straightforward. When someone is struggling to hold open a door, there is typically only one way to help. In many contexts, however, it is not so clear what kind of help is needed. In order to figure out how to help others, we need to understand *why* someone is struggling. Critically, more often than not, it is up to the helper, rather than the helpee, to determine exactly what kind of help is needed. If the traveler knew the reason why she was failing to insert her bill, she might have already solved the problem. When deciding how to help, therefore, it is critical to determine the source of an actor's failure: whether the failure is due to the actor herself, or due to the external world.

We routinely make these judgments about our own failed actions. If everyone else bought a ticket from the machine but somehow you cannot, you are likely using the machine incorrectly. However, if everyone experienced occasional failure, perhaps the machine is not reliable. Furthermore, these inferred reasons inform our decisions about what to do next: if you are the source of your failure, you might seek help; if the machine is broken, you might try a different one.

Previous work suggests that even infants can infer the causes of their own failed actions, and respond appropriately to achieve their goals (Gweon & Schulz, 2011). In this study, children were given covariation evidence indicating either that a toy sometimes worked and sometimes did not (regardless of the agent), or worked for some agents but not others. In the former case, when children failed to activate the toy, they reached for a new toy, suggesting they attributed their failures to the toy and not to their own actions. In the latter case, they were more likely to hand the toy to their mother, suggesting they inferred that their failures were due to something about their own actions and not the toy. In this case, infants were able to determine the source of their failures because they had observed others' interactions with the toy. Without such information, they would not have been able to determine why they had failed; they might not know what to do without a knowledgeable agent's help. Critically, this agent's help would be most effective is she could directly address the cause of the child's failure.

Here, we ask whether young children can reason about the cause of *others' failures* to inform their decisions of how to help. There are reasons to believe that even very young children may be able to do this. Studies with toddlers and preschoolers suggest that young children can provide help not only when the helpee's needs are straightforward and observable (e.g., picking up dropped objects, Warneken & Tomasello, 2007), but also when her needs are more internal and abstract (e.g., beliefs, goals, competence). For instance, 12-month-olds are more likely to point out the location of a dropped object if their social partner has not seen it fall than when she has seen it (Liszkowski, Carpenter, & Tomasello, 2008); 18-month-olds can use their social partner's prior experience to infer different goals from the same failed action and help her achieve that goal (Buttelmann, Carpenter, & Tomasello, 2009). Preschoolers (42-month-olds) can reason about other peoples' action capabilities to predict from whom someone else will ask for help (Paulus & Moore, 2011), and even anticipate that their social partner needs help before she does and pre-emptively intervene to help her achieve her ultimate goal (Bridgers, Jara-Ettinger, & Gweon, 2016; Martin & Olson, 2013).

However, inferring the possible causes of others' failed goal-directed actions might be more challenging than reasoning about the goals themselves, as the child must decide between (at least) two competing hypotheses which may or may not be observable in the failed action itself. Furthermore, us-

ing this inferred cause to generate the appropriate helpful behavior is also a nontrivial task, and arguably more difficult than helping in contexts in which there is one clear way to help. Even though prior work suggests that preverbal infants can make these inferences about *their own failures* and decide what to do to achieve *their own goals*, applying the same inferences to others' actions and providing the most effective help may be more challenging. Indeed, there is a body of research suggesting that reasoning about one's own actions may precede, and is a necessary precursor to, reasoning about others (e.g., Sommerville & Woodward, 2005; Sommerville, Woodward, & Needham, 2005).

The current study investigates 24- to 48-month-olds' abilities to reason about the causes of others' failed actions and offer help accordingly. Children observed an adult fail to activate a toy because she either (a) used the toy incorrectly, or (b) chose a faulty toy. We then gave children the choice to help by either handing the person a working toy or by demonstrating the correct way to use the toy. Individually, both options were perfectly reasonable ways to help, and within the repertoire of behaviors children have exhibited in prior work (e.g., Warneken & Tomasello, 2006). The critical question here, however, is whether children will provide help that best addresses the likely cause of this person's failure (i.e., the toy or her own actions).

Experiment

In our experiment, we created a situation in which children were faced with two ways to help. We manipulated the cause of the helpee's failure, which made one way more effective than the other. We recruited 24- to 48-month-olds, who were slightly older than children in other studies that reported spontaneous helping behaviors (e.g., Warneken & Tomasello, 2006; Cortes Barragan & Dweck, 2014), as the ability to help others appropriately based on the cause of their failure might require richer representations about others' goal-directed actions and more sophisticated inferential abilities.

Methods

Participants Fifty-two 24- to 48-month-olds ($M(SD) = 2.78(.48)$yrs, 44% female) from a museum in Palo Alto, CA participated. An additional 15 children were excluded from analysis due to parental interference (n = 9), experimenter error (n = 1), shyness (n = 3), or lack of video recording (n = 2). We randomly assigned children to one of two conditions: the Broken Toy condition (n = 26; $M(SD) = 2.78(.54)$yrs) or the Wrong Action condition (n = 26; $M(SD) = 2.78(.43)$yrs).

Stimuli We constructed 3 identical-looking toys. One side of each toy was covered in yellow felt and had a yellow button in the center. The opposite side was covered in red felt and had a red button in the center. The yellow button on two toys played music, while the yellow button on the third toy was inert. On all 3 toys, the red buttons were always inert. The toys were placed on a white-plastic tray and covered with grey felt. See Figure 1 for a schematic of the toys and procedure.

Procedure The experiment began with a *warm-up phase* in which a confederate and experimenter engaged the child in reciprocal games (e.g., rolling a ball back and forth through a tube) in order to help the child feel comfortable with the researchers, and promote general helping behavior (see Cortes Barragan & Dweck, 2014). After approximately 5 minutes of warm-up, the confederate excused herself from the room, explaining that she had work to do.

Next came the *play phase* in which the child gained experience with the toys. The experimenter did not pedagogically demonstrate how the toys worked, but instead behaved as if she were exploring the toys and discovering what they did. She took one toy out at a time and showed it to the child. In the Broken Toy condition, the toys were oriented such that the yellow side was on top. She noticed the yellow button, pressed it, and reacted positively to the music that played. She also encouraged the child to press the yellow button and again reacted positively, saying, "Music! The yellow side plays music!". She then turned the toy around in her hands until she discovered the red button on the opposite side, and expressed mild surprise, as if she did not expect it to be there. She pressed the red button and also encouraged the child to do so, acting perplexed and disappointed that it did not play music. The experimenter then took the second toy out, which she and the child explored in the same way (i.e., the experimenter pressed each button, and then encouraged the child to do so). This second toy was always the broken toy, so neither button played music. This process was repeated with the third toy, which functioned the same as the first (i.e., the yellow button played music, but the red button did nothing). The child and experimenter then explored each toy again, taking turns pressing the buttons. In the Wrong Action condition, everything was the same except that the toys were placed with the red side up, such that the red button was discovered first, and then the yellow. By the end of this phase, all children experienced that pressing the yellow buttons on two of the toys played music (and one was inert), and that none of the red buttons played music.

In the *helping phase*, the experimenter placed toys back on the tray and covered them with the felt. The toys were placed as they were during the play phase: yellow-side-up in the Broken Toy condition, and red-side-up in the Wrong Action condition. The child sat approximately 6 ft away from the tray, either by him-/herself or with a parent. The experimenter then called the confederate back into the room and explained that she and the child were playing with toys that played music. The confederate said, "I love music!" and knelt down behind the tray, facing the child. She appeared to select a toy at random from behind the felt; the child could not see which toy was chosen.

The confederate then moved the tray (which contained 2 of the 3 toys, covered by the felt) off to one side (counterbalanced) and placed her chosen toy in front of her. She pressed the button on top (the yellow button in the Broken Toy condition; the red button in the Wrong Action condition), and the

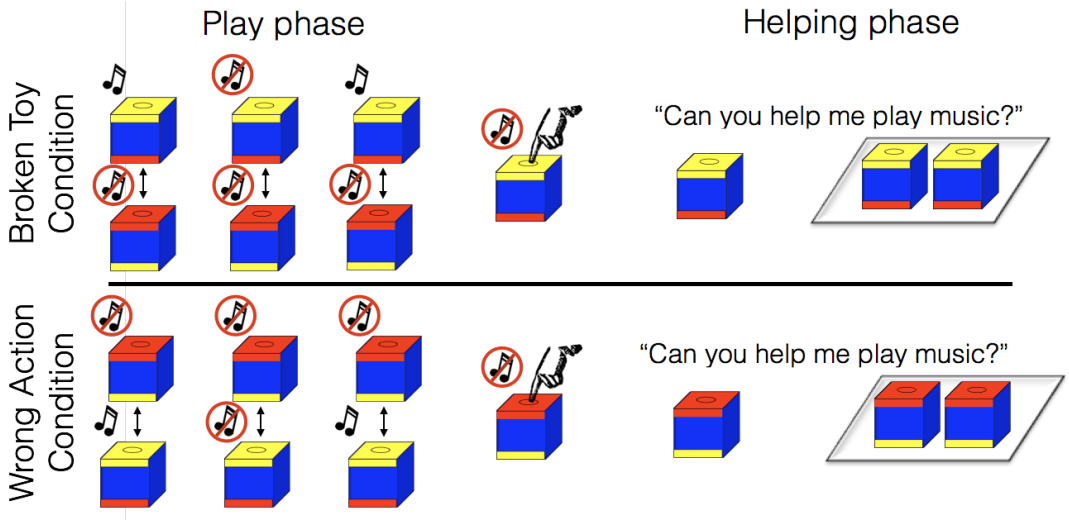

Figure 1: Schematic of the *play phase* and the *helping phase* and the toys used in both conditions.

toy did not play music. The confederate remarked, "Hmm, no music!" and pressed the button again, expressing disappointment and saying, "Still no music! I really want to play music!" She then put one hand on the tray, and at the same time, slid her toy with the other hand such that it was parallel with the tray but on her opposite side. Once the toy and tray were equidistant from the confederate, she removed her hand from the toy and removed the felt from the tray to reveal the two other toys. She then gestured to both the toy and the tray and asked, "Can you help me play music?" The toy and tray were far enough apart (approx. 2 ft) and from the child (approx. 5 ft) that s/he could not approach both simultaneously.

If the child did not respond, the confederate and experimenter provided planned prompts, waiting 5 seconds in between, until the child responded. The last of these prompts involved the confederate moving closer to the child (approx. 2 ft.) and placing the tray and the toy within the child's reach but still far enough apart that the child could only reach to one location at a time.

In summary, the only difference across conditions was whether the non-obvious button (i.e., the button on the bottom of the toy) that the experimenter revealed to the child during the course of the *play phase* was non-functional (Broken Toy condition) or functional (Wrong Action condition). In both conditions, the confederate pressed the obvious button (i.e., the button on top) and the toy did nothing.

Coding We were interested in children's first helping response *after* the confederate's failure to activate the toy (i.e., her first button press). The key dependent measure was the target toy of this behavior, coded as either the "confederate's toy" or the "toys on the tray". All children who responded fell into one of these two categories.

Additionally, we looked at the consequence of children's first helping responses. We coded whether their behavior was "successful or "unsuccessful" in achieving the confederate's goal of playing music. In the Broken Toy condition, a child's first response was coded as "successful" if the child pressed the yellow button on a toy from the tray or directed the confederate to press it (e.g., telling her to do so; handing or pointing to a toy yellow side up); "unsuccessful" responses included pressing or directing the confederate to press the red button on any toy or the yellow button on the confederate's toy. In the Wrong Action condition, a behavior was coded as "successful" if a child flipped and pressed the yellow button or directed the confederate to do so (e.g., telling her to press it, flipping a toy and handing or pointing to it yellow-side-up). Thus, in the Wrong Action condition, a behavior could be successful regardless of which toy a child's first response targeted, whereas in the Broken Toy condition, only behavior directed toward the toys on the tray could be successful. The first and second author transcribed and coded children's behavior and a researcher blind to the hypotheses coded these transcriptions for reliability; agreement was 100%.

Predictions and Results

Children in both conditions saw the same set of toys and a confederate fail in the same way (she pressed an obvious button on top of a toy and it did not play music). Furthermore, in response, all children could approach either the confederate's toy or a toy on the tray. What differed across conditions was the likely cause of the confederate's failure. We manipulated the source of failure by varying whether the obvious button on top of the toy was functional on 2 of the 3 toys (i.e., yellow button; Broken Toy condition) or non-functional on all 3 toys (i.e., red button; Wrong Action condition).

We predicted responses to vary across conditions depending on the source of the confederate's failure. In the Broken Toy condition, the likely reason for her failure was the *toy* and not her own action. Thus, it was more helpful to get a new toy (a toy on the tray) than to act on the confederate's toy. In the Wrong Action condition, however, the likely reason was the confederate's *action* and not the toy, suggesting that children could help by approaching the confederate's toy to correct her action (there was less need to get a new toy). Thus, we predicted that more children would approach the "toys on the tray" in the Broken Toy condition than in the Wrong Action condition. As predicted, children were significantly more

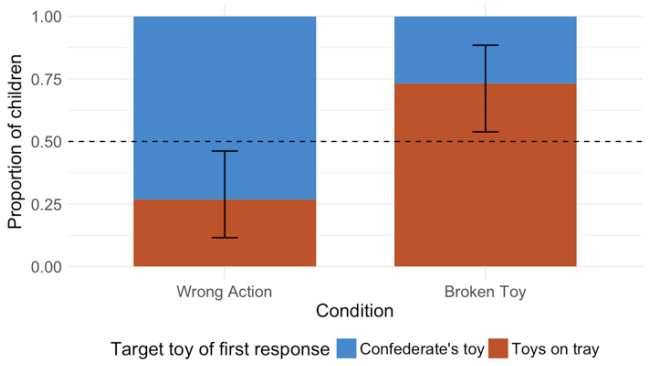

Figure 2: Proportion of children whose first response was directed to the confederate's toy (blue) or the toys on the tray (red) in the *helping phase*. Error bars: bootstrapped 95% CI.

likely to direct their help toward a toy on the tray in the Broken Toy condition than in the Wrong Action condition (73% vs. 27%; two-tailed Fisher's Exact Test, $p = 0.002$).

We then looked at children's responses within each condition. In the Broken Toy condition, it was clear that the confederate was acting on the broken toy, and that children could offer help only by approaching a toy on the tray. No action on the confederate's toy could yield music. We thus predicted that children in this condition would preferentially direct their help toward a toy on the tray. Indeed, children were more likely to approach the "toys on the tray" than the "confederate's toy" (19/26; two-tailed binomial test, $p = 0.029$).

In the Wrong Action condition, children could, in principle, help the confederate by showing the yellow button on either the confederate's toy or a toy on the tray. In fact, unlike in the Broken Toy condition, the outcome of their help was probabilistic, as there was a 33% chance that any toy children chose to flip over would be broken. However, there were reasons to expect a preference for the confederate's toy in the Wrong Action condition. First, children might have been inclined to approach the toy on which the confederate had just acted. Second, by acting on the object with which *she* failed, children can guarantee that they are offering help to achieve her *specific* goal to activate that toy. Finally, while approaching a toy on the tray changes two variables (both the object and the agent), by acting on the confederate's toy, children can more clearly disambiguate the cause of her failure. Thus, we expected that children might show a mild preference for the confederate's toy, although we did not have a strong a priori prediction. The results showed that the majority of children in the Wrong Action condition did approach the "confederate's toy" (19/26, two-tailed binomial test, $p = 0.029$). See Figure 2 for a summary of children's first responses.

Our secondary measure of interest was the success of children's helping responses (i.e., did their help enable the confederate to achieve her goal of playing music?). Successful behavior in the Wrong Action condition was arguably more complex than in the Broken Toy condition, as children had to reveal the non-obvious button on the bottom of a toy. In the Broken Toy condition, children simply had to point out another obvious button on a different toy. Despite this difference, children's help did not differ across conditions (two-tailed, Fisher's exact test, $p = 0.01$) and was remarkably successful overall. The majority of children engaged in successful helping behavior (44/52, 85%), and this trend was consistent within each condition (Broken Toy: 19/26, 73%; Wrong Action: 25/25, 100%). In the Broken Toy condition, children's help could only be successful if they approached the "toys on the tray". Of the children who did this, 100% of them were successful. In the Wrong Action condition, children's help could be successful if they approached either the "toys on the tray" or the "confederate's toy". One child was dropped from this analysis because the camera angle prevented clear visual access to the nature of her helping behavior, but all children included provided successful help.

Finally, as an exploratory analysis, we re-coded children's first responses as "correct" (Broken Toy: "toys on tray"; Wrong Action: "confederate's toy") or "incorrect". We fit a generalized linear model with correctness as the outcome variable, condition as a categorical predictor variable, and age as a continuous predictor variable. This analysis revealed no difference in children's tendency to behave "correctly" by condition or age (condition: $\beta = -.364$, $z = -.471$, $p = .638$; age: $\beta = 1.533$, $z = 1.614$, $p = 0.107$).

Discussion

Our results suggest that 2- and 3-year-old children were able to infer the likely cause of another person's failure and offer help that appropriately addressed this cause. Rather than simply helping the confederate with the toy she previously tried but failed to activate, or offering her a new toy across the board, children selectively approached the confederate's toy or a new toy depending on the *source* of the confederate's failure. More specifically, when children's prior knowledge suggested that the confederate was failing due to something about the world (e.g., a faulty toy), they provided help that changed this external variable (i.e., acting on a new toy in the same way). But when her own action was the likely culprit, children helped by keeping the world constant and showing her the correct action to take (i.e., acting on the same toy but in a different way). Moreover, beyond simply directing their help toward the likely cause, they provided assistance that successfully fulfilled the confederate's goal.

These results support the idea that young children are not just motivated to help (Tomasello, 2009); they are also motivated (and able) to provide help that is appropriate and effective. From a brief training with the causal structure of simple toys, children as young as 2 years of age were able to use their prior experience to infer the cause of the actor's failure, and intervene in a way that specifically targeted this cause.

In the Broken Toy condition, the toy was clearly the cause of the confederate's failure, and the only way to help was

to get her a new toy. In the Wrong Action condition, the confederate's action was clearly the cause of her failure, but there was more than one way to help: you could show her the right action on her toy or another toy. Children in this condition appeared sensitive to this response ambiguity. Although most children approached the confederate's toy (19/26; 73%) and revealed the functional button on the bottom, some (7/26; 27%) approached the toys on the tray and flipped one of these toys over instead. Therefore, although the children who approached the tray may have thought the confederate's toy was broken, their behavior suggests they still attributed the confederate's failure to her action.

Though children in the Wrong Action condition could have helped the confederate by revealing the functional button on the confederate's toy or on a toy from the tray, children still preferentially approached the confederate's toy. While this tendency could be a simple inclination to approach a toy that someone else has chosen before, it could also reflect more sophisticated reasoning about how best to help the confederate. First, showing the confederate the correct action on the same toy directly helps her achieve her specific goal of making *that* toy play music. Second, by acting on the confederate's toy, children can effectively hold the "toy" variable constant and vary just the "action" variable. Thus, even though the probability of providing effective help is the same (67%) for any of the toys, the outcome of the action is more informative when the child acts on the confederate's toy. If this action is successful (i.e., the toy plays music), then the confederate's action was wrong; if this action is unsuccessful, the confederate has a broken toy. By contrast, acting in a new way on a different toy can only be informative for the confederate if the action is successful. The exact reasoning underlying children's preference for the confederate's toy remains unclear and is an avenue for future work.

The content of children's helping behavior provides a more nuanced picture of their reasoning about the confederate. Children not only seemed to reason about the confederate's observable, failed action but also her internal mental states. In the Broken Toy condition, all of the children who successfully helped indicated that the confederate should try to press the yellow button on one of the toys on the tray. However, none of these children provided exhaustive information about the functionality of the toys (i.e., they did not reveal the nonfunctional red button on the bottom). This suggests that the children were sensitive to the fact that the confederate's goal was to play music, rather than to learn how the toys worked. This finding is consistent with prior research showing that 4- to 5-year-olds adjust the amount of information they provide depending on whether their social partner wants to know *how* a toy works or simply wants to *see* what the toy does: children were more likely to provide information that fully disambiguated the causal system for the former than for the latter goal (Gweon, Chu, & Schulz, 2014). Would children in our current age range similarly demonstrate the other side of the toy if the confederate expressed a desire to learn how the toy works? This is an interesting question we might explore in future studies.

In addition to reasoning about the confederate's goal, it is possible that children were reasoning about her knowledge and beliefs. This possibility is particularly salient in the Wrong Action condition. The confederate held the incorrect expectation that the red button played music and expressed frustration upon failure. Thus, a rich interpretation of children's helping behavior (in this case, flipping over the toy) is that they acted on the toy to correct the confederate's false belief. Although considerable evidence from the literature on Theory-of-mind development suggests children are unable to represent others' mistaken beliefs until around age 4 (e.g., Gopnik & Slaughter, 1991; Wellman, Cross, & Watson, 2001), some work suggests children the age of our participants might be capable of such belief reasoning, especially in contexts in which they are motivated to help others (Buttelmann et al., 2009; Southgate, Chevallier, & Csibra, 2010).

Although this is an interesting possibility, it is important to note that it was not necessary to attribute a mistaken belief to the confederate in order to provide appropriate help in our task. Children could have selected the appropriate action by simply attributing ignorance about the functionality of the toys instead of a false belief. Thus, understanding the exact nature of the representation that motivated children's behavior remains an important question for future research.

The absence of age-related trends raises the question of *when* children might be able to offer help that addresses the cause of others' failed actions. As previously discussed, 16-month-olds are capable of distinguishing between external and internal sources of their own failed actions and will intervene accordingly (Gweon & Schulz, 2011). Our current work extends these findings in an important direction, suggesting that the causal inference that supports how we respond to our own failed actions may also support how we help others remedy theirs. Thus one might naturally ask: Would 16-month-olds also use this reasoning to choose how to help?

In order to succeed in our task, children must (1) have the ability to infer the cause of failure for others' goal-directed actions, (2) have the knowledge to figure out how best to help, and (3) select and execute the more effective action. One possibility is that even though preverbal infants can reason about the cause of agents' failures, they may fail to recruit this reasoning in helping decisions due to constraints in their working memory or executive function. Additionally, prior work suggests that although one-year-olds can provide help when the helping action is constrained, they struggle when the situation is more open-ended (Svetlova, Nichols, & Brownell, 2010). However, it is possible that we may find similar abilities in infants in a simple paradigm that minimizes such demands. We are currently exploring this possibility.

Finally, our findings have implications for understanding the nature of early instrumental helping. Much of the prior work on the development of helping behavior has focused

on *whether* and *why* young children help (e.g., Warneken & Tomasello, 2006; Cortes Barragan & Dweck, 2014; Svetlova et al., 2010). Though our experiment instead focuses on the *how* of early helping, it is still reasonable to ask whether children in our task were really offering help to the confederate or if they responded for another reason, such as a desire to socially interact, or a personal desire to hear the music (see Paulus & Moore, 2012). Although the selectivity in children's helping responses in our study provides suggestive evidence that children were not simply motivated to interact with the confederate, our experimental design does not allow us to completely disentangle the different possible motivations behind their helping behavior. However, this distinction is not critical for our current purposes. Our main interest in this study was whether children can infer the likely cause of others' failures, and whether such causal reasoning can lead to behaviors that are consequentially effective in helping others achieve their goals.

In fact, children's behaviors in our study suggest that another important motivator for our prosocial behaviors may be our curiosity and desire to understand causal relationships (Gopnik, 1998). When we see someone struggling at the ticket machine, we might want to help not only because we want to help her but also because we want to know *why* she is failing. Children in our study might have been motivated by similar reasons; such actions would not only help others achieve their goals but also help children themselves learn about the world.

By using what we know, we can better help others. Although deciding how to help in the real-world can be a challenging, open-ended problem, humans can figure out why others fail and the best way to help. Our work suggests that even toddlers are able to solve this problem using their own experience as a guide. While young children are constantly helped and taught by others, the ability to harness this knowledge to figure out how to effectively help others themselves is present early in life.

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