Proactive help-seeking: Preschoolers know when they need help, but do not always ask for it

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Abstract

Help-seeking can be costly, particularly when help is not truly needed. Children typically seek help after encountering difficulty with a problem, but little is known about whether children can accurately judge whether they will need help with a problem prior to attempting it. Anticipation of a need for help requires children to assess both the problem and their existing knowledge of it; if an existing skill applies to a new problem, they should not need to seek help from a teacher. In four experiments, 151 3–to 5-year-olds were taught the solution to a puzzle box and decided how to approach subsequent boxes that were identical to (in perceptual appearance and name) or different from the initial box. Children successfully predicted that they would need help with different, but not identical, boxes. Other factors that may affect children's willingness to seek help are discussed.

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1. Introduction

From a very young age, children exhibit a persistent curiosity about the world around them. They take an active role in their learning, gathering information both by directly experimenting on their surroundings and by seeking it out from others. Free exploration offers many learning benefits. For example, direct intervention with objects helps children to understand causal relationships (e.g., Cook, Goodman, & Schulz, 2011; Schulz & Bonawitz, 2007). Sometimes, children even learn more about objects or problems through unguided exploration (as opposed to direct instruction), because instruction may restrict their focus to the highlighted features (Bonawitz et al., 2011).

Although free exploration can be extremely fruitful, it is also limited. Regardless of how persistently they explore the world, children are unlikely to learn about some things – for example, invisible things (e.g., germs), internal properties, and cultural traditions. Children must consult others to gain such knowledge. Moreover, some problems may be impossible for children to solve themselves, due to low skill level, lack of knowledge, or a need for collaboration. Social learning enables children to both expedite their information gathering and access information they would be unable to obtain on their own. Children are aware of the rich body of knowledge that adults possess and do not hesitate to query them (e.g., Callanan & Oakes, 1992; Frazier, Gelman, & Wellman, 2009). As one striking example, children under the age of five ask an average of 76–95 questions per hour (Chouinard, 2007). In asking questions, children are essentially asking for others’ help in solving some problem – be it what something is called, how something works, etc.

Previous work has demonstrated that preschool-aged children readily seek help from others after encountering difficulty with a problem. For example, preschoolers will request an experimenter’s help when they are unable to assemble a pictured

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toy (Vredenburgh & Kushnir, 2015) and they are more likely to seek help with perceptual identification problems whose solutions they are uncertain of (Coughlin, Hembacher, Lyons, & Ghetti, 2014). Even infants seek appropriate help after encountering a simple toy that does not work (Gweon & Schulz, 2011) and will selectively seek help from “good” helpers (Cluver, Heyman, & Carver, 2013).

It remains unclear, however, whether children have the foresight to proactively ask for help with a new problem. In previous studies, children have already attempted to solve some problem themselves and encountered difficulty; it is thus logical that they should then seek others’ help. Such reactive help-seeking requires that children have some awareness that their efforts are unsuccessful and that a knowledgeable other can help them to reach success. Proactive help-seeking, on the other hand, involves recognizing that help is necessary prior to attempting a problem. As such, proactive help-seeking likely relies upon a suite of cognitive abilities. Children need to inhibit any prepotent bias to immediately tackle a problem (which may be particularly difficult with hands-on or otherwise compelling problems). They must also possess some knowledge of their own abilities and use it to determine whether they are capable of solving the problem at hand. This involves analyzing the current problem and detecting any similarities with previous problems.

Being unable to accurately predict when you need help with a problem can be quite costly. Seeking help for problems you are already equipped to solve is not only redundant, but it strips you of the opportunity to test your skills and knowledge (and to potentially prove mastery to yourself and others). Moreover, seeking help may take more time than solving the problem yourself and the helper may expect some portion of any rewards that were generated as a result of their helping (or, worse yet, the helper may be less equipped to solve the problem than you are!). Conversely, failing to seek help for problems whose solutions you do not know may result in the total loss of a reward and the time spent in trying to solve the problem. You also forfeit the opportunity to learn how to solve the problem (and similar problems) in the future. The ability to recognize whether solutions from previous problems apply to new situations allows us to avoid these potential issues.

Recent work suggests that proactive help-seeking may have its roots in infancy. When 20-month-old infants had to indicate the location of a hidden toy – but were actually ignorant of its true location – they were able to withhold immediately responding and instead asked a knowledgeable caregiver for help (Goupil, Romand-Monnier, & Kouider, 2016). Infants were less likely to ask for help when they had seen where the toy was hidden, though they sometimes asked for help when they had to respond after a delay (adding a delay presumably made the task more difficult, as infants had to hold the toy’s location in memory for a longer amount of time). It remains an open question, however, whether children’s performance would be similar for more complex tasks. Infants in the Goupil et al. (2016) study learned about the location of a hidden object, but did not learn potential problem-solving skills (i.e., knowing where a toy is hidden in a given trial would not provide any insight as to where it was hidden – or whether you should ask for help – in later trials).

Research on children’s learning suggests that preschool-aged children may possess the necessary tools to engage in proactive help-seeking in complex tasks. Indeed, preschoolers can make informed decisions within social learning contexts. The testimony literature demonstrates that children know whose help to accept when offered it by multiple people. Preschoolers evaluate the trustworthiness of potential sources and prefer to learn from reliable, accurate others (e.g., Harris, 2012; Koenig & Harris, 2005; Pasquini, Corriveau, Koenig, & Harris, 2007). This ability is in place by the preschool years and it continues to improve with age (Corriveau & Harris, 2009; Corriveau, Meints, & Harris, 2009; Einav and Robinson, 2011; Mascaro & Sperber, 2009; Robinson, Haigh, & Nurmsoo, 2008). Research on pedagogy also suggests that children are sensitive to an informant’s intention to teach and treat pedagogically-presented information (information accompanied by specific social-ostensive cues, such as eye contact, motherese, or joint attention) as particularly important and generalizable (Bonawitz et al., 2011; Butler & Markman, 2012; Csibra & Gergely, 2009; Gergely, Egyed, & Király, 2007; Shafto & Goodman, 2008; Shafto, Goodman, Gerstle, & Ladusaw, 2010).

Furthermore, preschoolers possess some preliminary metacognitive abilities, which could help guide their predictions about whether they will need help with a problem. Although young children tend to overestimate their skill level or performance, e.g., in memorization tasks (Flavell, 1979; Flavell, Friedrichs, & Hoyt, 1970), they are able to reflect upon their uncertainty (termed uncertainty monitoring). This ability also improves across the preschool years. By three years of age, children report that they are more certain of their responses in a picture identification task when these responses are correct than when they are incorrect (they are not given feedback on the accuracy of their responses). Moreover, four- and five-year-olds do not express less confidence in certain responses merely because they took longer to produce than other responses (though response latency appears to directly inform three-year-olds’ confidence judgments; Lyons & Ghetti, 2011, 2013). Older preschoolers also tend to withhold a response instead of providing an answer they are unconfident about (Lyons & Ghetti, 2013). Thus, even three year olds have some awareness of their confidence in their ability to solve a specific problem. This ability may directly inform their decisions about proactive help-seeking. Children may decide to forgo help because they have high confidence in their ability to solve a problem; conversely, they may be more likely to seek out help if they are uncertain of their ability to solve a problem.

The current study investigates preschoolers’ a priori predictions of their need for help – that is, whether they recognize if they need help with a problem before they are given the chance to attempt it. We compare children’s help-seeking for problems of a same or different kind than a problem whose solution they have previously learned. Previous research suggests that children are sensitive to kind information starting at an early age. By 9 months of age, infants expect perceptually similar toys – but not dissimilar toys – to possess the same nonobvious properties (Baldwin, Markman, & Melartin, 1993). As children age, their inductive abilities become more sophisticated and they use cues beyond perceptual similarity (such as labels, animacy status, or traits) to guide their generalizations (e.g., Gelman & Markman, 1987; Heyman & Gelman, 2000; Massey &
Gelman, 1988; Xu & Tenenbaum, 2007). This suggests that preschoolers should be able to identify whether problems belong to the same kind, by attending to structural or perceptual similarities between them. An unresolved question is whether children can use kind information to appropriately guide their help-seeking.

In our paradigm, children see a set of puzzle boxes, but are only taught the solution to a single box (the “target box”). They then have to make decisions about test boxes that they know are either identical to the target box (same-kind condition) or completely different from the target box (different-kind condition). If children are sensitive to the boxes’ category membership, they should decide to ask for help in the different-kind condition, but not in the same-kind condition. We explored whether children engage in proactive help-seeking, how this help-seeking is affected by kind status, and how it changes over the preschool years.

2. Study 1

Study 1 explored whether children 3–5 years of age can appropriately predict whether they would need help with a given problem. We taught children a skill (how to open a certain kind of puzzle box) and presented them with other puzzle boxes that were either of the same or a different kind. We asked them whether they would be able to solve these subsequent boxes on their own or whether they would need the experimenter’s help. Children made these judgments without any direct, hands-on experience with the boxes, and were not given the opportunity to act on their predictions. We explored whether children would be more likely to report needing help with different-kind than same-kind boxes, as well as whether this tendency would increase with age.

2.1. Methods

2.1.1. Participants

The final sample consisted of 39 preschool-aged children: 12 3-year-olds (7 girls, 5 boys, Mage = 3.5 years, age range: 3.0–3.9 years), 15 4-year-olds (7 girls, 8 boys, Mage = 4.5 years, age range: 4.0–5.0 years), and 12 5-year-olds (7 girls, 5 boys, Mage = 5.6 years, age range: 5.0–6.0 years). Six additional children were dropped from analysis (5 girls, 1 boy, Mage = 4.5 years, age range: 3.1–5.6 years): 4 children’s parents or siblings answered test questions for them and 2 children did not follow directions. Participants were recruited from an urban science museum.

2.1.2. Materials

We created a set of eleven types of puzzle boxes (Appendix A). Each box contained a reward—a quarter-sized token that could be used to activate interactive banks such as a plush gorilla or a plinko machine that either made noise, moved, or both. The puzzle boxes were designed to meet the following criteria: (1) they require several steps that must be performed in a set order to open the box; (2) children should be unable to discover the box’s solution through their own exploration, but (3) be able to learn how to operate the boxes after only 1–3 demonstrations (see Table A1 for details). The boxes were pretested to ensure that they met these criteria (see Appendix B for details). Some of the boxes were ‘rigged,’ making them impossible to open (these are marked ‘inactive’ in Table A1); however, these boxes were still manipulable in several ways.

For Study 1, we used the following four puzzle boxes: Dumbbell, Roundabout, Stick, and Flap boxes. The three interactive banks used were a plush gorilla that made noise and moved its mouth, a pig that made noise and walked around, and a ‘plinko’ style bank in which tokens could ‘land’ on one of two Toy Story characters. All three banks were used during the study; when children received a token, they were allowed to choose which bank they wished to activate.

2.1.3. Item effects

Because different kinds of boxes were used in the different-kind condition of each study, we tested whether participants’ responses were associated with box type (within each study), using a series of Mann-Whitney U tests. For example, in Study 1, we compared children’s responses to each of the different-kind boxes (roundabout and flap). We found no significant difference (U = 814.0, Z = 1.4, p = 0.16), suggesting that children’s responses were not influenced by one different-kind box (roundabout) more than any other (flap). No item effects were found in any of the studies (all p’s > 0.05), so box type was not included in our subsequent analyses.

2.1.4. Study design

This study and all subsequent studies used a within-subjects design. Each child participated in both the same-kind and different-kind conditions. Test trials were presented in blocks, with the order of the blocks counterbalanced across participants. Both blocks used the same set of boxes.

2.1.5. Procedure

The experimenter placed five boxes on a table in front of the children: one target box, placed in the center and two sets of two boxes on either side of the target box. The boxes in one of these sets were completely identical to the target box (henceforth referred to as the ‘same-kind boxes’), whereas the boxes of the other set were completely different from both the target box and each other (‘different-kind boxes’). A sample set of boxes is depicted in Fig. 1. The experimenter then told participants: “These boxes are not like normal boxes – they are puzzle boxes, and they can be kind of hard to figure out. But
you know what? I made the boxes, so I know how they work.” This dialogue was used to help set up the expectation that the boxes would be difficult to solve, as well as to emphasize the experimenter’s expertise.

The experimenter then demonstrated how the target box worked by opening it and retrieving a token (which the child was allowed to place in one of the banks). Next, the boxes were given novel labels (e.g. “chatten”). The target box was always labeled first, followed by either the same-kind or different-kind boxes. Consistent with their appearance, the same-kind boxes received the same label as the target box (e.g. all were chattens), whereas the different-kind boxes each received unique labels (e.g. “tulver” and “virdax”). After the experimenter labeled the boxes, children were asked to produce the label for the target box and to identify the labels for each of test boxes (i.e., they were asked “Is this one a chatten or is it a virdax?”). If children answered incorrectly, the experimenter corrected them and proceeded to the next box. We used these labels to further emphasize the fact that the same-kind boxes were identical to the target box and the different-kind boxes were completely different; this information was also easily perceptually available. Thus, children had two cues (linguistic and perceptual) on which to base their category judgments. Previous research suggests that these cues should enable children to make accurate category and function judgments about new items (e.g., Gelman & Markman, 1986, 1987; Jaswal, 2006; Nelson, Frankenfield, Morris, & Blair, 2000).

The experimenter then asked participants whether they thought they could open each of the non-target boxes by themselves, or whether they would need the experimenter’s help. For each set of boxes, the experimenter reminded the children, “I showed you how to open this one [target box], so you know how this one works” and then probed, “Could you open this one [same-kind or different-kind Box 1] all by yourself, or would you need me to help?”, followed by asking “How about this one [same-kind or different-kind Box 2] – could you open it all by yourself or would you need me to help?” The study ended once children provided answers for all of the boxes. As we were primarily interested in children’s predictions of their ability to open the different kinds of boxes, participants in this study were not provided the opportunity to interact with the boxes.

Children were presented four test trials altogether (with each box used for a single trial): two in the same-kind condition and two in the different-kind condition. The order of presentation and location of the boxes (i.e., left or right of the target box) were counterbalanced across participants.

2.1.6. Analyses

For this study and all subsequent studies, we analyzed children’s response data using Generalized Linear Mixed Models (GLMMs; Baayen, 2008) with a binary response term using a binomial distribution (open box by self = 0, ask for help = 1). Mixed models were run using the package ‘lme4’ (Bates, Maechler, & Bolker, 2012) in the statistical program R (version 3.1.0; R Core Team, 2012).

For the GLMMs, we first generated a null model, which only included the random effect of participant identity (to control for repeated measures). We then created a full model, which included all of the predictor variables of interest. Unless otherwise noted, these variables were included as fixed effects: age in years (as a continuous predictor, range 3.00–5.99 years), block number (i.e., whether responses were from the first half of the study session or the second; 1 or 2), within-block trial number (1–2 for Studies 1 and 2; 1–4 for Studies 3 and 4) as covariates and condition (same-kind = 0, different-kind = 1) as categorical predictor. We also included as a predictor the interaction between condition and age. Next, the full model was compared to the null model using a likelihood ratio test (LRT) to examine whether the inclusion of predictors provided a better fit to the data than participant ID alone. Unless otherwise noted, full models provided a better fit to data than null models with \( p < .05 \). Finally, a minimal model was created from the full model by systematically dropping single terms from the model and testing whether their inclusion improved the model fit using LRTs. All figures show model results and binomial confidence intervals calculated using the Wilson method (Wilson, 1927).

2.2. Results

For each test trial, responses were coded as “0” if children said they could open a box themselves and “1” if they said they would need the experimenter’s help. If children are using kind information to guide their decisions, “0” would represent the appropriate choice for same-kind boxes (because children already know how they work) and “1” would represent the
appropriate choice for different-kind boxes (because children have no prior information about how those kinds of boxes work).

Results from Study 1 are depicted in Fig. 2a and model parameters in Table 1 (raw means are included in Appendix C). This figure shows that children across all age groups reported needing similar levels of help in the different-kind condition, but different levels of help in the same-kind condition. Our minimal model confirmed that there was a significant age by condition interaction (LR, $\chi^2 = 32.11, p < .001$), such that, as children got older, they were more likely to seek help in the different-kind condition than in the same-kind condition. Given this interaction, we conducted further analyses separately for the same-kind and different-kind conditions.

Our minimal model for the same-kind condition showed that participants’ responses were marginally predicted by block number ($\chi^2 = 3.71, p = .05$); children were less likely to report needing help when the same-kind boxes were presented in the second block. Participants’ responses were also marginally predicted by age ($\chi^2 = 3.32, p = .07$), such that children were less likely to report needing help as they got older. Responses were not predicted by trial number ($\chi^2 = 0.22, p > .05$). None of the predictors reached significance in the different-kind condition models (trial: $\chi^2 = 0.27, p > .05$; block: $\chi^2 = 0.01, p > .05$; age: $\chi^2 = 2.42, p > .05$).

As suggested by Fig. 2a, the youngest children tested – 3-year-olds – reported needing help even in the same-kind condition. When we analyze just the three-year-olds’ responses (independent of the other age groups), we find that condition only marginally predicts response ($\chi^2 = 3.38, p = .06$).

2.3. Discussion

Study 1 investigated preschool-aged children’s proactive help-seeking in a hypothetical problem-solving context. Children reported that they would need more help with different-kind problems, whose solutions they had not previously learned, than with problems of the kind that they had seen solved. This indicates that children can anticipate that they will need help with a problem before attempting it, and use kind information to guide these predictions.

The significant interaction of condition and age suggests that this ability improves with age. Although children of all ages reported needing similar levels of help in the different-kind condition, older children were less likely to say that they would need help in the same-kind condition than did younger children. Indeed, three-year-olds were only marginally more likely to report needing more help in the different-kind condition than the same-kind condition. This difference may reflect an improvement of children’s ability to recognize that items of the same kind should be treated similarly. Conversely, this could also reflect an increase in children’s confidence in their general problem-solving skills.
Table 1
Minimal GLMM Output of Participants’ Responses in Studies 1–4.

<table>
<thead>
<tr>
<th>Study</th>
<th>β</th>
<th>SE</th>
<th>z</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
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<td>2.13</td>
<td>1.60</td>
<td>0.11</td>
</tr>
<tr>
<td>Condition</td>
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<td>−2.08</td>
<td>0.04</td>
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<tr>
<td>Age</td>
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<td>0.49</td>
<td>−2.10</td>
<td>0.04</td>
</tr>
<tr>
<td>Condition x Age</td>
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<td>0.56</td>
<td>2.89</td>
<td>0.004</td>
</tr>
<tr>
<td>Block</td>
<td>−1.08</td>
<td>0.46</td>
<td>−2.34</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Study 1 Same-Kind Condition
| Intercept | 9.19  | 6.13 | 1.50  | 0.13    |
| Age      | −2.51 | 1.42 | −1.76 | 0.07    |
| Block    | −5.08 | 2.77 | −1.83 | 0.05    |

Study 1 Different-Kind Condition
| Intercept | 0.45  | 0.31 | 1.44  | 0.15    |
| Age      | −0.18 | 1.41 | −0.13 | 0.90    |
| Block    | 1.35  | 0.52 | 2.59  | <0.01   |
| Condition | −0.54 | 0.32 | −1.68 | 0.09    |

Study 3
| Intercept | 0.45  | 1.25 | 0.36  | 0.72    |
| Age      | −0.52 | 0.28 | −1.89 | 0.06    |
| Condition | 1.09  | 0.32 | 3.43  | <0.001  |

Study 4
| Intercept | −1.41 | 0.24 | −5.94 | <0.001  |
| Condition | 0.68  | 0.27 | 2.58  | <0.01   |

Note: β-coefficients indicate the estimated effects of predictors on the response term (Study 1: 0 = could open box by self, 1 = would need help; Studies 2–3: 0 = try by self, 1 = seek help; Study 4: 0 = receive a token, 1 = see how box works) relative to the following baseline levels: Condition = Same-Kind; Block = 1.

Children successfully used kind information to guide their help-seeking in their verbal reports, but an open question is how well their reports would map on to their actual problem-solving behavior. Thus, in Study 2 children were given the additional opportunity to act upon their predictions.

3. Study 2

It is possible that children’s behavioral responses may differ from their verbal responses in Study 1. For example, when provided with the opportunity to physically interact with the boxes, they may find it difficult to inhibit their desire to do so. If this is the case, we would expect children to rarely seek help with the boxes in either of the conditions. Alternatively, children may give more accurate behavioral responses because of the first-hand experience with the boxes and the concrete feedback that they receive from failing or succeeding at opening the boxes after their choice. These are both features that were not part of the first study using purely verbal measures. Study 2 explored whether children’s response patterns would be similar to those in Study 1: i.e., that they would seek help more in the different-kind condition than in the same-kind condition and that difference would become stronger with age.

3.1. Methods

3.1.1. Participants

Thirty-six preschool-aged children participated: 12 3-year-olds (7 girls, 5 boys, Mage = 3.4 years, age range: 3.1–4.0 years), 12 4-year-olds (7 girls, 5 boys, Mage = 4.5 years, age range: 4.0–4.9 years), and 12 5-year-olds (7 girls, 5 boys, Mage = 5.4 years, age range: 5.0–5.9 years). The majority of participants were White (69%); 6% were non-White (3% Asian American and 3% multiracial) and 25% did not provide demographic information. Five additional children were dropped from analysis (3 girls, 2 boys, Mage = 4.2 years, age range: 3.1–5.1 years): two failed to learn how the target apparatus worked, two spontaneously solved a box before demonstration, and one chose not to finish the study.

3.1.2. Materials

Six puzzle boxes were used: Dumbbell, Roundabout, Stick, Flap, Column, and Block. The Dumbbell and Stick boxes were used as target boxes (with additional instances of these used as the same-kind boxes). The Roundabout, Dumbbell, Column, and Door boxes were used as the different-kind boxes. The three interactive banks (gorilla, pig, and plinko) were also used.

3.1.3. Procedure

In an introductory phase, the experimenter demonstrated how to operate the banks and then invited participants to try them out themselves. Children were then told that if they wanted to play with them further, they would have to retrieve
tokens from puzzle boxes. The experimenter said that “These boxes are not like normal boxes, though, so they might be kind of hard to figure out. But you know what? I made the boxes so I know how they work.” The experimenter then brought out a set of five puzzle boxes — one target box, two same-kind boxes, and two different-kind boxes. As in Study 1, the experimenter provided novel labels for each of the boxes, with the target box and same-kind boxes receiving the same label.

The test phase had two blocks of trials. Blocks were counterbalanced across participants and separated by a short break in which the child and experimenter played with unrelated toys. In the same-kind block, the experimenter left only the target box and the two same-kind boxes on the table. In the different-kind block, she left the target box and the two different-kind boxes on the table. The experimenter then asked the child to label the boxes. If the child answered incorrectly, the experimenter provided the correct label and moved on to the next box.

Children were then invited to retrieve a token from the target box during a first exploration period. They could explore the box for up to 30 s, after which the experimenter demonstrated its solution. The experimenter then put another token in the box and invited the child to retrieve it. If the child failed, this process was repeated up to two times.

Next, children were told that they could choose what to do with the remaining two boxes; they could choose to attempt to open each box themselves or they could have the experimenter open it. If children chose to seek the experimenter’s help, the experimenter opened the box out of the child’s sight and gave them the token to use. If they chose to attempt the box themselves, they could try to open it for up to 1 min. After that time elapsed (or the participant gave up), the experimenter put the box aside and moved on to the next trial.

If children successfully opened a box, they could use the token on the bank of their choice. If they failed, the experimenter moved on to the next trial. In this and all subsequent studies, none of the children included in the analyses solved any of the different-kind boxes; conversely, all children who attempted to open the same-kind boxes were successful. As in Study 1, we were primarily interested in children’s predictions of their ability to open the boxes and not whether they sought help after they had chosen to open a box.

3.2. Results

Per the study inclusion criteria, all participants included in the final analyses failed to open any different-kind boxes they chose to attempt themselves, but were successful with same-kind boxes. Responses were coded as “0” if children chose to attempt a box themselves and “1” if they requested the experimenter’s help. If children are relying only on kind information to guide their decisions, “0” would represent the appropriate choice for same-kind boxes (because children already know how they work and have already opened the identical, target box) and “1” would represent the appropriate choice for different-kind boxes (because children do not know how those kinds of boxes work).

Results are depicted in Fig. 2b and model parameters in Table 1. This figure shows both that children sought help more often in the different-kind condition than in the same-kind condition and that help-seeking rates decreased with age. Our minimal model confirmed that condition significantly predicted participants’ responses (LRT, χ²(1) = 7.73, p < .01) and age marginally predicted responses (χ²(1) = 2.84, p = .09). Odds ratios for these predictor variables indicate that participants were 3.86 times more likely to seek help in the different-kind condition than in the same-kind condition and that with each additional year in age, children were .58 times as likely to seek help (i.e., their help-seeking decreased by 42% per year of age). None of the other predictor variables were significant; unlike in Study 1, there were no effects of block (χ²(1) = 0.07, p > .05) or of the age by condition interaction (χ²(1) = 0, p > .05).

We also coded the video files for children’s explicit requests for help after attempting to solve a box. These requests included asking the experimenter explicitly to help (e.g., “Can you help me?”), as well as questions about how the box or box parts worked. Children chose to attempt a box themselves in 52 trials in the different-kind condition and 73 in the same-kind condition; however, due to technical difficulties with videotaping, we were not able to code two of the different-kind trials and eight of the same-kind trials. In the different-kind condition, children sought help in 30 of the 50 codeable trials (60%) in which they attempted to open the box themselves. In the same-kind condition, children sought help in 3 of the 65 codeable trials (5%). The difference in reactive help-seeking is significant between conditions (Fisher’s exact test, p < .001).

3.3. Discussion

Study 2 investigated whether children could use kind information to decide whether to solve a problem with or without asking for help first. We found that children sought help more with different-kind problems than with same-kind problems whose solutions they had previously learned. In combination with the results from Study 1, this suggests that not only do children have an awareness of when they should ask for help with a problem, but that they actually do seek this help.

Children’s reactive help-seeking followed a similar pattern. That is, when children chose to attempt a box themselves, they asked for help more often in the different-kind condition than in the same-kind condition. This is the expected pattern of results, as children always struggled with the different-kind boxes. Even though children were told that the experimenter could not help them with these boxes (and she never did), they still explicitly sought help in 60% of the different-kind trials. It is possible that children truly believed the experimenter would help them — and that this belief influenced their decision to attempt the boxes. If this were the case, we might expect children who chose to attempt a different-kind box to realize that the experimenter will not help them with subsequent boxes. This could lead to increased proactive help-seeking in later trials. We found no such trial effects, but this possibility is further tested in Study 3.
Another possible explanation for children’s reactive help-seeking is that this is simply their default strategy when struggling with a difficult problem. Indeed, it does not hurt to ask a knowledgeable other for help, even if you are fairly certain you will not receive it. Given our study design, we are unable to test this possibility; however, it seems unlikely that it would affect children’s proactive help-seeking decisions.

Although the condition difference remained stable across Studies 1 and 2, the actual proactive help-seeking rates diverged. Help-seeking rates were globally and dramatically lower in Study 2. Moreover, whereas rates of help-seeking in the different-kind condition increased with age in Study 1, the opposite effect was found in Study 2. Older children in Study 1 were near ceiling in their help-seeking predictions. In Study 2, help-seeking tended to decrease with age in both the same-kind and different-kind conditions – though even the oldest children continued to show a condition effect. A decline in help-seeking with age might be expected in the same-kind condition, given the results of Study 1. It is surprising, however, that this decline is also present in the different-kind condition.

If children are able to correctly predict whether or not they need help, why do they not always follow through with these predictions? One possibility is that, as they age, children become generally less willing to seek out others’ help. Indeed, previous research has suggested that mastery motivation – the motivation to discover and produce solutions to problems on one’s own – increases between the ages of 4 and 10 (Harter, 1975). Such motivation might override children’s desire to receive the material reward guaranteed by choosing to seek the experimenter’s help.

Another possibility is that, even though they knew they could not successfully open the different-kind boxes and that they should thus ask for help, children simply found it difficult to forfeit the opportunity to interact with the boxes. After all, children only interacted with a single target box before making their test choices; if they were given more experience with the boxes, they may be better able to inhibit their desire to interact with them, and thus may be more likely to seek help when appropriate. We tested this possibility in Study 3 by introducing a familiarization phase in which children could interact with a unique puzzle box (thus increasing their general experience with puzzle boxes) and by doubling the number of test trials children received (giving more opportunities for learning from experience).

4. Study 3

Study 3 sought to replicate and extend the results of Study 2. To this end, we made two major changes to the study design. First, we improved children’s familiarization with the boxes and test choices. This helped ensure that children understood the consequences of their choices; that is, that they would be unable to independently figure out the solutions to puzzle boxes and that the experimenter would not help them open any boxes that they chose to try.

We also doubled the number of test trials in each condition. This allowed us to detect potential learning effects within the different-kind condition – that is, whether children who choose to attempt some of the different-kind boxes themselves can use their failure to open them to guide their approach to the remaining boxes. If children learn from their mistakes, we would expect them to be more likely to seek help in later different-kind trials; i.e., they might attempt to open the first or second different-kind box themselves, be unable to do so, and then reason that they should seek the experimenter’s aid with the remaining boxes.

4.1. Methods

4.1.1. Participants

Thirty-six preschool-aged children participated: 12 3-year-olds (6 girls, 6 boys, Mage = 3.5 years, age range: 3.2–4.0 years), 12 4-year-olds (8 girls, 4 boys, Mage = 4.5 years, age range: 4.1–4.9 years), and 12 5-year-olds (5 girls, 7 boys, Mage = 5.4 years, age range: 5.2–5.8 years); 67% of participants were White, 19% were non-White (11% Asian American and 8% multiracial), and 14% did not provide demographic information. Six additional children were dropped from analysis (6 boys, Mage = 4.8 years, age range: 3.2–5.6 years): four spontaneously solved a target box before demonstration, one failed to learn how the target apparatus worked, and one exhibited difficulty concentrating on the task.

4.1.2. Materials

All eleven puzzle boxes were used. The Dumbbell and Stick boxes were used as the target and same-kind boxes. The Roundabout, Flap, Plunger, Totem, Block, Column, Diagonal, and Door boxes were used as the different-kind boxes. The Axle box was used during familiarization. The gorilla and plinko banks were used as rewards.

4.1.3. Procedure

The methods were similar to those used in Study 2, with the following exceptions, designed to better highlight the differences between the test choices and to provide children with additional experience with the puzzle boxes.

4.1.3.1. Distinct locations. Three tables rather than one table were used in Study 3. There was one large table for labeling events and demonstrations. Two smaller tables, located behind and to either side of the large table, were used for the test trials. If children chose to seek the experimenter’s help, the experimenter would take the box to one small table and open the box under the table out of the child’s view. If children chose to try to open a box themselves, they would do so at the other small table. These locations were shown after the introductory phase with the banks with a new box not used in the
main test. We used multiple tables in order to help clarify the consequences of children's decisions at test. It is possible that in Study 2, children assumed the experimenter would help them with difficult boxes (after they had decided to attempt the boxes themselves) because she had previously done so with the target box.

4.1.3.2. Familiarization phase. Following the introductory phase with the banks (and before interacting with any of the test boxes), participants were introduced to the Axle box. This box was used to demonstrate the functions of the three tables. At the large table, the experimenter labeled the box; she then brought the box to one of the small tables and opened it out of sight, producing a token for the child. The box was reset, rebaited, and brought to the other small table so that the participant could attempt the box themselves. Once children had stopped exploring the box, or after approximately 30 s of exploration, the experimenter took the box away and moved on to the test trials. Thus, the familiarization phase served two purposes: it demonstrated what happened at each of the three tables and increased children's general experience with puzzle boxes.

4.1.3.3. Number of boxes. The number of boxes per block was increased from 5 (1 target, 2 same-kind, and 2 different-kind) to 9 (1 target, 4 same-kind, and 4 different-kind). This larger number of boxes allowed us to test whether children's performance improved across trials — that is, whether there were any learning effects.

4.2. Results

All participants included in the final analyses failed to open any different-kind boxes they chose to attempt themselves, but were successful with same-kind boxes. As in Study 2, responses were coded as “0” if children chose to attempt a box themselves and “1” if they requested the experimenter’s help. Results from Study 3 are depicted in Fig. 2c and model parameters in Table 1. This figure shows both that children sought help more often in the different-kind condition than in the same-kind condition and that help-seeking rates tended to decrease globally with age. Our minimal model confirmed that condition significantly predicted participants’ responses ($\chi^2 = 12.71, p < .001$). Age marginally predicted responses ($\chi^2 = 3.45, p = .06$). Odds ratios showed that participants were 2.97 times more likely to seek help in the different-kind condition than in the same-kind condition and that with each additional year in age, children were .59 times as likely to seek help (i.e., help-seeking decreased by 41% per year of age).

Within-block trial number did not significantly predict participants’ responses ($\chi^2 = 1.02, p > .05$), even when examined separately for the different-kind condition ($\chi^2 = 1.42, p > .05$). None of the other predictor variables that we tested significantly predicted responses and were thus eliminated from the model.

We also coded the study videos for reactive help-seeking behavior, using the same criteria as in Study 2. Due to technical difficulties with videotaping, we could not code four of the different-kind trials and five of the same-kind trials. Children explicitly sought help in 46 of the 91 codeable, different-kind trials (51%) and 1 of the 114 codeable, same-kind trials (0.9%). A Fisher’s exact test indicates that this difference is significant ($p < .001$).

4.3. Discussion

Study 3 replicated the results of Study 2 and further demonstrated that children’s decisions to seek help were not dependent on the number of test trials or previous experience with the boxes. As a group, children differentiated between the conditions, seeking help more with different-kind problems than with same-kind problems. The absence of trial effects, particularly in the different-kind condition, suggests that children’s decisions to seek help were not influenced by the outcomes of previous trials. That is, children did not seem to learn from their mistakes. Choosing to attempt the different-kind boxes always resulted in failure and loss of a reward, but this did not push children to seek help in subsequent trials.

Moreover, this suggests that children were not operating under the false assumption that the experimenter would help them with boxes they chose to attempt (even though they still asked for help when struggling with the different-kind boxes). If this were the case, we would expect children to proactively seek help in later trials, after they've learned that is the only way the experimenter will provide help.

As in Study 2, children’s help-seeking tended to decrease with age. Despite having twice as many opportunities to seek help (and having prior experience with a puzzle box during the familiarization phase), older children continually neglected to do so. One possibility is that older children rarely sought help because they were generally confident in their ability to open the boxes. However, the results of Study 1 speak against this possibility as children across all tested age groups predicted that they would need help at similar levels.

Another possibility is that older children found that handling the different-kind puzzle boxes to be more rewarding than trading the boxes in for rewards — even if they failed to open them. Results from our pretests (Appendix B) provide some evidence against this possibility, as we found that children preferred to play with the banks instead of handle the puzzle boxes. However, in those situations, children had already seen the puzzle boxes solved.

A third possibility is that older children were more likely to realize that only through the “attempt by self” option could they potentially see how the box opens (i.e., if they are lucky and figure out the solution by themselves). If they ask for help, they will receive a token to play with the banks, but forfeit the opportunity to potentially learn about the functions of the box. Perhaps children’s desire to learn about the different-kind boxes supersedes their desire to receive a reward. In Studies 2 and 3, children chose between either attempting a box themselves or having the experimenter retrieve the token from
the box for them. If they chose to seek the experimenter’s help, the experimenter opened the box out of the child’s view and gave them the reward. Thus, if children were interested in learning how a box worked, they could only do so through direct experimentation.

We designed a new study to address the second and third possibilities. Study 4 explored children’s desire to learn about the boxes in the absence of other tangible rewards.

5. Study 4

The goal of Study 4 was to investigate to what extent children’s behaviors were influenced by a desire to gain new knowledge as an end in itself versus a more pragmatic goal to obtain the tangible rewards (with learning how to open boxes serving as a means to this end). Previous research has demonstrated that preschoolers are indeed motivated to receive causal information. They persistently ask others for explanations (Frazier, Gelman, & Wellman, 2009) and even expend more effort in a game when they are rewarded with causal information than with either noncausal information or material rewards (Alvarez & Booth, 2013).

Study 4 provides a strong test of this “desire to learn” hypothesis by inviting children to choose between either receiving a reward or seeing how a box works, without ever operating the boxes themselves. If children choose to learn about the boxes more in the different-kind condition than in the same-kind condition, it would suggest that they recognize that they have no experience with the different-kind boxes and that they value the opportunity to learn more about them. On the other hand, if children choose to learn more in the same-kind condition, it would suggest that either they fail to realize the same-kind boxes’ similarity to the target box, or that they have little desire to learn about new boxes. Of course, it is also possible that children will choose to learn about the boxes in similar rates across the conditions. Such a result would suggest that children do not use category information to guide their choices to learn.

5.1. Methods

5.1.1. Participants

Forty children participated: 20 3-year-olds (8 girls, 12 boys, Mage = 3.6 years, age range: 3.0–4.0 years) and 20 5-year-olds (14 girls, 6 boys, Mage = 5.6 years, age range: 5.1–5.9 years). 58% of participants were White; 35% were non-White (including 20% multiracial, 10% Asian American, 2.5% African American, 2.5% Native Hawaiian or Pacific Islander) and 5% did not provide demographic information. Two additional children were dropped from analysis (1 girl, 1 boy, Mage = 4.6 years, age range: 3.2–5.9 years): one did not finish the study and one exhibited difficulty concentrating on the task.

5.1.2. Materials

The Plunger and Totem boxes were used during familiarization. The Dumbbell boxes were used as the target and same-kind boxes, and the Roundabout, Flap, Axle, and Stick boxes were used as different-kind boxes. The gorilla and plinko banks were used as rewards.

5.1.3. Procedure

The procedure was similar to that used in Study 3, except for the following three changes.

5.1.3.1. Choices at test. During the test trials, children could chose between receiving a token or asking the experimenter to show them how the box worked. If children chose the token, the box was put away, and they received a token to use on one of the banks. If they chose to see how the box worked, the experimenter demonstrated its solution and then put both the box and token away. In neither case did children interact with the boxes themselves.

5.1.3.2. Familiarization. Two familiarization boxes were used; the experimenter demonstrated how one box worked and gave the child a token for the exchange for the other box.

5.1.3.3. Presentation of boxes. Instead of using two separate sets of boxes for each block, we used one set for the whole study. Thus, children were introduced to all of the boxes at once, and the same target box was used for each block. After completing the first block, we checked that children could recognize the labels of the second block’s boxes and had them demonstrate their ability to open the target box before they selected what to do with the boxes.

5.2. Results

Children’s responses were coded as “0” if they chose to receive a token and “1” if they chose to see how the box worked. Results from Study 4 are depicted in Fig. 2d and model parameters in Table 1. This figure indicates that children were more interested in receiving causal information in the different-kind condition than in the same-kind condition. Our minimal
model confirmed that condition was the only significant predictor of children's responses (LRT, $\chi^2_1 = 6.79, p < .01$). An odds ratio shows that children were 1.98 times more likely to choose to see how the box works in the different-kind condition than in the same-kind condition. Unlike in the previous studies, responses were not significantly predicted by either age (LRT, $\chi^2_1 = 0.18, p > .05$) or the condition x age interaction (LRT, $\chi^2_1 = 1.18, p > .05$).

5.3. Discussion

In Study 4, children could choose between receiving a reward or a demonstration of the boxes' solutions. Across age, children evaluated whether the information gleaned from a demonstration would actually be new to them, choosing to learn about the different-kind boxes more often than the same-kind boxes. Importantly, this was true even though children were not allowed to handle the boxes themselves.

As is evident in Fig. 2d, children were overall more likely to choose a token than to learn about the boxes. Although they differentiated between conditions, children seemed generally more interested in receiving tokens than in learning about the boxes. This result is perhaps not too surprising, however, given that the primary function of the boxes was to yield tokens and that children were not given any opportunity to use the information they learned themselves. In this light, it is notable that in the different-kind condition, in which children had not yet seen how a given box opened, they chose to learn how it worked in about 30% of trials, without any tangible outcome other than knowledge.

Interestingly, unlike in Studies 1–3, there were no age-related trends; both the three- and five-year-olds were similarly interested in learning about the boxes. Indeed, 3-year-olds chose to learn about the same-kind boxes on average of .90 trials and the different-kind boxes on average of 1.15 trials; 5-year-olds chose to do so on .85 trials and 1.60 trials, respectively. It is thus unlikely that receiving tokens and playing with the banks appealed more to younger children; this reinforces the results of the second pretest of the boxes, in which children were more interested in playing with the banks than interacting with empty boxes.

Overall, the results of this study suggest that children have a desire to learn, without any obvious pragmatic benefit. This tendency may partly explain the results from Studies 2 and 3 in which children frequently chose to try the boxes themselves if that was the only way to potentially learn about the puzzle box mechanism.

6. General discussion

We investigated the ability of preschool-aged children to proactively seek help with problems. We compared help-seeking for problems of a same or different kind than a problem whose solution they have previously learned. In Study 1, preschoolers were able to use this kind information to correctly predict when they would need help with problems, a tendency that improved with age. Three-year-olds were only marginally more likely to report needing help in the different-kind condition over the same-kind condition in Study 1. However, we found that, in Studies 2 and 3, preschoolers of all ages selectively sought help when faced with novel problems. It remains unclear why three-year-olds' performance differs between the hypothetical and hands-on situations. It is possible that the youngest children in Study 1 generally lacked confidence in their ability to solve problems whose solutions they had only seen once (and with which they have had no direct, hands-on experience). Perhaps the experience of interacting with and opening the target boxes in Studies 2 and 3 bolstered their confidence in their ability to solve other problems of the same type. Further research is required to explore this possibility. In Study 4, children sought to learn the solutions to different-kind problems — forfeiting a potential reward — more often than for same-kind problems. Across all studies, children consistently used information about kind status to guide their proactive help-seeking.

Previous work has demonstrated that children seek help reactively — once they attempt a problem and fail, they readily seek help from others. Indeed, we found that children did ask for help when struggling with novel puzzle boxes. Our set of studies, however, demonstrates that they also engage in proactive help-seeking. By three years of age, children are able to analyze problems, assess their knowledge of these problems, and use this knowledge to guide their decisions. This process is different from that employed in reactive help-seeking, in which children turn to a knowledgeable other in response to experiencing some difficulty with a problem. Our findings suggest that children appreciate the potential costs of help-seeking and can predict when help is necessary. It is important to note that, in our studies, children were provided with fairly rich information about the problem landscape: they were informed that puzzle boxes as a whole were difficult and failed to solve boxes without the experimenter's help (both during the different-kind trials and with the familiarization and target boxes). Children's patterns of responses may differ in less informationally rich settings; nevertheless, this work confirms data from many other paradigms that children are able to make informed decisions about their social learning.

We also found a divergence in results between hypothetical and hands-on contexts. In hypothetical situations, children were more likely to seek help with different-kind problems and forgo help with same-kind problems as they grew older. Conversely, we observed that, with age, children in hands-on contexts became somewhat more likely to attempt to solve problems for themselves even if they did not have the relevant information of how to open the puzzle boxes. Thus, even though children appeared to know when they should ask others for help from an early age, they increasingly neglected to ask for information as they grew older. Study 4 suggests that this seemingly irrational behavior may be partly driven by a desire to gain knowledge even in the absence of tangible rewards.
It seems unlikely that the change from hypothetical (Study 1) to hands-on (Studies 2 and 3) rendered children unable to detect the similarities or differences between the target box and the test boxes. Rather, it seems more likely that some aspect of the learning situation caused children to overlook or ignore these characteristics. It is possible that children did not fully understand or appreciate the fact that they had one opportunity to seek help with a problem (and that this option was only available to them prior to attempting the problem). If this was the case, we might expect children to seek help more in the later, different-kind trials – but no such trend emerged. It is also possible that, with age, the values children apply to physical rewards versus active learning opportunities change. Older children may be generally more interested in trying problems themselves, even if it sometimes results in the loss of a physical reward. Although Study 4 provides some insight here, it pitted passive learning opportunities against a reward. The results from Pretest 2 show that children prefer to play with a bank than to open an empty puzzle box; however, children had already learned the puzzle boxes’ solutions and stood to gain neither knowledge nor reward from choosing to interact with the box. Taken altogether, it seems possible that children’s choices to attempt different-kind boxes themselves may be partially driven by the desire to both physically interact with the box and learn about it at the same time.

Although this work demonstrates that preschoolers can engage in proactive help-seeking, whether they spontaneously do so remains an open question. We have shown that children can anticipate whether or not they will need help on a problem, as opposed to only seeking help upon experiencing some difficulty. It is possible, however, that children predominately prefer to engage in reactive help-seeking. Further research is required to explore this possibility.

The present research suggests that children are able to use cues to problems’ category membership to predict whether they will need help. Of course, children draw upon more than category membership information when deciding whether they should seek help with a problem. For example, children may reference the perceived difficulty of a novel problem. By three years of age, children can compare task features to determine which of two tasks is easier – and this ability improves during the preschool years (Wellman, 1977). When a new problem seems relatively easy to solve (due to its appearance, information they have been given about the problem, etc.), children may disregard cues to category membership. In our studies, we create the expectation that all of the puzzle boxes are very difficult unless you have direct experience with a particular box (or kind of box). We explicitly tell children that the boxes are difficult to solve and they receive direct experience with the boxes during familiarization, further demonstrating that the boxes as a group are impossible for them to solve. Furthermore, the causal mechanisms of the boxes are opaque. Once children have learned the solution to the target box, however, they can extend this to other boxes of the same kind. In this way, perceived difficulty depends on category membership: if children recognize that new boxes belong to the same category as the target box (which they are able to solve), their perceived difficulty should be very low. The consistent main effect of condition also demonstrates that children are not simply making decisions based upon the salience of novelty of the boxes (even though children tend to be particularly attracted to novel items; e.g., Henderson & Moore, 1980). If this were the case, we would expect children to always attempt the different-kind boxes themselves (and conversely, to attempt the same-kind boxes less often).

There are some limitations to these studies, however. First, the sample size for each study was relatively small, which may limit the generalizability of our findings. However, because the difference between conditions was reliable across all four studies presented here, we would expect a similar pattern of results given larger sample sizes. Second, our experiment placed children into a somewhat unnatural learning situation; children must decide whether or not they can open a puzzle box by themselves and if they decide to try and fail, they receive no help from the experimenter. Children are perhaps accustomed to receiving help from adults and thus the fact that the experimenter would not respond to their requests for help after they had decided to try it themselves was unexpected. This may have increased the likelihood that they would choose to try to open boxes themselves and thus have contributed to the relatively low levels of help-seeking in Studies 2 and 3. On the other hand, in Study 3 we increased the number of trials and obtained the same results. More importantly, this explanation alone cannot account for the difference between conditions. Third, it is possible that children’s decisions to try the boxes themselves in Studies 2 and 3 were driven by a desire to play with the boxes or a general averseness to asking for help. Either of these possibilities may explain why the global levels of help-seeking were low; however, they would not explain the differences between the different-kind and same-kind conditions.

In sum, we explored whether preschool-aged children can accurately predict whether they would need help with a problem before attempting to solve it themselves. Children engaged in proactive help-seeking – appropriately applying previously learned solutions to problems of the same kind, but seeking help with different kinds of problems. However, further research is necessary to explore the mechanisms underlying this ability, as well as how children use this strategy across different contexts.

Acknowledgements

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Appendix A.

See Table A1.

Table A1

<table>
<thead>
<tr>
<th>Puzzle Box ID</th>
<th>Studies</th>
<th>Status</th>
<th>Solution (for active boxes)</th>
</tr>
</thead>
</table>
| Dumbbell      | 1, 2, 3, 4 | Active | 1. Remove right handle  
|               |          |        | 2. Pull string atop box  
|               |          |        | 3. Open Velcro box  
|               |          |        | 4. Remove token  |
| Roundabout    | 1, 2, 3, 4 | Active | 1. Remove bottom stopper  
|               |          |        | 2. Pull right stopper  
|               |          |        | 3. Turn top lever  
|               |          |        | 4. Remove token  |
| Stick         | 1, 2, 3, 4 | Active | 1. Turn top stick  
|               |          |        | 2. Remove top stick  
|               |          |        | 3. Fully insert stick through left side window (dislodging token pod)  
|               |          |        | 4. Remove token from dislodged token pod  |
| Flap          | 1, 2, 3, 4 | Active | 1. Open flap atop box  
|               |          |        | 2. Align and insert blocker into hole under it  
|               |          |        | 3. Pull out token pod from inside box  
|               |          |        | 4. Remove token  |
| Plunger       | 3, 4     | Active | 1. Pull out stopper  
|               |          |        | 2. Push down top plunger  
|               |          |        | 3. Open Velcro flap  
|               |          |        | 4. Remove token from dislodged token pod  |
| Axle          | 3, 4     | Active | 1. Turn and pull stopper  
|               |          |        | 2. Turn and extract stopper  
|               |          |        | 3. Pull out token pod from inside box  
|               |          |        | 4. Remove token  |
| Column        | 2, 3     | Inactive |  |
| Door          | 2, 3     | Inactive |  |
| Block         | 3        | Inactive |  |
| Diagonal      | 3        | Inactive |  |
| Totem         | 3, 4     | Inactive |  |

Appendix B.

Pretests

We carried out two pretests with a separate group of children not included in the main sample to ensure that these criteria were met for the four active boxes used in Studies 1 and 2 (Dumbbell, Roundabout, Stick, and Flap). In the first phase, children attempted to solve the boxes on their own. Of the ten children from the first pretest (7 girls, 3 boys, Mage = 4.8 years, age range: 3.5–5.8 years), three spontaneously solved the Flap box and none spontaneously solved any of the Stick, Dumbbell, or Roundabout boxes.

In the second pretest (carried out on the Stick, Dumbbell, and Roundabout boxes), a new group of 13 children (6 girls, 7 boys, Mage = 3.9 years, age range: 3.1–5.2 years) were again invited to attempt to solve the boxes. If they failed to solve a box, the experimenter demonstrated the solution, reset the box, and asked them to reproduce the solution on their own. None of the children spontaneously solved any of the three boxes. They required an average of 1.00 demonstrations in order to reproduce the solutions to the Stick and Dumbbell boxes and 1.33 demonstrations for the Roundabout box. We were also interested in gauging children’s interest in the reward versus in the opportunity to physically manipulate the boxes. To this end, children were asked to choose between playing with a bank or opening an empty box. Across nine trials (one for every possible bank-box pairing), children chose the banks 81% of the time (two participants did not receive all 9 trials – one received 6 and one received 3). Furthermore, when given the choice to either play with a new bank or a new box, all 13 children reported that they would prefer the new bank.
Appendix C.

See Table C1.

Table C1
Help-Seeking Rates: Raw Data.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Condition</th>
<th>Study 1</th>
<th>Study 2</th>
<th>Study 3</th>
<th>Study 4</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Same-Kind</td>
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<td>4-year-olds</td>
<td>3-year-olds</td>
<td>3-year-olds</td>
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<tr>
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<td>0.90</td>
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<tr>
<td>Study 3</td>
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<td>0.17</td>
<td>0.92</td>
<td>1.60</td>
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<tr>
<td>Study 4</td>
<td>1.00</td>
<td>1.26</td>
<td>1.25</td>
<td>1.42</td>
<td>1.15</td>
</tr>
</tbody>
</table>

Note: Raw data for the mean number of trials in which participants sought the experimenter’s help (Studies 1-3) or chose to learn about a puzzle box (Study 4). The maximum score is 2 for Studies 1 and 2 and 4 for Studies 3 and 4.

References


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