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Preschoolers' Quarantining of Fantasy Stories

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Preschool-aged children are exposed to fantasy stories with the expectation that they will learn messages in those stories that are applied to real-world situations. We examined children's transfer from fantastical and real stories. Over the course of 2 studies, 3½- to 5½-year-old children were less likely to transfer problem solutions from stories about fantasy characters than stories about real people. A combined analysis of the participants in the 2 studies revealed that the factors predicting transfer differed for the fantasy and real stories. These findings are discussed within the context of their implications for preschoolers' developing boundaries between fantasy and real worlds.

As Williams James (1890) noted, adults contemplate many subworlds, including a world of science, a world of sense, and supernatural worlds. The world of sense includes physical things as we perceive them, the world of science includes physical things as people learn about them, and supernatural worlds are consistent systems of thought not based in physical things. James argued, ''The popular mind conceives of all these sub-worlds more or less disconnectedly; and when dealing with one of them, forgets for the time being its relation to the rest'' (p. 291). Implicit in this characterization of the adult mind is that children must learn to distinguish between these subworlds, as well as to learn in and about them. As reviewed next, researchers have studied children's developing ability to discriminate fantasy from reality and to engage in fantasy worlds. However, children are faced with another difficult task. Once they have learned that fantasy and reality are distinct from each other, they must also learn to negotiate the boundaries between the fantastical and realistic worlds in which they engage. We present two studies examining the factors that influence children's transfer of information from fantasy stories and stories about real characters.

This question is particularly relevant because preschool children are often exposed to information through fantasy stories, and adults generally assume children learn from these stories. There is some suggestive evidence that preschool children have begun to distinguish fantasy subworlds from the real world. Four-year-old children can distinguish fantastical events from real events (Samuels & Taylor, 1994), fantasy characters from real characters (Morison & Gardner, 1978; Skolnick & Bloom, 2006; Wellman & Estes, 1986), and the properties of fantasy characters from the properties of real characters (Sharon & Woolley, 2004). In addition, 4-year-old children acknowledge that extraordinary events that happen in stories cannot happen in the real world (Shtulman & Carey, 2007) and that simply pretending something exists does not make that thing real (Golomb & Galasso, 1995; Woolley & Wellman, 1993).

The implications of these distinction abilities for children's use of fantastical information remain unclear and should be considered in research on children's thinking *within* a fantasy context. This research suggests that children can perform cognitive tasks within a fantasy context that they are otherwise unable to do successfully. When embedding cognitive tasks within a fantasy context, children have demonstrated significant increases in performance on logical syllogisms (Dias & Harris, 1988, 1990; Dias, Roazzi, O'Brien, & Harris, 2005; Hawkins, Pea, Glick, & Scribner, 1984; Leevers & Harris, 1999; Richards & Sanderson, 1999) and understanding the mentalistic aspects of pretense (Lillard & Sobel, 1999; Sobel, 2006; Sobel & Lillard, 2001). Thus, preschool children have demonstrated the ability to think about and within a fantasy context as a distinct subworld. Additionally, preschool children distinguish between different fantasy

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worlds (Skolnick & Bloom, 2006; Weisberg & Bloom, 2009). The 3- and 4-year-olds will claim that once ambiguous objects (e.g., blocks) have been identified with a specific pretend scenario (e.g., bath time), the objects cannot be used to play another pretend game (e.g., nap time; Weisberg & Bloom, 2009). Four-year-old children also know that characters from different fantasy worlds cannot act on each other (Skolnick & Bloom, 2006).

Despite preschool children's ability to distinguish fantasy worlds from realistic worlds and despite some precocious reasoning within a fantasy context, it is not clear how much of the information preschool children learn within a fantastical context is transferred into real-world situations. The analogical problem-solving paradigm is useful for studying what children learn and use from fantasy stories. Analogical problem solving involves transferring a solution from a problem presented in one domain to solve a novel problem presented in another domain. Successful transfer requires the recognition of a similar relational structure of problems in the different domains (Gentner, 1989; Vosniadou, 1989). Historically, researchers have suggested that children do not have the cognitive abilities to solve analogical problems until age 9 or 10 (e.g., Goldman, Pellegrino, Parseghian, & Sallis, 1982).

There are certain conditions, however, under which children as young as 4 years will demonstrate transfer (Goswami, 1991). In one study, when a relatively simple story and solution structure were used, 58% of 4- to 5-year-olds transferred an analogical solution to a novel problem (Holyoak, Junn, & Billman, 1984). Approximately 70% of 4- to 5-year-old children will transfer a solution if they verbally repeat goal-relevant features of the simple story, compared with 20% of the children in the same age range who will transfer if they do not recall these features of a story (Brown, Kane, & Echols, 1986).

Although age, a simple story structure (e.g., a limited number of analogical relations; Goswami, 2001; Holyoak et al., 1984), and access to the relevant features of the original story (Brown et al., 1986; Kim & Choi, 2003) are important for children's transfer, researchers have identified additional influences on children's ability to use analogy. These influences include perceptual similarity between the original story and the context of the transfer situation (Crisafi & Brown, 1986; Daehler & Chen, 1993; Holyoak et al., 1984), familiarity with the characters in the source story (Goswami, 2001; Holyoak et al., 1984; Richert, Shawber, Hoffman, & Taylor, 2009), and the style of the analogical task, with younger children profiting from a story-style format rather than a formal-style task (e.g., A:B::C:D; Singer-Freeman, 2005; Tunteler & Resing, 2002). Because of the variety of factors influencing transfer, there are large individual differences in analogical transfer for young children. In a microgenetic study, Tunteler and Resing (2002) assessed 4-year-old children's spontaneous analogical transfer as it developed over 6 weeks. Children did not receive hints or references to the source story, and 45% of the 4-year-olds demonstrated spontaneous analogical transfer after exposure to only one base problem.

In a recent study, Richert et al. (2009) used the analogical problem-solving paradigm to test children's transfer of problem solutions from a fantasy context to a real-world problem. Across three experiments, 3½- to 6-year-old children were told stories in which either familiar or novel fantastical or realistic characters had to solve physical and social problems. Children were then presented with analogically similar problems in a variety of contexts (e.g., to complete a story or play a game). The participants were less likely to transfer both the physical and the social solutions from the stories about the fantasy characters than the stories about the real characters, findings unrelated to increased memory or attention to the stories. However, children's preference for the fantasy stories interacted with the likelihood of transfer. In particular, children who demonstrated a preference for the fantasy stories were more likely to transfer from the realistic than the fantastical characters (Richert et al., 2009).

Based on these findings, it is important to consider the factors involved in children's negotiation between real and fantasy worlds. One important factor is the different kinds of fantasy stories from which adults expect children to learn. Previous findings of children's transfer from simple vignettes need to be extended to stories in which solutions are embedded in a larger plot structure to examine whether differences in transfer maintain in relation to the kinds of stories to which children are naturally exposed. The first goal of the current studies was to examine children's learning and transfer from a professionally produced fantasy story and a structurally similar story about real children. The second goal of the current studies was related to how individual difference characteristics of the children influence their ability to transfer from fantasy and real stories. Despite the fact that memory may not differ for fantasy and real stories, the influence of memory on transfer from fantasy and real stories

has not been closely examined (Richert et al., 2009). One task added to the current studies was the inclusion of a measure of solution-relevant memory to assess children's understanding of the relevant features for solving the analogy (Brown et al., 1986).

Consistent with Richert et al. (2009), we hypothesized that children read the fantasy story would transfer at lower rates than the children read the real story. Furthermore, we hypothesized that this difference would not be the result of differences in solution-relevant memory but that children who read the fantasy stories would display memory for the relevant features of the problem structure and solution at the same level as the children who were read the real story. In other words, responding for the children who read the fantasy story should reflect a disconnect between knowledge of the elements of the story related to transfer and actual transfer. If children who read the fantasy story respond in this fashion, this would support James's (1890) proposal about subworlds, namely, that information learned within a fantasy context is maintained and used separately from information learned within a real context. This disconnect between story knowledge and transfer was not expected for the children who were read the real story. In this circumstance, the information children learn in a real context would be readily available for use during the transfer task. We hypothesized that memory for the goal-relevant aspects of the problem after being read the real story would play the same role as in past research (Brown et al., 1986). In order to be able to factor out whether the influence of children's solution memory was merely a proxy for general memory abilities or cognitive ability, we also included measures of children's general memory for the story and a standardized measure of cognitive ability.

In addition to the measures of memory, we included a measure of children's fantasy orientation. Previous research has suggested that there are reliable individual differences in fantasy orientation that predict children's ability to distinguish fantasy and reality (Sharon & Woolley, 2004), participation in more sophisticated pretend play (Taylor, Cartwright, & Carlson, 1993), and belief in the existence of a novel fantastical being (Woolley, Boerger, & Markman, 2004). These individual differences in fantasy orientation may also interact with children's ability to transfer from a fantastical or a realistic story.

There are two possible relations between fantasy orientation and transfer. First, children who have a high fantasy orientation and frequently participate in fantastical and imaginative play may have an increased knowledge of the boundaries between fantasy and real worlds. This increased knowledge may lead these children to quarantine fantasy characters (Harris, 2000), subsequently reducing the application of the problem solution demonstrated by a fantastical character to a novel problem. Alternatively, children who are high in fantasy orientation may have more experience in transferring between their fantasy worlds and the real world. Therefore, children high in fantasy orientation may be more likely to transfer the solution from fantasy characters. To examine these possibilities, we included a measure of fantasy orientation.

In Study 1, children were read a full-length fantasy or real story to examine whether differences in transfer remain when the problem solutions are embedded in a professionally produced story plot. In Study 2, we extended these findings by reading a fantasy or real story to children in a classroom context. Finally, we conducted a combined analysis of the participants from the two studies to examine the influence of gender, age, cognitive ability, general memory, solution memory, exposure context, and fantasy orientation on transfer from the fantasy and real stories.

Study 1

In order to measure children's learning from fantasy and real characters, Richert et al. (2009) used relatively simple base stories to introduce preschool-aged children to problems solved by different characters. Children were then asked to solve structurally similar problems in a novel situation, which is a measure of analogical transfer. The key manipulation in these studies was the reality status of the characters in the base stories. Children were more likely to transfer solutions from the real characters than from the fantasy characters (Richert et al., 2009). Study 1 was designed to replicate the findings of Richert et al. (2009) using different, more ecologically valid and complex stimulus materials and analogical problems.

Method

Participants

Participants in this study were 33 children aged 3½ to 5½ (M = 4.48, SD = 0.46). There were 17 boys and 16 girls. The majority of the participants were Hispanic (75.8%), 9.1% were African American,

3.0% were Caucasian, 6.1% were some other ethnicity, and 6.1% declined to indicate their ethnicity. Participants were recruited through their day cares and preschools to hear a story individually. In order to participate in the study, participants did not have to be native speakers of English but had to be proficient in English. English proficiency was determined by children's ability to participate in a standardized test of intelligence, including four vocabulary subtests.

Materials

Storybook stimuli. Two books were used for telling children the stories. The fantasy storybook was professionally produced and available for purchase. The main characters of the story were a young boy and an adult male astronaut. In the story, the young boy helps the astronaut rescue other astronauts. The astronauts are trapped in a cave on a distant planet by a giant robot. Of primary importance in the story were the problems the main characters encountered and had to solve. In one problem, the characters had to hide from a giant robot in outer space and did so by hiding behind the robot (*point-of-view problem*). In another problem, the characters had to dislodge the robot from the cave. This was accomplished by attaching the robot to the spaceship with a rope and a suction cup and pulling the robot out of the cave (*pulling problem*). The realistic book was created for experimental purposes, but was bound and printed with pictures and words in a fashion similar to the fantasy story. The story was structurally similar and the characters solved structurally similar problems. In the real story, the boys hid from their babysitter while playing hide-and-go-seek (point-of-view problem) and used a suction cup and string to pull a small toy toward them (pulling problem).

Testing materials. Children were asked to transfer solutions for two novel problems structurally similar to the problems solved by the characters in the fantasy and real book. In the point-of-view transfer problem, children were shown one small pocket-sized doll, one large pocket-sized doll with a camera, and a model room without furniture. The doll with the camera was placed in a corner and children were asked where the small doll could hide so as not to be seen by the camera. The same small-sized pocket doll was used in the pulling transfer problem. This doll was presented with a remote-controlled car, a block, two small suction cups, a piece of yarn, as well as an index card, and a paperclip. Children were asked to how the doll could move the block without using its hands.

Cognitive ability. Cognitive ability was measured using the Brief Intellectual Abilities subtests of the Woodcock-Johnson III–NU. The three tests administered measure verbal comprehension, concept formation, and visual matching, a test of cognitive efficiency. For children between 3 and 5 years of age, the verbal comprehension test has a reliability of .88–.89, the concept formation test has a reliability range of .86–.94, and the visual matching test has a reliability range of .87–.91 (McGrew, Schrank, & Woodcock, 2007).

Fantasy Orientation Interview. The Fantasy Orientation Interview consisted of four types of questions: questions about the child's general play preferences, impersonation play, imaginative behaviors, and imaginary companions. Several of the general play questions, such as asking about the child's favorite television show or their favorite toy, as well as questions from an Impersonation Interview were taken from Taylor and Carlson (1997). The questions adapted from the Impersonation Interview ask about the child's pattern of impersonation-oriented, pretend behavior (i.e., pretending to be an animal or a person). Similar questions have been used by other researchers as well (e.g., Sharon & Woolley, 2004; Woolley et al., 2004). Questions about the child's imaginative play were adapted from the Imaginative Play Predisposition Interview originally developed by Singer (1961) and Singer and Streiner (1966). These questions ask about the child's favorite game, as well as what the child thinks, does, and says when they are by themselves. The Imaginary Companion Interview was taken from Taylor et al. (1993; see also Taylor & Carlson, 1997). Imaginary companions were defined according to Taylor and colleagues; an imaginary companion could be completely pretend, a toy, or a stuffed animal as long as there was evidence of extended pretend play and interaction as if the imaginary companion were real.

Children's answers to these questions were used to develop a fantasy orientation composite through principal component analysis. Prior to collection of the data for this study, this survey was given to 89 children, ranging in age from 3 years 2 months to 5 years 5 months ($M = 4.51$, $SD = 0.46$). Principal components analysis was used to determine a fantasy orientation subscale. Based on these analyses, children's fantasy orientation was determined by their answers to four questions: ''Do you talk to yourself when you are lying in bed?'' (Singer, 1961; Singer & Streiner, 1966), ''Do you have a pretend

friend?'' (Taylor et al., 1993), ''Do you like to make up songs or plays?'' and ''Do you ever sing those songs or act out the plays for your family or friends?'' The loadings of these questions after varimax rotation were .73, .54, .74, and .78, respectively. Children received 1 point for *yes* and 0 points for *no* for a total possible fantasy orientation score of 4. One item that may have been expected to load on this measure was the question ''Do you like to pretend?'' The reason this question did not load is that nearly all of the participants (90.9%) indicated they liked to pretend, so the question did not have enough variation to warrant inclusion on this factor. The additional questions included in the principal component analysis used to derive the Fantasy Orientation composite are included, with their factor loadings, in Appendix A.

Procedure

Children were randomly divided into two groups to hear either the fantasy book (n = 17; 10 males, 7 females; mean age = 4.36) or the realistic book (n = 16; 7 males, 9 females; mean age = 4.64) in a quiet corner of their preschool classroom, one-on-one with an experimenter. The experimenter read the stories in a manner typical for young children (e.g., mimicking character voices). Although children were allowed to comment on the reading, there was no additional interaction about the story.

After the storybook reading, children were interviewed by the experimenter. The first two questions measured children's memory for the solutions to the problems the characters faced in the story (*solution memory*). Children were given a score of 1 if they provided the correct response, for a possible score of 2. In the case that the child did not provide the correct response, they were reminded of the relevant story details to increase the likelihood of transfer.

Following the solution memory questions, children were asked two transfer questions (*transfer*). These transfer problems were structurally similar to the aspects of the story memory measured in the solution memory questions. If children were to apply the same solution to the transfer problems as the characters did, then children would arrive at the correct transfer solution. The solution memory and transfer questions are shown in Appendix B. Questions in both the real and the fantasy story were the same. These questions were determined by the characters use of a physical concept, such as spatial orientation (point-of-view problem) or the use of tools (pulling problem) to solve a novel problem. The correspondence of the story solution questions and the transfer questions are noted in Table 1 for both the fantasy and the real stories. Again, children were given a score of 1 if they provided the correct response, for a possible score of 2. If children did not spontaneously produce the solution, they were prompted to think about the story and were encouraged to come up with as many solutions as they could before the testing ended. A pilot study with 10 children determined that children did not provide the correct transfer solutions to these problems without exposure to the storybook.

Following the transfer problems, children were asked five general memory questions (*general memory*). These questions asked about content-irrelevant aspects of the story that children were likely to know if they attended to the storybook, such as the color of protagonists' shirts. Children could answer these questions correctly without having an understanding of the problem solutions. For each question a child answered correctly, they received 1 point. Points were summed across general memory questions for a possible composite score of 5.

On a separate testing day, children were given a standardized test of cognitive ability and a fantasy

Table 1
Correspondence Between Story Solution Questions and Transfer

	Story solution: Fantasy	Story solution: Real	Transfer solution
Point of view	Little Bill and Captain Brainstorm hid behind Robotcha to avoid being seen	Ford hid behind his babysitter during hide-and-go-seek so the babysitter couldn't find him	Children move Joey behind his dad to avoid being in the picture
Pulling	Little Bill and Captain Brainstorm used a plunger and a rope to attach the spaceship to Robotcha and pull his foot out of the cave	Tucker used a suction cup dart gun and a piece of string to pull a toy closer to him during a movie	Children attach a suction and a string to the remote-controlled car and block to move both items without using their hands[a]

[a]Children were awarded the full points for producing half of the required steps: putting the suction or yarn on/around the car without connecting it to the block, or vice versa.

orientation interview. The order of these tests was counterbalanced across participants.

Results

All analyses were initially run including gender as a variable, and there were no significant main effects of or interactions with gender. Therefore, gender was not included in the analyses. In addition, because the study was between subjects, all individual difference variables were compared between the story-type groups. There was a trend toward a significant difference of age, $F(1, 32) = 3.28$, $p = .08$. Participants in the fantasy story condition ($M = 4.36$, $SD = 0.51$) were somewhat younger than participants in the reality story condition ($M = 4.64$, $SD = 0.35$). Participants' cognitive ability ($M = 18.86$ vs. 22.81, fantasy vs. reality, respectively) and fantasy orientation ($M = 2.71$ vs. 3.31, fantasy vs. reality, respectively) scores did not differ by condition.

Age, cognitive ability, and fantasy orientation were not correlated with responses to the outcome variables. Given that age, cognitive ability, and fantasy orientation were not significantly different based on condition, these variables were not included in these analyses. However, they are used for analyses later in this article. The means and standard deviations of the outcome variables by story group can be found in Figure 1.

We first examined whether children remembered the solutions to the problems presented to them in the story. When asked how the characters solved the two problems, only 9 (27%) of the children provided the correct responses. Although this may seem fairly low, it is important to note that the story structure was more complex than those typically used in the analogical-transfer paradigm. Thus, the majority of children needed to be reminded about the characters' solutions to the problems in the stories. Once children were reminded of the solutions, they were able to repeat these solutions back to the interviewer before continuing with the transfer questions. We also examined whether children who remembered the solution on their own were more likely to transfer the solutions than the children who needed to be reminded of the solutions, and there was no significant difference in transfer for the two groups of children.

A multivariate analysis of variance (MANOVA) was conducted comparing responses to the general memory questions, the solution memory questions, and the transfer questions based on story condition (fantasy vs. reality). The MANOVA revealed no multivariate effect of condition (Wilks's lambda = .83, $p = .22$). In terms of the univariate effects, there was no significant difference between the groups for the general memory and solution memory questions. There was a significant difference between the groups on the number of correct responses to the transfer questions, $F(1, 26) = 4.55$, $p < .05$. Participants in the reality condition ($M = 1.36$, $SE = 0.24$) were significantly more likely to correctly transfer solutions than participants in the fantasy condition ($M = 0.64$, $SE = 0.24$).

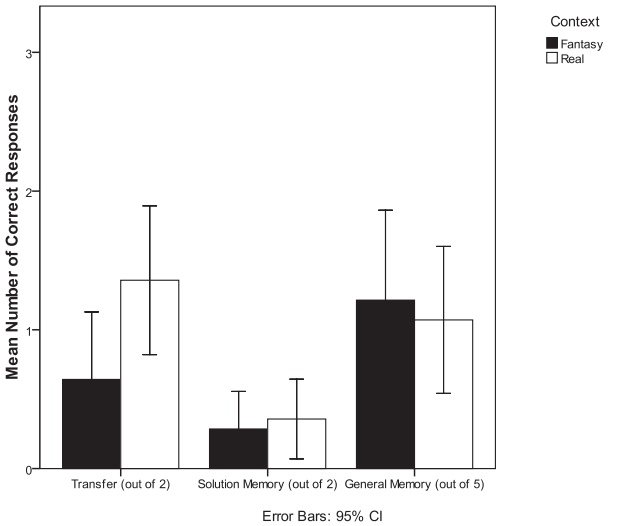

Figure 1. Mean number of correct responses by story context for Study 1.

Discussion

Children were significantly more likely to transfer problem solutions if they heard the real story rather than the fantasy story. The fact that there were no differences in general memory or solution memory for the two stories suggests this difference cannot be accounted for by greater attention to or memory for the real story than the fantasy story. Consistent with our hypotheses, children from both story conditions displayed memory for the relevant problem features; however, the children who were read the fantasy story were generally unable to connect their memory to the transfer of these solutions.

One possible explanation for these findings is that children in this age range do not expect that they should learn anything from fantasy stories that they can apply to real-world problems. Indeed, many children in this age range determine that events that happen within fantasy contexts are impossible (Shtulman & Carey, 2007). Thus, the

resistance to transferring solutions may reflect either a general distrust of information learned in fantasy contexts or be a by-product of the fact that children at this age are still learning the repercussions of quarantining the fantasy world from the real world. One way to indicate to children that they should trust the information in the fantasy stories is to present that information in a context in which children are used to hearing stories and answering questions about them. Indeed, preschool children do experience circumstances in which they are expected to transfer learning between fantasy stories and real-world situations, namely, the classroom context. Thus, presenting the information in a classroom setting may increase the likelihood that children will encode the information in a way that does not result in quarantining the solutions.

Study 2

One reason children may have resisted transferring from fantasy characters is that they have not yet learned that fantasy characters can be ''trusted'' as a source of information about the real world (Richert et al., 2009). Children at this age have demonstrated the ability to discriminately trust informants based on age (Taylor, Cartwright, & Bowden, 1991), past accuracy (Pasquini, Corriveau, Koenig, & Harris, 2007), and expertise (Lutz & Keil, 2002). One way to test this possibility is to present children with the material in a classroom setting in which they commonly are expected to learn, remember, and repeat information. Admittedly, preschool children's learning expectations in a classroom setting are likely implicit, although young children do understand that teachers ''teach'' information (Ziv & Frye, 2004). If in the classroom setting children approach the fantasy stories more similarly to the way in which they approach the real stories, this may result in increased transfer from the fantasy stories. We tested this possibility in Study 2. We hypothesized that children may treat fantasy and real sources equally in contexts that children have previously been expected to learn from this kind of material.

Method

Participants

Participants in this study were 51 children aged 3½ to 5½ (M = 4.52, SD = 0.43). There were 20 boys and 31 girls. The majority of the participants were Hispanic (60.8%), 9.8% were African American, 3.9% were Asian, 3.9% were some other ethnicity, and 21.6% declined to indicate their ethnicity. Participants were recruited through their day cares and preschools to hear a story as a full class. Although children heard the story as an entire class, only the children whose parents had signed permission slips were interviewed after the story was read. As with the Study 1, participants did not have to be native speakers of English to participate in this study, but they had to be proficient in English. English proficiency was determined by children's ability to participate in a standardized test of intelligence that included four vocabulary subtests.

Procedure

The materials in Study 2 were the same as the materials in Study 1. The procedure for Study 2 was identical to the procedure for Study 1, with two exceptions. First, participants were read either the fantasy (n = 33; 10 males, 23 females; mean age = 4.65) or realistic (n = 18; 10 males, 8 females; mean age = 4.29) book as an entire class during a normal circle time. Second, because of time constraints, approximately half of the children were not tested on the same day as the storybook reading (n = 30). All children were tested within 2 weeks of hearing the story, and our initial analyses assessed whether children differed in their responses based on the time of testing. Similar to Study 1, all participants were asked the solution memory, transfer, and general memory questions. On a separate day, children were assessed for cognitive ability and fantasy orientation, which were presented in a counterbalanced fashion.

Results

Although the day of testing varied by child, there were no significant differences in general memory, solution memory, or transfer based on the day of testing. Thus, scores were collapsed across the time of testing in all analyses. All analyses were initially run including gender as a variable, and there were no significant main effects of or interactions with gender. Therefore, gender was not included in the analyses. In addition, because the study was between subjects, all individual difference variables were compared between the story-type groups. In contrast to Study 1, there were significant differences in age, $F(1, 49) = 9.34$, $p < .01$, and cognitive ability, $F(1, 49) = 5.48$, $p < .05$, by condition. Participants in the fantasy story condition (M = 4.64, SD = 0.38) were signifi-

cantly older than participants in the reality story condition (M = 4.29, SD = 0.45). Participants in the fantasy story condition (M = 24.66, SD = 6.52) also had significantly higher cognitive ability scores than participants in the reality story condition (M = 19.94, SD = 7.37). Participants' fantasy orientation scores did not differ by condition (M = 2.91 vs. 2.61, fantasy vs. reality, respectively).

Given that age and cognitive ability were significantly different based on condition, we examined whether these variables correlated with our outcome variables to determine whether they needed to be included as covariates in our analyses. Age was significantly correlated with solution memory (r = .39, $p < .01$), and cognitive ability was significantly correlated with general memory (r = .34, $p < .05$). Therefore, these variables were included as covariates in the following analyses. The means of the outcome variables by story group can be found in Figure 2.

As with Study 1, we examined children's spontaneous memory of the solutions to the problems in the stories. In this study, 25 (49%) of the children provided the correct responses. Children who did not provide the correct responses were reminded of the solutions before continuing with the transfer questions. An examination of whether children who remembered the solution on their own were more likely to transfer the solutions than the children who needed to be reminded of the solutions indicated that there was a significant difference in transfer between children who recalled the solutions on their own (M = 0.80, SE = 0.19) and children who needed to be reminded of the solutions (M = 0.19, SE = 0.11), $t(49) = 2.77$, $p < .01$. The role of solution memory in transfer is expanded in the Combined Analyses section.

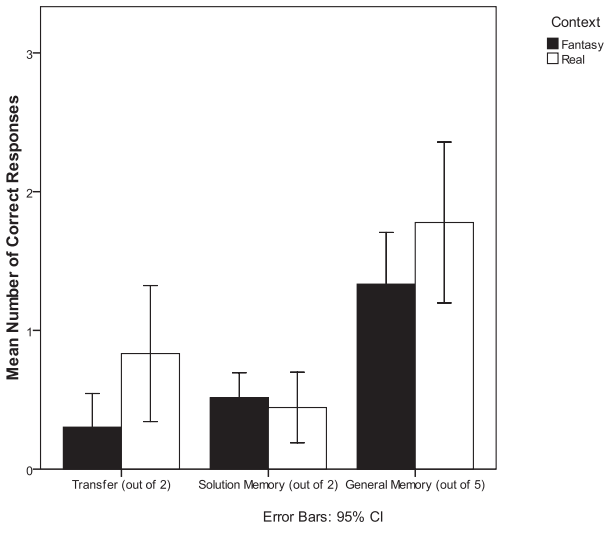

Figure 2. Mean number of correct responses by story context for Study 2.

A multivariate analyses of covariance was conducted comparing responses to the general memory questions, the solution memory questions, and transfer questions based on story condition (fantasy vs. reality) and with age and cognitive ability as covariates. The MANOVA revealed significant multivariate effects of age (Wilks's lambda = .83, $p \leq .05$), cognitive ability (Wilks's lambda = .81, $p < .05$), and story condition (Wilks's lambda = .79, $p \leq .05$). In terms of univariate effects, for solution memory, there was a main effect of age, $F(1, 46) = 8.46$, $p < .01$, but no effect of cognitive ability or story condition. Regression analyses confirmed that as age increased, so did the number of correct responses to the solution memory questions (R^2 = .15, β = .39, $p < .01$). For general memory, there was a main effect of cognitive ability, $F(1, 46) = 10.40$, $p < .01$, but no effect of age. Regression analyses confirmed that as cognitive ability increased, so did the number of correct responses to the general memory questions (R^2 = .12, β = .34, $p < .05$). There was also a main effect of story type, $F(1, 46) = 7.38$, $p < .01$. Participants in the reality condition (M = 2.08, SE = 0.26) were more likely to respond correctly to the general memory questions than participants in the fantasy condition (M = 1.17, SE = 0.19).

In terms of the number of correct transfer responses, there were no main effects of age or cognitive ability. There was a significant difference between the groups on the number of correct responses to the transfer questions, $F(1, 46) = 6.56$, $p < .05$. Participants in the reality condition (M = 0.88, SE = 0.20) were more likely to correctly transfer solutions than participants in the fantasy condition (M = 0.22, SE = 0.15).

Finally, given that participants in the reality condition had significantly higher general memory scores, we examined whether general memory scores could account for the increase in transfer from the reality stories. We conducted an analysis of covariance (ANCOVA) comparing responses to the transfer questions based on story condition (fantasy vs. reality), with general memory scores as the covariate. In this analysis, there was no effect of general memory scores, and the effect of context remained significant, $F(1, 46) = 4.00$, $p < .05$.

Discussion

In summary, similar to the findings of Study 1 and Richert et al. (2009), children were significantly more likely to transfer from the real story than the

fantasy story. Although children also had higher general memory for the real stories, the greater likelihood in transfer from the real stories could not be accounted for by general memory.

As is evident in Figure 2, the participants in Study 2 had transfer rates significantly lower than in Study 1, $F(1, 82) = 5.29$, $p < .05$, although their solution memory was significantly higher, $F(1, 82) = 4.03$, $p < .05$. There were no significant differences in general memory between the classroom and one-on-one conditions. Despite the prediction that hearing the stories in a classroom setting might result in increased transfer, only children's solution memory, and not transfer, benefited from the learning environment. Importantly, despite decreased levels of transfer overall, participants were still significantly more likely to transfer the solutions from the real story than the fantasy story. Given that similar patterns of responding emerged for Study 1 and Study 2, we were interested in examining the factors that predicted transfer from the fantasy story and the real story. Thus, we collapsed the data from the two studies together to conduct regression analyses.

Combined Analyses

The goal of the following analyses was to examine whether the factors predicting transfer vary between the fantastical and realistic stories. After collapsing the one-on-one and the classroom data together, we conducted simple regressions to examine the factors that predict transfer from the fantasy story and the real story separately. The means of participants' individual difference characteristics and scores for the collapsed data can be found in Table 2. The correlation matrices for the variables in the realistic context can be found in Table 3 and for the fantasy context can be found in Table 4.

In assessing transfer of solutions in the real character condition, linear regressions were conducted predicting transfer from age, exposure condition, cognitive ability, general memory, fantasy orientation, and solution memory (see Table 5). For the realistic context, the simple regression analyses indicated age significantly predicted transfer ($R^2 = .11$, $\beta = .33$, $p < .05$). In addition, solution memory also predicted transfer ($R^2 = .13$, $\beta = .36$, $p < .05$), and there was a trend toward an effect of general memory ($R^2 = .09$, $\beta = .30$, $p = .07$). As age, solution memory, and general memory increased, so did transfer.

Similar to the analyses for the realistic context, simple linear regressions were conducted predicting transfer from age, exposure condition, cognitive ability, general memory, fantasy orientation, and solution memory (see Table 6). For the fantasy context, the initial regression analyses indicated the only significant predictors of transfer were fantasy orientation ($R^2 = .10$, $\beta = -.32$, $p < .05$) and exposure condition ($R^2 = .08$, $\beta = .28$, $p < .05$). As fantasy orientation increased, transfer decreased, and participants in the one-on-one exposure group were more likely to transfer than participants in the classroom exposure group. In addition, there was a trend toward an effect of general memory ($R^2 = .06$, $\beta = .25$, $p = .08$). As general memory increased, so did transfer.

As hypothesized, age and solution memory were the primary factors that influenced transfer from the real story. These findings mirror other research suggesting the importance of understanding the goal-relevant aspects of a problem for successful analogical transfer (Brown et al., 1986). The factors predicting transfer in the fantasy condition were different, however. Children were less likely to transfer if they scored high on fantasy orientation, and they were more likely to transfer if they were read the story in the one-on-one condition.

General Discussion

The goal of these studies was to examine preschool children's transfer from fantasy and real stories. Given that preschoolers have demonstrated the ability to distinguish fantasy from reality in a variety of previous studies (Golomb & Galasso, 1995; Morison & Gardner, 1978; Samuels & Taylor, 1994; Sharon & Woolley, 2004; Shtulman & Carey, 2007;

Table 2
Means (and Standard Deviations) of Participants' Individual Difference Characteristics and Scores by Story Context for Collapsed Data

	Age	Woodcock-Johnson (raw)	Fantasy orientation	General memory	Solution memory	Transfer
Fantasy	4.55 (0.44)	22.81 (7.32)	2.84 (1.20)	1.30 (1.06)	0.42 (0.50)	0.42 (0.76)
Real	4.45 (0.44)	21.29 (8.64)	2.94 (1.10)	1.47 (1.11)	0.38 (0.49)	1.02 (0.97)

Table 3
Correlation Matrix: Realistic Stories

	Age	Woodcock-Johnson	Fantasy orientation	General memory	Solution memory	Transfer
Age	—					
Woodcock-Johnson	.35*	—				
Fantasy orientation	−.08	−.27†	—			
General memory	.20	.36*	−.32†	—		
Solution memory	.34*	.13	.02	−.01	—	
Transfer	.33*	.25	.06	.30†	.36*	—

†$p < .10$. *$p < .05$.

Table 4
Correlation Matrix: Fantasy Stories

	Age	Woodcock-Johnson	Fantasy orientation	General memory	Solution memory	Transfer
Age	—					
Woodcock-Johnson	.21	—				
Fantasy orientation	.02	−.12	—			
General memory	.28*	.24	−.16	—		
Solution memory	.28*	.07	.07	.21	—	
Transfer	.23†	.16	−.32*	.25†	.13	—

†$p < .10$. *$p < .05$.

Table 5
Summary of Simple Regression Analysis for Transfer in Realistic Context

Variable	*B*	*SE*(*B*)	β
Age ($R^2 = .11$, $p < .05$)	.71	.33	.33*
Exposure condition ($R^2 = .02$, *ns*)	.30	.40	.12
Cognitive ability ($R^2 = .06$, *ns*)	.04	.02	.25
General memory ($R^2 = .09$, $p = .07$)	.34	.18	.30†
Solution memory ($R^2 = .13$, $p < .05$)	.36	.15	.36*
Fantasy orientation ($R^2 = .00$, *ns*)	.07	.20	.06

†$p < .10$. *$p < .05$.

Table 6
Summary of Simple Regression Analysis for Transfer in Fantasy Context

Variable	*B*	*SE*(*B*)	β
Age ($R^2 = .05$, p = *ns*)	.48	.29	.23
Exposure condition ($R^2 = .08$, $p < .05$)	.64	.31	.28*
Cognitive ability ($R^2 = .03$, p = *ns*)	.03	.02	.16
General memory ($R^2 = .06$, $p = .07$)	.27	.15	.25†
Solution memory ($R^2 = .02$, p = *ns*)	.13	.13	.13
Fantasy orientation ($R^2 = .10$, $p < .05$)	−.29	.12	−.32*

†$p < .10$. *$p < .05$.

Wellman & Estes, 1986; Woolley & Wellman, 1993), we examined whether children differentiate in their use of fantasy and real stories as sources of information about real-world problems. One previous study indicated preschool children were less likely to transfer solutions from stories about fantasy characters than from stories about real characters (Richert et al., 2009).

The studies reported in this article used the analogical problem-solving paradigm (e.g., Brown et al., 1986; Holyoak et al., 1984). Children heard either a fantasy story or a real story about characters solving problems. Children were then asked to solve structurally similar problems in a novel domain. In Study 1, participants were least likely to transfer solutions from fantasy stories. This decreased transfer could not be accounted for by general memory or solution memory for the two stories. Study 2 examined the possibility that children might treat information from fantasy storybooks differently when presented in a classroom situation. Children performed better on the solution memory questions in the classroom condition compared to the one-on-one condition, but there was no difference in children's solution memory as a function of story type. If the classroom setting evoked an implicit expectation of learning in young children, as evidenced by better

memory for the central story features, this expectation was not sufficient to overcome the deficit of transfer from the fantasy story. Children were still more likely to transfer from the real story than the fantasy story.

Given that the participants were primarily Hispanic and from low-income preschools, a sample different from samples in previous research on analogical transfer, it is important to note that the analogical transfer rate for children in Study 1 (55.9% transferred at least one analogical solution) was consistent with transfer rates reported in previous research. Past research has suggested that preschool children transfer anywhere from 18% of the time (Kim & Choi, 2003) to 58% of the time (Holyoak et al., 1984). The lower rates of transfer in the classroom condition of Study 2 (27.5% of children transferred at least one of the analogical solutions) are not inconsistent with the lower end of previously reported transfer rates. Additionally, the fact that transfer in general was better in the one-on-one condition should not be surprising given research on improved learning with personalized attention (e.g., Berk & Winsler, 1995). Thus, the findings from our research with the types of stories children transfer from in their natural environment provide ecological validity to past studies on analogical transfer.

Related to the factors generally associated with increased transfer, it is important to note that, in some ways, the children in the fantasy condition were at an advantage to transfer solutions, compared to the children read the real stories. Although there was a trend for children in the real condition to be older than children in the fantasy condition in Study 1, in Study 2 the children who were read the fantasy story were older and had higher cognitive ability scores. Analogical transfer is a fundamental cognitive skill (Goswami, 2001), and its use increases with age (Holyoak et al., 1984). The fact that transfer was higher for children who heard the real book in Study 2, children who were younger with lower general cognitive ability scores, indicates the significance of the greater likelihood of transfer from the real stories.

One explanation for the differences in transfer between the stories is that it was harder for children to see the superficial similarity between the fantasy context and the target analog, given that the target analog used realistic dolls. This explanation would be supported by previous research suggesting children's increased likelihood of transfer when the source and target analogs are superficially similar (Crisafi & Brown, 1986; Daehler & Chen, 1993; Holyoak et al., 1984). Even if this is the sole explanation for children's decreased likelihood of transferring from the fantasy stories, it points to an important stage in children's developing ability to negotiate the relation between fantasy and real worlds. Almost by definition, fantasy worlds are superficially dissimilar to the real world, and as Weisberg and Goodstein (2009) noted, there are gradations in the degree to which fantasy worlds differ from the real world. Thus, researchers should consider how transfer between these worlds is influenced by the degree of both superficial and relational differences between these subworlds.

The combined regression analyses indicated that the processes underlying transfer were different for the children who were read the real story and the children who were read the fantasy story. The factors that predicted transfer for the children read the real story were similar to those documented by previous research (e.g., Brown et al., 1986; Crisafi & Brown, 1986; Daehler & Chen, 1993; Goswami, 2001; Holyoak et al., 1984; Kim & Choi, 2003; Richert et al., 2009; Richland, Morrison, & Holyoak, 2006; Singer-Freeman, 2005; Tunteler & Resing, 2002): age and memory for the solution-relevant parts of the source story. In contrast, children who were read the fantasy story were most likely to transfer solutions if they were read the story one-on-one with the experimenter, if they had low fantasy orientation, and if they had higher cognitive ability scores. Children's increased transfer in a one-on-one situation and with higher cognitive ability scores is also consistent with previous research (e.g., Berk & Winsler, 1995).

The finding related to fantasy orientation is particularly informative for interpreting children's reduced likelihood in transferring from the fantasy stories. The children with the most experience in fantasy worlds were the least likely to use the fantasy story as resource for real-world problem-solving strategies. One possible explanation is that fantasy orientation was serving as a proxy for lack of attention or lower cognitive ability. However, fantasy orientation was not correlated with age, cognitive ability, general memory, or solution memory, indicating children's general engagement in fantasy independently influenced their transfer from the fantasy stories. Also, fantasy orientation was unrelated to children's transfer from the realistic stories. So, the negative relation between fantasy orientation and transfer from fantasy stories is likely attributable to individual differences in children's general experience with fantasy.

An alternative explanation is that children who are more involved in fantasy also have a stronger fantasy–real boundary (Richert et al., 2009; Sharon & Woolley, 2004). This stronger boundary might make fantasy-oriented children less likely to learn and transfer problem-solving strategies to the real world from the fantasy with which they more frequently engage. Highly fantastical children may be more likely to quarantine information learned in a fantasy context from real-life situations because their heightened involvement with fantasy may lead them to realize how different fantasy worlds can be from the real world. This increased knowledge of the differences between the two worlds could lead children to the view that fantasy stories do not provide relevant information for solving real-world problems.

Given that fantasies are free to vary from real-world constraints and may not be applicable to real-world problems, quarantining fantasy may indicate a mature strategy on the part of preschool children. Preschool children are learning about what is possible and impossible in the real world (e.g., Shtulman, 2009; Shtulman & Carey, 2007), and not all strategies that work in fantasy worlds (e.g., walking through walls, flying) will work in the real world. Until children have a firm grasp on what kinds of principles can overlap between real and fantasy worlds and what kinds of principles cannot, it may be beneficial for children to keep fantasy and real worlds separate from each other. Certainly, we do not want children thinking that just because Superman can fly, that they should try to fly themselves.

If quarantining is a sophisticated strategy, we may expect children to only quarantine certain kinds of strategies they learn about in fantasy stories. In the case of the studies reported earlier, children needed to abstract physical solutions to problems. However, the fantasy story had situations that did not coincide with the physical laws on earth (e.g., flying space rockets and agentic robots). Other kinds of information may be more likely to transfer, such as messages about morals or social conventions. Indeed, in making judgments about whether certain facts would be true in a novel fantasy world, adults are more likely claim social conventions would continue to be true rather than facts contingent on physical reality (Weisberg & Goodstein, 2009). However, preliminary evidence suggests that understanding the maintenance of social conventions in most fantasy worlds may itself be a developmental task. Recent research by Mares and Acosta (2010) suggests children do not abstract the intended moral lessons from fantasy stories on television without adult intervention. In addition, in a study similar to the ones reported earlier, children were no more likely to transfer social solutions than physical solutions from fantasy stories (Richert et al., 2009). Thus, future research should address the kinds of information children are likely to transfer between real and fantasy worlds.

Lastly, the findings from the studies reported here do not suggest engaging children in fantasy stories is detrimental. Many scholars have outlined the importance of fantastical thinking for cognitive development (Harris, 2000; Lillard, 2001; Nichols & Stitch, 2000; Taylor, 1999; Vygotsky, 1978; Woolley, 1997). Two common features of these characterizations are that imagination is a sophisticated form of cognition and that engaging children's imagination plays an important role in children's cognitive development. However, this precocious cognition in fantasy contexts does not ensure preschool children's seamless negotiation between fantasy stories and the real world. Despite and perhaps because of preschool children's abilities to distinguish fantasy from reality, children at this age may be less likely to transfer information from the fantasy world to help them solve real-world problems. Therefore, researchers, parents, and teachers need to consider not only what children's thinking is like within these various subworlds but also what and why we expect young children to transfer between them.

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Appendix A: Fantasy Orientation Composite

Fantasy Orientation Questions

Question	Loading
Do you talk to yourself when you are lying in bed?	**.72**
Do you like to make up songs or plays?	**.74**
Do you ever sing those songs or act out the plays for your family or friends?	**.78**
Do you have a pretend friend?	**.54**
Do you like to watch TV?	−.12
Do you like to read books?	.04
Do you like to play tag?	.06
Do you like to draw?	.09
Do you like to pretend?	−.02
Do you like to play on the computer?	−.11
Do you ever play video games?	.30

Note. Composite loadings after varimax rotation. The bold values are the factors that load onto the Fantasy Orientation score. The responses to the other questions are not a part of the final score.

Appendix B: Target Problems

Description of Solution Memory and Transfer Questions

	Solution memory	Transfer
Point of view	Do you remember when Little Bill and Captain Brainstorm needed to hide from Robotcha? Where did they hide?	Ok. Now I want to play a game with you. This game is about taking pictures. Have you ever taken a picture with a camera before? Well, Joey's dad here wants to take a picture of this whole room. So, he holds the camera up to his eyes and turns his head to the left and to the right to see the whole room. But he doesn't want Joey in the picture. So, he tells Joey to hide somewhere. Joey has to hide in a spot that, no matter which way his dad turns his head with the camera, he can't see Joey. Can you think of a place that Joey can hide from the camera?
Pulling	Do you remember when they had to get Robotcha's foot out of the cave? How did they do that?	This game is about moving things around. Joey wants to find a way to move both his Lightening McQueen toy car and this block without touching either of them. Look, see how this car moves forward and backwards by using the remote. Joey can make the car move without touching it. What would you do to show Joey how he can make both things move at the same time without touching either? You can use any of these things here (car, block, suction cup, string, paper, and paperclip).