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Learning From Fantasy and Real Characters in Preschool and Kindergarten

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In three experiments, 3½- to 6-year-old children were presented with analogical problems in which the protagonists were either real people or fantasy characters. Children were more likely to transfer solutions from the stories about real people rather than the stories about fantasy characters. These results suggest that the use of a fantasy character might not be an effective strategy for teaching children information that is meant to be applied to the real world.

Research has established that the transfer of knowledge is facilitated by similarity between the context in which the information is learned and the context in which it is to be applied (Catranbone & Holyoak, 1989; Spencer & Weisberg, 1986). However, many learning contexts designed for young children reduce the similarity between learning and transfer by using fantasy contexts and/or fantasy characters to teach information that is meant to be applied in the real world (e.g., Allender, 1991). For example, preschool teachers often embed their curriculum within a fantasy context; and fantasy characters are used in educational television to communicate important real-world information to young children. The assumption is that children

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will pay attention and learn better because fantasy is engaging and makes the material interesting (Lepper, Aspinwall, Mumme, & Chabay, 1990; Parker & Lepper, 1992). Despite these assumptions, children might be more likely to apply information learned from real sources rather than fantastical sources.

Given past research showing a facilitative effect of fantasy contexts on children's performance for some cognitive tasks (Dias & Harris, 1988, 1990; Hawkins, Pea, Glick, & Scribner, 1984; Leevers & Harris, 1999; Richards & Sanderson, 1999; Lillard, 1996; Lillard & Sobel, 1999; Sobel & Lillard, 2001), it is not unwarranted to assume that using fantasy characters as teachers will have a beneficial effect on learning. But do children consider fantasy characters to be good sources of information about the real world? Research shows that children distinguish fantasy characters from real ones (e.g., Morison & Gardner, 1978; Wellman & Estes, 1986), but there is less information about what children expect fantasy characters to know. If they consider fantasy characters to be poor sources of information about the real world, they might not transfer information taught by fantasy characters to real-world situations.

Research investigating the ability of preschool children to judge the source of information provides some support for this alternative hypothesis about the efficacy of fantasy characters as teachers of real-world information. In general, preschool children are quite discriminating in their evaluation of the information provided to them by others (Harris, 2006). They judge some sources of information to be more reliable and trustworthy than others. For example, they distinguish between the kinds of knowledge that different people are likely to have as a function of expertise (e.g., a doctor knows more about a broken arm than a car mechanic; Lutz & Keil, 2002), expect that knowledge increases with age (Taylor, Cartwright, & Bowden, 1991), and are able to make evaluative judgments about informants based on the accuracy of their past statements (Pasquini, Corriveau, Koenig, & Harris, 2007). But what might children think about a fantasy character as an information source? According to Skolnick and Bloom (2006), children conceptualize fictional worlds (e.g., the world of "Sponge Bob" or of "Batman") as distinct and separate from each other and from the real world. Given children's quarantine of fictional worlds from the real one, it is possible that children might not expect the statements or actions of a fantasy character to be relevant to real-world situations.

To investigate children's transfer of information presented to them by real and fantasy characters, we used the analogical problem-solving paradigm developed by Holyoak, Junn, and Billman (1984) for testing children's ability to transfer problem solutions from one context to another. In this procedure, children hear a story in which a character solves a problem (the source analog), and then the children are given a similar problem to solve themselves (the target analog). For example, Holyoak et al. told

children a source story about a genie who wanted to transfer his jewels from one bottle into another without dropping any (the source analog). In order to achieve this goal, the genie used a magic staff to pull one bottle closer to the other bottle and then dropped the jewels into it. In another version of the story, the genie used a rolled-up magic carpet to move the jewels from one bottle into the other. Children were then presented with a problem (the target analog) in which they could use any number of tools (a walking cane, a large piece of poster board, a hollow tube, scissors, string, tape, paper clips, and rubber bands) to transfer balls from a bowl in front of them to an out-of-reach bowl.

These tasks proved to be quite challenging; only 50% of 4½- to 6-year-olds produced the cane solution after the magic staff story, and only 30% produced the rolled paper solution after the magic carpet story, even after a hint to think about the source story. Holyoak et al. found some improvement in children's performance when they used fantasy characters that were more familiar than a genie, but more substantial improvement was achieved when the procedure focused the children's attention on the relevant goal-structure of the source problem. In a study by Brown, Kane, and Echols (1986), 70% of the 4- to 5-year-old children who were asked to repeat the goal structure of the source story about a genie transferring jewels from one bottle to another used the solution provided in the source to solve a target problem in which they had to help the Easter Bunny move eggs across a river. In contrast, when children were simply given the target problem immediately following the source story, only 20% transferred the problem solution.

Children also benefit from additional experience with analogical problems. Brown and Kane (1988) told 3-year-old children stories in which animals employed defense mechanisms against danger (e.g., strange markings) and found that 75% of the children were able to successfully transfer the defense mechanism from a source story to the target story for the last of three trials. This result was interpreted as evidence of the facilitative effect of experience with analogical problems, because only 10% of children were able to solve the problem if they were provided with only one source story and asked to infer how the animal could defend itself.

In sum, past research has identified three facilitative conditions for solving analogical problems: (1) familiarity with the characters in the stories, (2) attention to the goal-relevant features of the source analog, and (3) experience with the analogical problems. However, the pattern of results found in these studies might have been partly a function of the kinds of source analogs presented to children. The youngest children who were able to demonstrate transfer in these studies were the 3-year-olds in Brown and Kane's (1988) study about transferring defense mechanisms from one animal to another. In this case, both the source and target stories involved

the need for real life animals to be protected from danger. In contrast, when problems require children to transfer from source stories about genies or other fantastical characters to real life target problems, children demonstrate difficulty with spontaneous transfer until the ages of five or six (Brown et al., 1986; Holyoak et al., 1984).

Our goal with this research was to investigate whether or not the use of fantasy or reality characters has an effect on preschoolers' ability to transfer solutions to novel problems. In three experiments, we used the analogical problem-solving paradigm developed by Holyoak et al. (1984), in which children are presented with the solution to a problem in one context and then presented with another context in which they can successfully solve a problem using a similar solution. In Experiment 1, we compared how well children transfer information they have learned from a fantasy character to help a real-world character, with how well they do the reverse (i.e., transfer information learned from a real-world character to help a fantasy character). In Experiment 2, we varied the type of information that was taught in the source stories to include solutions to social interaction problems (e.g., how to gain entry to a play group), as well as solutions to physical problem (e.g., how to move objects). In Experiment 3, children were taught information from a real character or a fantasy character and then were given similar problems to solve for themselves (i.e., a real-world situation).

The participants ranged in age from 3½ to 5½, an age range in which there is important development both in judgments of information sources and analogical transfer. Despite the wide use of fantasy characters for teaching children information they are expected to apply to the real world, we suspected children of all ages might show better transfer of information when the source of the information was real rather than fantasy. This hypothesis was derived from the data suggesting that even 3½-year-old children can discriminate fantasy characters from real characters and can demonstrate understanding of the implications of expertise.

EXPERIMENT 1

The purpose of Experiment 1 was to explore whether or not children differentiate between source analogs in their transfer of solutions from real and fantasy characters. Our hypothesis was that the children would be more likely to transfer information from stories about their teachers than the fantasy characters, because they are likely to see their teachers as more relevant sources of information than the fantasy characters.

In this experiment, the analogical tasks were made as simple as possible by using familiar characters (Holyoak et al., 1984) and by having children

repeat the relevant features of the source and target stories (Brown et al., 1986). In the fantasy condition, children were told a story about Mike and Sulley of the 2001 Disney movie *Monsters, Inc.* At the time these data were collected, the movie *Monsters, Inc.* had just been released on DVD. In the reality condition, children were told a story about their school teacher. In the source stories, children learned that (a) objects can be moved from one point to another by wrapping them up in a towel, and (b) stacking dominoes under a block will make it the same height as another block. Each child was told one fantasy context story and one reality context story (the order was counterbalanced). The wrap and stack problems occurred equally often in the fantasy and reality contexts across the sample.

Pilot testing was conducted with 12 children (range = 3;3 to 5;6) who were given the real target stories only (without source stories). One child (age = 5;3) produced the correct solutions for both the stacking problem and the wrapping problem, and one child (age = 5;6) produced the correct solution for the wrapping problem. However, 10 of the 12 children did not produce either solution. A second pilot test was conducted with an additional 12 children (range = 3;4 to 5;3) who were given the fantasy target stories only. None of these children produced the correct solution to either problem. These results indicate preschool children are unlikely to produce the solutions on their own regardless of context, and thus participants in this experiment who produce a solution following a source story are very likely to be transferring the solution from the source story.

Method

Participants. Sixty-four children, ages 3½ to 5½ ($M = 4$ years; 6, $SD = 5$ months), were recruited from preschools and day care centers in a small university town. There were two age groups: younger ($n = 30$, range = 3; 5 to 4; 6, 17 girls; 13 boys) and older ($n = 34$, range = 4; 8 to 5; 7, 14 girls; 20 boys). Nearly all participants were White and middle-class, representative of the community from which they were drawn.

Materials. Materials for the source stories included four pictures to assist in story-telling: one of each of the teachers from the three schools included in the study and one of the *Monsters, Inc.* characters Mike and Sulley. Materials for the wrap target story included marbles, a towel (analogical solution: wrapping), a small spoon, a blue block, a twistie, paper clips, a binder clip, and rubber bands. Materials for the stack target story included a blue block and an orange block (in descending height order, respectively), two dominoes (analogical solution: stacking), a spool of string, paper, tape, paper clips, and rubber bands. The *Peabody Picture Vocabulary*

Test-Revised (PPVT-R), a standardized measure of children's receptive vocabulary abilities, was also administered.

Procedure. Children were invited to go with the experimenter to look at some pictures and listen to some stories. At the beginning of the interview, each child was asked to identify the characters in the pictures (their teacher, Mike, and Sulley). All children correctly identified their teacher, but four children were excluded from the study because they could not identify the fantasy characters in the pictures.

All children were tested on two analogical problems and administered the PPVT-R between the problems. Each analogical problem had two phases, a source story phase and a target story phase. The source stories varied by character type (fantasy vs. reality) and by solution type (wrap vs. stack). Each child heard two stories counterbalanced by type and solution. Thus, each child heard both a fantasy story and a reality story; in one of the stories they were told the stacking solution and in the other story the wrapping solution.

In this first experiment, we focused on children's ability to transfer solutions across contexts, so for each problem there was a mismatch between the source and target stories. If children received the story about the fantasy character as the source story, the target story was about the children's teacher (*fantasy-source condition*). Conversely, if children were told the source story about a real character, the target story was about Mike and Sulley (*reality-source condition*).

The following is an example of the procedure for a child who was first presented the teacher story with the wrapping solution and the fantasy story with the stacking solution. To preface the source story, the experimenter showed the child the picture of his or her teacher and asked, "Who is this?" After the child responded that it was his or her teacher, the experimenter told the child, "I am going to tell you a story about your teacher. Listen closely to the story, okay? Because when I'm done telling it to you, I'm going to have you tell it back to me."

With the picture of the teacher displayed so the child could see it, the experimenter proceeded to tell the reality-wrap story: "(Teacher's name) told me that one day she was in the classroom handing out snacks and wanted to get all of the apples from the table to all of the students. She realized she couldn't carry them all without dropping some. She looked and looked for something to help her move the apples. Then she had a great idea. She decided to wrap the apples up in the blanket. That way, she could fit all of the apples into the blanket, carry them all at the same time to the tables, and hand them out."

To verify that the child understood the key elements of the story and that the relevant elements were encoded, the experimenter asked the child, "Can you tell the story back to me?" If the child left out information important to the transfer solution, the experimenter asked one of the relevant prompts—either "What was (teacher's name) trying to do?" or "How did (teacher's name) get all of the apples to the students?"

Once the child recounted the relevant elements of the source story about the teacher, the experimenter told the child the target story about the fantasy characters. In the wrap target story phase, the experimenter explained to the child that she was going to tell a story about a time when Mike and Sulley won a game. In this game, Mike and Sulley won a bunch of marbles and wanted to get them home without dropping any. The experimenter then placed the materials for the wrap game on the table (i.e., marbles, a towel, a small spoon, a blue block, a twistie, paper clips, a binder clip, and rubber bands), and children were told that Mike and Sulley found all of the materials in front of them. They were asked to come up with as many solutions as they could for ways Mike and Sulley could get the marbles home. If children did not spontaneously choose the analogical solution (i.e., wrapping the marbles in the towel), the experimenter asked, "Do you remember the story I told you? Does anything from the story help?" The game ended when the child either produced the analogical solution or responded that he or she could not come up with another way to accomplish the goal.

After completing the PPVT-R, children were told that the experimenter had another story to tell them. They were again asked to pay close attention, because they would be asked to tell the story back to the experimenter. Continuing with the current order example, following the reality-wrap story a child would have been shown the picture of the characters from *Monsters, Inc.* and told the following fantasy-stack story. "Let's imagine that one day Sulley and Mike were shopping for some fruit. Sulley wanted to give the apple to the monster up in the window. He realized he couldn't reach the window. He looked and looked for something to help him reach the monster in the window. Then he had a great idea. He decided to put the lunch boxes into a stack and stand on them. That way, he was the same height as the monster in the window and could give him the apple." Children were asked to repeat the story and given the same prompts as the first story.

Following this story, children were told about a time when their teacher was building a tower (stack target story). Children were told, "The other day (teacher's name) was building a tower with some blocks. The teacher wanted to make the top of this orange block the same height as the top of this blue one. The teacher looked and looked for something to help with

the blocks. These were the things that the teacher found. Can you think of a way that (teacher's name) found to make the blocks the same height?" The experimenter then placed a blue block, an orange block (in descending height, respectively), two dominos, a spool of string, rubber bands, a binder clip, and paper clips on the table. Children were again encouraged to come up with as many solutions as possible and prompted to think about the story if they did not perform the analogical solution (stacking the dominoes under the orange block) spontaneously.

Results and Discussion

Table 1 shows the number and percent of older and younger children in each condition who did not produce the analogical solution, produced the solution after the prompt to think about the source story, and produced the solution on their own without prompting.

For the analyses, children were given 1 point for transferring a solution after being given a hint (being prompted to think about the source story) and 2 points for transferring a solution on their own without being prompted. There were no significant differences in responses by gender, so gender was not included in the analyses. An Analysis of Covariance (ANCOVA) was conducted on participants' scores (ranging from 0 to 2), with source story (fantasy vs. real) as the within-subjects factor, age group (younger vs. older) as the between-subjects factors, and raw PPVT-R score as the covariate. There was no main effect of source story, age group, or PPVT-R score. However, there was a significant interaction between age group and source story, $F(1,61) = 4.96$, $p < .05$. Children in the younger age group were less likely to transfer from the fantasy source

TABLE 1
The Number of Children in Experiment 1 Who Transferred the Problem Solution as a Function of Age and Source of the Information (Real or Fantasy Character)

		<i>Source</i>	
		<i>Real character</i>	<i>Fantasy character</i>
Younger children (n = 30)	No transfer	8 (26.7%)	16 (53.3%)
	With hint	1 (3.3%)	5 (16.7%)
	Transfer	21 (70%)	9 (30%)
Older children (n = 34)	No transfer	10 (29.4%)	8 (23.5%)
	With hint	4 (11.8%)	6 (17.6%)
	Transfer	20 (58.8%)	20 (58.8%)

story ($M=.78$, $SE=.16$) than the reality source story ($M=1.39$, $SE=.17$). There was no significant difference for the older age group.

In summary, younger children were more likely to transfer solutions from stories about their teachers than from stories about fantasy characters. This result is not consistent with the hypothesis that fantasy has a facilitative effect on children's analogical problem-solving. However, this study does not allow us to draw conclusions about exactly why the fantasy condition was more difficult. One possibility is that children do not readily transfer information learned from a fantasy character. Alternatively, the difficulty might be with the target for the analogical transfer rather than the source. In the fantasy condition, the target was a story about a teacher who was trying to solve the problem. Perhaps children view teachers as people who know everything and who would already know how to solve the problem. This explanation seems unlikely, because most of the children who failed to transfer the solution used in the source story (74%) did suggest other solutions for the teacher to try (e.g., using the spoon to carry the marbles across the room for the wrap story). However, our point is that the results of this study do not uniquely place the difficulty with transfer from the fantasy characters as stemming from the use of a fantasy character in the source story, because the target stories also varied as a function of condition.

Experiment 2 teases out the issues related to the source and target contexts and the kinds of information children are asked to transfer. First, the experiment addresses the question about whether children's differences in responding can be explained by the characters in the source stories as opposed to the characters in the target story. This issue is examined by counterbalancing children's source and target stories in four ways: fantasy-to-fantasy, fantasy-to-reality, reality-to-fantasy, and reality-to-reality. Second, to address whether or not children may be more or less likely to transfer different kinds of information, Experiment 2 added social as well as physical solutions. Third, to clarify the issues related to using teachers as source characters, the characters in the stories were changed to characters that children might be more likely to identify with (by using younger characters) and be less familiar with (by using novel characters). This change was made because it is possible that the results of Experiment 1 might reflect children's preference for teachers as sources of information rather than (a) a more general tendency to transfer information learned from real-life characters, or (b) their lack of trust in fantasy characters as a source of information. Fourth, because we expected removing the familiarity of the characters might result in transfer difficulties for the younger children (Holyoak et al., 1984), we only recruited older children.

EXPERIMENT 2

In Experiment 1, children were taught solutions to physical problems (e.g., how to move a large number of apples). However, there is no reason to expect real-world physical properties to coincide with fantasy physical properties (e.g., in a fantasy world, one might move apples with magic words). Harris (2000) has argued that in children's fantasies and imaginative play, the focus is more on exploring social interactions than causal or physical properties. In Experiment 2, we used a wider range of problems, including two that involved social interaction rather than the physical manipulation of objects. The inclusion of problems involving social interaction was motivated by research suggesting that pretend play helps children with a mastery of social/emotional issues (Singer & Singer, 1990). In addition, some researchers have argued that analogical reasoning is particularly important for learning social behaviors, such as social roles (Holyoak & Gordon, 1984). Although the results of Experiments 1 suggest that, if anything, children are more likely to transfer information learned from a real character than a fantasy one, perhaps this advantage is specific to physical problems (e.g., how to move objects) rather than social ones (e.g., how to make friends). Our hypothesis was that children would successfully transfer solutions to social interaction problems learned in a fantasy context to real life situations.

Another goal of Experiment 2 was to increase the overall level of performance by giving children an additional rehearsal of the problem solutions during the source stories and by using a forced-choice rather than open-ended test question. Third, to clarify that the results are true of children who encode the information from the stories, stricter selection criteria were used for Experiment 2.

Method

Participants. Thirty-seven 4- and 5-year-old children participated in this experiment. Three participants were dropped because they did not meet our comprehension criteria for the stories. (See Results & Discussion section for exclusion criteria.) The final sample included 34 children, 17 boys and 17 girls ($M = 5;1$, $SD = 4$ months; range = 4;6 to 5;6). Participants were predominantly White and middle-class, representative of the community from which they were drawn.

Materials. Two photographs were used to illustrate the fantasy and reality characters in the stories. The fantasy character (named Beamer) was a unique, nonmedia based puppet with a colorful face, large ears, a tail,

and a brown body with black tufts on the head, neck, and hands. The reality character (named Pat) was an androgynous preschool-age child dressed in neutral-colored clothes. Experiment 2 used “wrap” and “stack” stories that were similar to those used in Experiment 1.

Pilot testing was conducted with 15 children (7 boys and 8 girls; $M = 4;3$, $SD = 2$ months, range = 4;0 to 4;8) to select social interaction problems that children did not already know how to solve. For the social interaction stories, we piloted two different stories: (a) a “group entry” story about how to join a group of children playing by finding a way to help the children (the incorrect answer was to ask if he or she could play), and (b) a “perspective taking” story about choosing a gift for an adult by remembering what a similar adult had really liked as a gift (the incorrect answer was to choose a gift that the child liked). Only 40% of the children correctly answered the “group entry” story, and only 26.7% of the children correctly answered the “perspective taking” story. Because a majority of the children were not as successful at answering the “group entry” and the “perspective taking” stories correctly, we chose to use them as the social interaction stories in Experiment 2. For the forced-choice test questions, the pilot study showed that children who did not hear the source stories tended to prefer the distracters rather than the solution described in the source stories. Thus, the participants in Experiment 2 who selected the correct solutions would be likely to be transferring the solutions from the source stories.

Procedure. Participants were told four stories in blocks of two, with the two social interaction stories in one block and the two physical stories in the other. Block order was counterbalanced, as well as the order of the two stories within each block. As in Experiment 1, the PPTV-III was administered between the two blocks.

In contrast to Experiment 1, in which children were told source stories about both fantasy and real characters, children in Experiment 2 were randomly assigned to either a reality or a fantasy character condition. This change was made to incorporate the different transfer contexts without requiring the children to spend too much time in the lab. In the reality source condition, “Pat” served as the protagonist of the learning sections of all of the stories. In the fantasy source condition, “Beamer” acted as the protagonist in the learning sections of all the stories. For the target stories in which children were meant to transfer the solution they had learned in the source story, we varied the type of character. Each block had one target story with Beamer as the protagonist and one with Pat as the protagonist. This manipulation allowed us to examine four types of transfer situations: fantasy-to-fantasy, fantasy-to-reality, reality-to-reality, and reality-to-fantasy.

Both characters were designed to be androgynous so that the gender of the character could be matched to the gender of the participant. For example, if the child was female, Pat and Beamer were females. Before each block of stories, participants were introduced to Pat and Beamer. The order of the introductions was randomized. For Pat's introduction, the experimenter set the photo of Pat on the table and said, "This is a picture of Pat. Pat lives in [name of child's town] like you. Pat likes to go for rides in the family car and likes to eat cookies." To introduce Beamer, the experimenter displayed the photo of Beamer and said, "This is a picture of Beamer. Beamer lives in storybooks like Winnie the Pooh. Beamer likes to go for rides on the family's flying carpet and likes to eat stardust."

Children were asked questions during each of the source stories to assess their comprehension of the problem and their understanding of the solution. The problem comprehension question (e.g., "What did Pat/Beamer want to do?") was asked directly after the problem in the story was stated. If children answered correctly, the experimenter responded by repeating the correct answer. Wrong answers were corrected and the question was repeated. If a child answered incorrectly a second time, the correct answer was repeated and the story continued. The solution comprehension question (e.g., "How did Pat/Beamer get the other children/creatures to let him/her play with them?") was asked at the end of the source story. Correct answers were repeated and wrong answers were corrected and the question was asked again.

The wrap and stack target stories were similar to the target stories in Experiment 1, except that there were not actual materials present. This change was to compensate for the fact that solutions to the social interaction problems did not involve physical materials. Instead of testing children's transfer by asking them an open-ended question, children in this experiment were given a forced choice between two solutions for each of the four problems (see Appendix). The order in which the solutions were presented was counterbalanced.

Results and Discussion

Assessment of learning. To assess children's learning of the solutions presented in the four stories, they were asked problem-and-solution comprehension questions for each story. Participants received a score from 1 to 3 for each question based on the degree of difficulty they had mastering the material, as follows: (a) if they answered the question correctly on the first try, participants received a score of 3; (b) if they answered this question incorrectly, the correct answer was repeated, they were asked the question again, and if they answered correctly on the second try, they were given a

score of 2; (c) if they answered incorrectly a second time, the correct answer was repeated and participants were given a score of 1. An overall story comprehension score was calculated for each participant by adding together the total degree of difficulty scores. Lower scores indicated a greater degree of difficulty with the stories overall (including both the problems and the solutions of the stories). The best possible score was 24 and the worst possible score was 8. Three children had overall story comprehension scores lower than 14. These three children were eliminated from the remainder of the analysis because they did not sufficiently comprehend the stories. There were no significant differences in responses by gender, so gender was not included in the analyses.

A Univariate ANCOVA was conducted comparing responses to the story comprehension questions for participants in each condition. The within-subjects factor was problem type (wrap, stack, perspective taking, or group entry), the between-subjects factor was condition (reality source vs. fantasy source), and the covariates were age and PPVT-III. There were no significant effects of age, PPVT-III, condition, or problem type. Thus, the children in our sample comprehended the fantasy and reality source stories equally.

Assessment of transfer. To assess children's ability to analogically transfer information from the stories, children were given a score of 1 if they selected the analogical solution and a score of 0 if they did not. This scoring is different from the scoring in Experiment 1 because in this experiment children were given forced-choice options rather than open-response options. Table 2 gives the number and percentage of children in the reality source and fantasy source conditions who transferred the solution for each of the four types of problems. A McNemar test for significant differences in responding to the two physical solutions and the two social solutions

TABLE 2
Number and Percentage of Children in Experiment 2 Who Transferred
the Problem Solution as a Function of Information Source (Reality
Character or Fantasy Character) and Type of Problem

<i>Problem type</i>	<i>Source</i>	
	<i>Real character</i>	<i>Fantasy character</i>
Physical fantasy	14 (41.2%)	9 (26.5%)
Physical real	13 (38.2%)	11 (32.4%)
Social fantasy	8 (23.5%)	9 (26.5%)
Social real	10 (29.4%)	7 (20.6%)

revealed no significant differences. Therefore, the solution types were collapsed for further analysis. Although the children in the experiment were somewhat older than the children in the pilot, and they received feedback about the correct response, they still found the physical and social problems equally challenging. Again, there were no significant differences in responses by gender.

A $2 \times 2 \times 2$ ANCOVA was conducted on children's scores, with transfer context (reality vs. fantasy) and problem type (reality vs. fantasy) as the within-subjects variables, condition (reality source vs. fantasy source) as the between-subjects variable, and standardized PPVT-III scores as the covariate. The only significant effect was a main effect of condition ($F(1,30) = 4.19, p < .05$). Overall, participants in the reality source condition ($M = .71, SE = .07$) performed significantly better than participants in the fantasy source condition ($M = .51, SE = .07$), regardless of transfer condition or problem type.

These findings clarified that children's increased likelihood of transferring from real characters, as opposed to fantasy characters, was not due to the kind of information they were asked to transfer (physical vs. social) or the way they were asked the transfer questions (open-ended vs. forced-choice). Children in this age range were more likely to transfer from stories about real characters than stories about fantasy characters.

By manipulating the target context, these findings clarified that children's increased likelihood of transferring from real characters, as opposed to fantasy characters, was not due to the context into which children were transferring. Instead, children were more likely to transfer from stories about real characters than from stories about fantasy characters, regardless of the target context. In addition, children maintained the preference for transferring from real characters, despite changing the characters to novel characters, providing children with forced-choice options, and including the possibility of transferring social information. Note that in future research, in order to boost performance for the "group entry" stories, the correct option could be worded to be more of a replication of the solution that was taught. However, this introduces other interpretive problems if children were to respond correctly, because they could be learning a specific phrase without understanding the underlying goal of the solution.

Although interesting, the results need to be clarified in a few ways. First, it should be noted that this difference emerged with the older children, whereas there was no context effect for the older children in Experiment 1. In particular, the older children's performance after the reality source stories was comparable in the two experiments; but their performance after the fantasy source stories dropped in Experiment 2. These age differences will be clarified by including younger children in Experiment 3.

Second, because language ability did not contribute to children's performance in either Experiment 1 or 2, other potential individual differences in performance should be explored. Experiment 3 tests for two individual differences: memory and story preference. First, recall that arguments for the beneficial effects of using fantasy characters have centered around the fact that children pay more attention to the details of fantasy stories (Harris, 2000), and that this increased attention should result in increased memory abilities and better cognitive organization for the stories (e.g., Renninger, 1990; Renninger & Wozniak, 1985). Although Experiments 1 and 2 incorporated memory for the stories to ensure participants had the relevant knowledge to make the analogical transfer, only Experiment 2 was designed in a way to directly analyze memory for the stories. Although there were no significant differences, recall that some participants were excluded for insufficient memory. Thus, Experiment 3 specifically tested for children's memory for the stories. Second, it may be that the children in Experiments 1 and 2 were generally more interested in the stories with the real characters than the stories with the fantasy characters. Thus, Experiment 3 also tested children's general story preference.

Third, Experiment 3 was designed to be a more specific test of the hypothesis that children do not transfer as readily from source stories involving fantasy characters. In this experiment, the characters in the source story were again varied (either a fantasy character or a real character), but the transfer situation was held constant: the children themselves were asked to solve the problems (e.g., move some marbles). Thus, instead of asking children to suggest a solution to help a character in a target story, we tested the extent to which children would transfer a solution learned in a story about a real character or about a fantasy character to a real life situation in which they were given a problem to solve.

EXPERIMENT 3

The procedure used in this experiment was similar to the procedures for Experiments 1 and 2, but was modified in several ways. First, as described above, the transfer part of the procedure was changed from being a target story about a character who had a problem to solve, to the children themselves needing to solve a problem in a game situation. Second, we assessed children's memory for the stories at the end of the session. Finally, to determine if children's performance was partly driven by story preferences, we asked the participants which of the source stories they would like to hear a second time. In the fantasy source story, we used a male or female fairy

(depending on the gender of the participant) instead of two cartoon characters (Mike and Sulley) or a novel fantasy character (Beamer) to keep the appearance of the characters in the source stories as similar as possible across conditions.

Method

Participants. Thirty-four children were recruited from the university area of a medium-sized city ($M=4;6$, $SD=9$ months). Participants were divided into two groups: younger ($n=17$, range=3; 6 to 4; 6, 8 girls and 9 boys) and older ($n=17$, range=4; 7 to 6; 2, 11 girls and 6 boys). The majority of the children were White and middle-class, representative of the community from which they were drawn.

Materials. The materials for the target game were the same as those used in Experiment 1. In addition, four pictures were used in this study. Two pictures were of a boy fairy, one picture was of a real boy, and one picture was of a real girl.

Procedure. The source story part of the procedure was similar to Experiment 1, except the fantasy character was a fairy, and the real character was a real child. Male participants heard stories about male characters, and female participants heard stories about female characters. Each of the source stories incorporated two solutions (one was the analogical solution to the target problem, the other was a distracter solution to a different problem); however, children were only asked to transfer one solution. The incorporation of a distracter solution served the purpose of ensuring that children's production of the analogical solution was an indication of analogical reasoning, rather than just looking for objects that were similar to those used in the stories. All children heard both source stories in counterbalanced order. As in Experiments 1 and 2, children were asked control questions assessing their memory of the stories immediately after hearing the stories. In contrast to Experiment 1, children were excluded if they did not respond correctly to the control questions.

After being told a source story with the wrap solution (either in the fantasy condition or the reality condition), children were introduced in the following way to the wrap game: "Now I have a game for us to play. For this game we use all of these pretty marbles." The experimenter dumped the marbles onto a pile on the table and then said, "What we do in this game is find a way to carry all of these marbles without dropping any of them. You can use anything here that you want to." The experimenter then placed the following items on the table in front of the child: a towel (analogical

solution: wrapping), a small spoon, a blue block, a twistie, paper clips, a binder clip, and rubber bands.

After being told a source story with the stack solution (either in the fantasy condition or the reality condition), children were introduced in the following way to the stack game: "Now I have a game for us to play. For this game we use these two blocks." The experimenter placed two blocks of differing heights side by side on the table and then said, "What we do in this game is find a way to make the top of this orange block be the same height as the top of this blue one. You can use anything here that you want to." The experimenter then placed the following items on the table in front of the child: two dominoes (analogical solution: stacking), a spool of string, a piece of paper, paper clips, a binder clip, and rubber bands.

As in Experiment 1, if children did not spontaneously choose the analogical solution (wrapping the marbles in the towel or stacking with the dominoes) the experimenter asked, "Do you remember the story I told you? Does anything from the story help?" To assess children's memory for the stories, after hearing both stories participants were asked four questions about various details of each story (eight memory questions total). Finally, participants were asked which story they would like to hear again as a measure of their story preference.

Results and Discussion

Table 3 gives the number and percentage of children in each condition who transferred the solution described in the source story to the target game. The same scoring system used in Experiment 1 was used in this experiment: children were given 1 point for transferring a solution after being given a hint (being prompted to think about the source story) and 2 points for transferring

TABLE 3
The Number of Children in Experiment 3 Who Transferred the Problem Solution as a Function of Age and Source of the Information (Fantasy or Real Character)

		<i>Source</i>	
		<i>Real character</i>	<i>Fantasy character</i>
Younger children (n = 17)	No transfer	7 (41.2%)	9 (52.9%)
	With hint	2 (11.8%)	1 (5.9%)
	Transfer	6 (47.1%)	7 (41.2%)
Older children (n = 17)	No transfer	4 (23.5%)	8 (47.1%)
	With hint	4 (23.5%)	2 (11.8%)
	Transfer	9 (52.9%)	7 (41.2%)

a solution on their own without being prompted. As with the other experiments, there were no significant differences in responses by gender.

An ANCOVA was conducted on participants' scores (ranging from 0 to 2), with source story (fantasy vs. real) as the within-subjects factor, age group (younger vs. older) and story preference (fantasy vs. reality vs. neither) as the between-subjects factors, and memory as the covariate. There were no main effects for source story, age group, or story preference. There was a main effect of memory, $F(1,27) = 7.72, p < .01$. Not surprisingly, participants' memory for the stories significantly predicted their likelihood of producing the analogical responses for both the fantasy story ($r^2 = .13, \beta = .35, p < .05$) and the real story ($r^2 = .33, \beta = .58, p < .001$). In contrast to Experiment 1, the interaction between source story and age group was not significant.

However, there was a story preference by story type interaction, $F(2,27) = 9.67, p < .001$. Participants who preferred the fantasy source story (32.4%) were significantly more likely to respond correctly to the targets paired with the real source story ($M = 1.57, SE = .26$) than the fantasy source story ($M = .37, SE = .25; t(10) = 3.99, p < .01$). There were no significant differences in transfer between participants who preferred the real story (17.6%) or neither story (50.0%). One explanation for the interaction with story preference is that children may have chosen to hear the fantasy story again because they did not understand it. However, there were no significant differences in memory for the fantasy and reality source stories. Thus, children's preference for, and seeming enjoyment of, the story with the fantasy characters may have interfered with their ability to see how that story connected with the real-world problem they had to solve.

In addition, there was a three-way story type by age group by story preference interaction, $F(2,27) = 3.52, p < .05$. This effect was driven by the fact that children in the youngest group demonstrated a different pattern of responding based on story preference than did children in the older group. In particular, younger children who preferred the fantasy story were less likely to transfer from the fantasy story than the real story; but older children who preferred the fantasy story were more likely to transfer from the fantasy story. One potential implication is related to the age by story type interaction of Experiment 1 and may suggest changes in how children view these characters over time. Perhaps younger children are affected by learning from fantasy characters because they do not view them as appropriate sources of information, but older children, who have more experience with fantasy books and other media and are also more proficient at analogical transfer in general (Brown et al., 1986; Holyoak et al., 1984), may be less affected. Given that the number of children who preferred the real story was small, this interaction should be interpreted with caution.

Overall, the tasks in this experiment proved to be somewhat challenging for the children: 15 of the 34 children scored a 0 on the final memory questions for at least one of the source stories, suggesting they had not fully encoded the source stories. If only the children who scored above 0 on the memory tests are analyzed, a matched-pairs *t*-test shows a trend for children to transfer more from the real character ($M = 1.53$, $SD = .70$) than from the fantasy character ($M = 1.11$, $SD = .93$; $t(18) = 1.71$, $p = .10$). The difficulty children had with these tasks may be explained by the fact that we removed the familiarity with the characters from the source stories, which was done to help children with analogy tasks (Holyoak et al., 1984). In addition, we asked children to solve problems physically, whereas the initial solutions were presented in pictorial format.

GENERAL DISCUSSION

Three experiments explored children's ability to transfer analogical solutions from stories about fantasy characters and real characters into different kinds of situations. In Experiment 1, 3½- to 5-year-old children were tested on their ability to transfer a solution from a story about two familiar fantasy characters to a story about their teacher and from a story about their teacher to a story about the familiar fantasy characters. The younger children in this experiment were more likely to transfer the solution from the story about their teacher to the story about the familiar fantasy characters than vice versa, with the older children showing no difference between the fantasy source and reality source conditions.

The difference between reality source and fantasy source conditions again emerged in Experiment 2 with older children. In Experiment 2, we used a child character instead of a teacher character in the reality source stories because we suspected that teachers might be a special type of reality character in the context of being taught new information. Similar to Experiment 1, 4- and 5-year-old children were more likely to transfer information learned from stories about a child character than from stories about a fantasy character (an animal-like creature named Beamer). The findings from these experiments were consistent across variations in the characters that were used in the source stories, the context in which the participants were asked to transfer the information, the type of problem that was addressed in the source story, and the dependent measures that were used to assess transfer.

In Experiment 3, we chose a novel child fantasy character to increase the likelihood that children could identify with that character. We again interviewed 3½- to 5½-year-old children. In this case, the advantage for the reality condition was related to an interaction with children's age and story

preference, suggesting a shift in how children view fantasy characters as sources of information over time. In particular, younger children who preferred the fantasy story were less likely to transfer the information, whereas older children who preferred the fantasy story were more likely to transfer the information. This finding is likely related to research by Skolnick and Bloom (2006) that suggests that children have different conceptions of fictional worlds and the real world. If children view fantasy characters as separate from the world, we should not expect them to view fantasy characters as reliable sources of information about the real world. In contrast, older children who have experience with reading fictional stories and being asked to report on what they mean (either at home or in school) have likely learned that information from the fantasy domain can be useful in the real world.

The findings from all three experiments supported the initial hypothesis that the use of a fantasy character may not be beneficial for teaching preschool children real-world information. Although a range of research findings suggest fantasy contexts often promote improved performance in cognitive tasks, a result that is sometimes attributed to increased attention to the details of fantasy stories (Harris, 2000; Renninger, 1990; Renninger & Wozniak, 1985), we did not find any evidence of improved learning and/or transfer when using a fantasy character. Whether or not children paid more attention to the stories about fantasy characters, they were less likely to use the information from these stories in deriving a solution for the target stories than when the information was initially presented to them in stories about real characters.

In our view, the results from these experiments are relevant to a debate in the developmental literature about when and how children differentiate between fantasy and reality (see reviews in Bourchier & Davis, 2002; Woolley, 1997). Methods for testing children's ability to distinguish between fantasy and reality vary from interviewing children on their belief in fantasy figures such as Santa Claus (e.g., Clark, 1995), to the prevalence of imaginary companions (e.g., Taylor, 1999), and belief in the plausibility of magical events (e.g., Rosengren, Kalish, Hickling, & Gelman, 1994). Combined, these methods of studying children's distinction between fantasy and reality suggest that sometime between the ages of 3 and 8, children consistently distinguish between fantasy and reality (Woolley, 1997). Although further experiments should be conducted to pinpoint more specific reasons for children's decreased likelihood to transfer from the stories about fantasy characters in our research, the fact that 3- and 4-year-olds were less likely to use the stories about fantasy characters as source analogs suggests they were making a distinction between fantasy and real characters. This result is consistent with recent research suggesting that 3- to 5-year-old children differentiate among the contexts in which they encounter information in

books (Woolley, 2001; Woolley & Van Reet, 2006). For example, if children learned about a novel entity from a fantastical-looking book, they were likely to claim the entity was not real. In contrast, if they learned about the novel entity in a scientific-looking book, they were more likely to claim the entity was real (Woolley, 2001; Woolley & Van Reet, 2006).

In addition to reflecting the competence of preschool children in distinguishing fantasy from reality, our results suggest that preschool children judge the usefulness of information learned from different types of story characters (also see Lutz & Keil, 2002; Pasquini et al., 2007; Taylor et al., 1991). Children's decreased likelihood of transferring from stories about fantasy characters suggests children viewed fantasy characters as a less appropriate source for information for solving real-world problems than real characters. This finding has implications for education. Teachers often instruct using a fantasy context, assuming they are creating learning contexts that are enjoyable, interesting, and intrinsically motivating (Lepper et al., 1990; Parker & Lepper, 1992). In addition, fantasy storybooks and religious parables are often used to teach moral lessons to children. If it is the case that children, at least at early ages, do not transfer that easily from stories about fantasy characters into reality, educators may need to be careful in their use of fantasy characters as a teaching tool.

On the other hand, we do not want to overstate this cautionary note on the use of fantasy contexts for teaching real-world information. In our experiments, the fantasy source conditions were designed to parallel the reality source conditions and thus did not have many fantasy details beyond what was necessary for children to categorize the character as fantasy. Children are exposed to various multimedia fantasy worlds, including television, movies, computers, and video games; and children receive mixed messages about whether or not they should transfer from these worlds (e.g., "Don't try this at home" vs. "Do what Dora's doing"). Although our results showed an advantage for reality sources, the fantasy stories, films, and television shows designed to teach children real-world information have many more embellishments to hold children's attention. It might be that the interest level that fantasy elicits, at least for some children, is a large enough effect to counteract the initial advantage of learning from a reality source. Nevertheless, it is important not to assume that children are learning what we intend from fantasy characters and stories or that they are transferring what they have learned to real-world contexts.

Our findings contribute to a growing literature questioning the use of fantasy for teaching real-world information to young children (e.g., Ganea, Pickard, & Deloache, 2008; Mares & Acosta, 2008; Woolley, 2001, 2003). For example, Mares and Acosta (in press) found that many preschool children did not extract the intended messages from a cartoon in which

dog characters overcame their initial negative reactions to a dog with only three legs. Instead of learning tolerance-related information that was meant to be transferred to humans (e.g., disability is not contagious), many children extracted a more narrow and incorrect message (e.g., they reported that three-legged dogs are scary).

Although our results show an advantage for the transfer of information learned from reality characters, we are not claiming that children do not learn useful information in the context of fantasy. First, many children in this research did transfer problem solutions learned from fantasy characters (although they were somewhat more likely to do so from reality characters). More importantly, there is a distinction to be made between what children learn from fantasy material presented to them by adults and what they learn from fantasy scenarios that they create for themselves. Our research addresses the former type of scenario and should not be interpreted as evidence against the view that children's pretend play can be a vehicle for real-world learning or understanding. In pretend play, children intentionally produce transformations of reality according to their own specifications, mentally transcending their current time, place, and surroundings. This process helps children express their thoughts and feelings about real-world issues and events that are important in their lives in a way that facilitates emotional mastery (Ariel, 2002; Bretherton, 1989; Harris, 2000). Our findings focus on the extent to which children transfer problem solutions taught to them by real and fantasy characters, not whether or not children can benefit in real life from the exploration of thoughts and feelings in their own spontaneous pretending.

There is the issue, however, of whether or not individual differences in children's pretend play are related to children's performance on our tasks. It might be that children who are more oriented toward fantasy would demonstrate a greater likelihood of transfer because they are used to navigating the fantasy-reality distinction regularly. Alternatively, fantasy-oriented children may be less likely to transfer, as they might have more experience quarantining their fantasy lives from reality. Future research should investigate how individual differences in children's own pretend play might influence the extent to which they transfer information presented in a fantasy context or in using a fantasy character created by someone else.

One of the limitations of these studies is that we did not manipulate the expertise of the fantasy characters. Thus, we cannot differentiate whether or not children were less successful at transferring from fantasy characters because they deem them as irrelevant sources or as uninformed sources. Our findings of the generally better performance of children in Experiment 1 on transferring from the stories about their teachers may suggest that even the youngest children were evaluating expertise at some level. Future

studies should manipulate the degree of knowledge of both fantasy and real characters.

Despite these limitations, the findings of this research suggest that although children may demonstrate precocious cognitive abilities in their imaginative thought, and that in some situations they differentiate between fantastical and realistic scenarios at quite young ages, they do not necessarily transfer information taught to them by a fantasy character to real-world problems. There is clearly much to learn about how children negotiate the world into which they are born with the fictional worlds that they create on their own and the ones that are presented to them.

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APPENDIX

Stories and Test Questions Used in Experiment 2

Stack problem. Source: One day Pat/Beamer was getting ready to have lunch with his/her friends, but his/her lunch box was up on a really high shelf. Pat/Beamer wanted to get his/her lunch box down. So, Pat/Beamer piled some books into a stack and stood on top of them. Then, he/she was up high and could get his/her lunch box. Now Pat/Beamer was happy because he/she could get his/her lunch box and eat lunch with his/her friends.

Target: Today, Pat/Beamer is at a school play, but he/she can't see the play because a bunch of tall children/creatures are standing in front of him/her. Pat/Beamer wants to see the play. What do you think Pat/Beamer should do? Should Pat/Beamer jump up in the air, or should Pat/Beamer go get some boxes?

Wrap problem. One day, Pat/Beamer was shopping for lots of oranges for the friends who live on his/her street. He/she wanted to get all the oranges back to his/her friends in one trip. So, Pat/Beamer took off his/her sweater, put the oranges on it, and gathered up the ends like a sack. Then he/she could carry them all without dropping any. Now Pat/Beamer was happy because he/she could carry all the oranges back to his/her friends.

Target: Today, Pat/Beamer is picking lots of apples for the friends who live on his/her street. Pat/Beamer wants to carry all the apples back to

his/her friends in one trip. What do you think Pat/Beamer should do? Should Pat carry all the apples in his/her arms, or should Pat put the apples on his/her scarf?

Perspective taking problem. Source: One day, Pat's/Beamer's aunt had a birthday party. Pat/Beamer wanted to give his/her aunt a gift that his/her aunt would like. So, Pat/Beamer thought about how his/her aunt is a lot like his/her mom, and that his/her mom loves to get flowers as a gift. So, Pat/Beamer gave his/her aunt some flowers and his/her aunt said, "Thank you, Pat/Beamer, I love flowers." Now Pat/Beamer was happy because he/she gave his/her aunt a gift that his/her aunt liked."

Target: Pat/Beamer has a teacher who is a lot like Pat's/Beamer's father. Pat/Beamer wants to give his/her teacher a birthday gift that the teacher will like. What do you think Pat/Beamer should do? Should Pat/Beamer give the teacher something Pat likes, Pokemon cards, or should Pat/Beamer give the teacher something Pat's/Beamer's father likes, a picture that Pat/Beamer drew?

Group entry problem. Source: One day, Pat/Beamer went to the beach where some children/creatures like him/her were digging holes in the sand. Pat/Beamer wanted to play with the children/creatures. So, Pat/Beamer got a bucket and started to fill it with sand to help the other children. One of the children/creatures smiled and said "Thank you," then, another child/creature gave Pat/Beamer a shovel and said, "You can dig too." Now Pat/Beamer was happy because the other children were letting him/her play.

Target: Today, Pat/Beamer is at the playground where some children/creatures like him/her are painting a picture of some flowers on the wall. Pat/Beamer wants to play too. What do you think Pat/Beamer should do? Should Pat/Beamer ask the children/creatures if he/she can play, or should Pat/Beamer find a way to help?