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RESEARCH ARTICLE

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Preschoolers' extension and export of information from realistic and fantastical stories

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Abstract

How do young children decide which events can happen within fictional stories (extension) and learn new information from these stories (export)? In two studies, we investigate these two issues as well as the influence of story genre (realistic or fantastical) on these processes. Preschoolers (N = 192) heard either a realistic or fantastical story and were asked (a) whether a target piece of information should be extended to a different situation within the story context and (b) whether that piece of information could be true in real life. Extension and export were not generally affected by genre, but they were affected by the type of information with which children were presented. Adults (N = 93) responded similarly. These results suggest that children have a mature tendency to expect stories to remain internally consistent and rely on their background knowledge to interpret story events.

Highlights

- We tested preschoolers' extension of information within realistic and fantastical stories and their learning from these stories.
- Children expect stories to remain internally consistent, regardless of genre; both extension and learning were affected primarily by their familiarity with the target material.
- Children's interactions with stories can shed light on their developing conceptual knowledge.

KEYWORDS

fiction, learning, preschoolers, stories

Young children are surrounded by fictional stories. In order to appropriately understand these stories, children should be able to draw inferences about what kinds of events can and cannot happen within the worlds that these stories present. Can they do so? To answer this question, the current paper presents two studies that primarily aim to discover how children use the premises presented in a fictional world to reason about new events within that world (*extension*). These studies additionally investigate how children bring new information from that world into reality (*export*).

Although a small body of literature has begun to address these issues (e.g., Ganea, Ma, & DeLoache, 2011; Sutherland & Friedman, 2012; Walker, Gopnik, & Ganea, 2015; Weisberg, Sobel, Goodstein, & Bloom, 2013), little prior work has explored the role of genre in these processes. We thus do not know whether a story's degree of realism affects children's extension or export of the information presented in that story. This is the main question that the current studies aimed to address: How might children's extension and export differ for realistic and fantastical stories?

Further, no previous studies have compared extension and export using the same stories and types of information. This limits the conclusions that we can draw about these two processes, since it is not clear whether children who make accurate inferences about what can happen within a story world will also learn appropriately from stories; do children who believe that an event can happen within a story world also believe that it can happen in real life? Results from this work can inform our understanding of children's early interactions with fictional stories and thereby provide guidance in how to select stories that children will effectively understand.

1 | EXTENSION

While all fictional stories provide some description of the worlds in which they take place, no story could ever be long enough to list all of the facts that hold true within that world (see Lewis, 1978; Ryan, 1980; Skolnick & Bloom, 2006). This means that children must use the information with which they are presented to make inferences about the nature of the story's fictional world, much of which is unspecified. Although adults expect that future events within a story will generally conform to the same rules as the rest of the story (Weisberg & Goodstein, 2009), previous work has shown that children do not necessarily share this expectation. Instead, they tend to infer that future events within story worlds will resemble reality as closely as possible. For example, Weisberg et al. (2013) presented preschool-aged children with either realistic stories, in which no laws of reality were violated (e.g., a character who could walk and had a pet dog), or fantastical stories, which contained many violations of real-world laws (e.g., a character who could fly and had a talking dog). At several points within this story, children were asked to choose which event should come next: an ordinary event or an impossible event. Regardless of the story frame, children tended to choose the ordinary event to include in the story. This reality-prone tendency is even evident when children are constructing their own stories, without any adult-provided frame (Sobel & Weisberg, 2014). Indeed, children tend to assume that events within fictional contexts will match reality, as illustrated by their tendency to protest when unrealistic elements are introduced into a pretend game (Van de Vondervoort & Friedman, 2017).

Although these results seem to suggest that preschoolers are insensitive to the nature of a story when drawing inferences about the rest of the story world, other studies have shown that children can reason productively from unrealistic premises in certain circumstances. For example, children can accept an impossible event within the context of a pretend game (e.g., all cats bark) and use this information to draw the appropriate conclusion within that game (e.g., this cat will bark; Dias & Harris, 1988, 1990; Scott, Baron-Cohen, & Leslie, 1999).

More directly, a recent study showed 2- to 4-year-old children two toy cats who spoke to other animals using those animals' canonical sounds, rather than saying “meow” (e.g., one cat would greet a frog by saying “ribbit”). Children were then asked what a third toy cat would say to several other animals. Children tended to report that the third cat would make the other animals' sounds rather than saying “meow.” This indicates that they had inferred the

rule "cats make the sounds of the animals they address" and applied it generally within the pretend scenario (Van de Vondervoort & Friedman, 2014).

Similarly, a study on children's understanding of story genre found that 4- to 6-year-olds could successfully match events from different unrealistic genres (science fiction and fantasy) to their respective stories (Kibbe, Kreisky, & Weisberg, 2018). Children in this study were read stories that conformed to conventions either of the science fiction genre (e.g., the main character lives on the moon and talks with a robot) or the fantasy genre (e.g., the main character lives in a castle and talks with a witch). When asked to choose an ending for these stories, children tended to select the event that matched the genre of the story they had heard: They reported that the character in the science fiction story went to school in a rocket bus while the character in the fantasy story went to school in a magic bus with wings.

These studies make it clear that children can make inferences about fictional worlds on the basis of information they receive about the nature of the worlds. But these results seem to be in conflict with the work demonstrating that children generally believe that stories should conform to the laws of reality (Sobel & Weisberg, 2014; Weisberg et al., 2013). We can reconcile these two bodies of work by noting an important methodological difference between them: Studies finding that children can succeed at matching story events to their context tended to ask children to extend specific premises to very close instances (e.g., inferring what one cat would say based on information about other cats). In contrast, studies finding reality-proneness tended to present situations that asked children to draw broader inferences about the nature of the world (e.g., inferring whether a road would be purple based on information about a character who could fly). Children may have had difficulty with seeing the commonalities among the disparate fantastical events in the latter task, leading them to respond with events that matched reality as a default.

The current studies were designed to investigate this issue in more detail, specifically to probe which features of the story context and which features of the target information would affect children's extensions of information within the context of a story. Our extension questions ask about events that are closely related to those presented in the story (as in Van de Vondervoort & Friedman, 2014), which should make it easier for children to extend these premises within the story world. We thus hypothesize that children in our studies will generally report that future events in a story world will confirm to the rules set up by that world. We also asked children to extend to slightly more distant premises (e.g., inferring what a mouse would say based on information about a cat) to directly investigate how similarity affects children's inferences.

Children in Study 1 thus heard either a Realistic story, in which no violations of real-world laws occurred, or a Fantastical story, in which many events violated real-world laws. Embedded in each type of story was a target fact about a cat in the story. We varied the nature of this fact, so that it was either Ordinary (a cat says "meow"), Anthropomorphic (a cat speaks human language), or Unlikely (a cat says "chit-chit"). Children at this age know that cats can say "meow" in real life and cannot say "good morning." But anthropomorphic animals are a common feature of children's stories, making this impossible event a familiar kind of violation (Geerdts, 2016). Additionally, and crucially, the information presented in the Unlikely Fact condition was designed to strike children as unusual, but not strictly impossible. This condition thus allowed us to investigate a case that resembles the material presented in real educational storybooks.

At the end of the story, children were asked whether their target fact was still true of the original cat and whether it would also be true of another cat. This design builds on earlier work by investigating in more detail how children construct fictional worlds based on the premises with which they are presented, and also adds an investigation of how story genre affects these inferences. In keeping with the body of prior work reviewed above, the current studies recruited preschoolers (3–5 years old). Children at this age have been shown to have some sensitivity to the structure of fictional worlds when choosing how to extend stories (Van de Vondervoort & Friedman, 2014) and counterfactual scenarios (Dias & Harris, 1988), though they also tend to continue stories with realistic events as a general default (Weisberg et al., 2013). Additionally, children at this age are beginning to understand the difference between realistic and fantastical stories (Woolley & Cox, 2007) and can use the context in which a novel entity is presented to make reality status judgments about that entity (Woolley & Van Reet, 2006).

Based on this prior work, we predict that children will extend the information presented about the target cat within the story and infer that other animals will speak in the same way (making their canonical sounds, speaking human language, or saying "chit"). There may be an interaction between the type of sound they are asked to reason about and the story context in which they hear it, such that fantastical stories (which already contain many violations to real-world laws) may make it particularly likely that other animals will speak in non-canonical ways. In support of this prediction, a recent study found that children are more likely to bend normative rules within the context of a fantastical pretend scenario than a realistic pretend scenario (Fast & Van Reet, 2018). Finally, we predict that children's degree of extension will vary based on the similarity between the target cat and the second animal. Children at this age recognize the similarity between animals in a way that roughly recapitulates a phylogenetic tree (Carey, 1985), and we expect that they will apply that rubric to their inferences here: Children will be most likely to extend what one cat says to another cat, somewhat less likely to make this extension for other animals.

2 | EXPORT

A secondary goal of the current studies is to examine children's willingness to export novel information from the story into reality—that is, to learn from the story. Stories can play a major role as sources of new information to children, and previous work has shown that preschool-aged children do take the information they hear in stories and incorporate it into their real-world knowledge base (see review in Hopkins & Weisberg, 2017).

This body of work also generally concludes that children learn better from realistic stories than from fantastical ones. Realistic stories' similarity to the real world may help children to more easily see the applicability of the target educational information (see Brown, Kane, & Echols, 1986; Daehler & Chen, 1993; Holyoak, Junn, & Billman, 1984). For example, one study taught preschoolers about "popple flowers," which gave a character the hiccups (Walker et al., 2015). This information was embedded in a story that was either entirely realistic (e.g., the character found a ladybug) or that contained fantastical events (e.g., the character found a fairy). Children were significantly more likely to say that real-life popple flowers would cause hiccups when they heard the realistic story than when they heard the fantastical story. Other work has found similar effects of realism for children's learning of problem solutions from stories: Children were more likely to use analogical solutions to solve problems in reality when these solutions were embedded in realistic rather than fantastical stories (Richert, Shawber, Hoffman, & Taylor, 2009; Richert & Smith, 2011).

Similar findings were obtained in a comparison of children's learning from realistic and fantastical pretend play. When children were presented with properties of a new animal in a realistic play scenario, they tended to say that this animal would have these properties in real life (Sutherland & Friedman, 2012). Children were much less likely to generalize information about the animals to reality if the animals engaged in unrealistic activities (Sutherland & Friedman, 2013). Indeed, anthropomorphism of this sort in children's stories often has a negative effect on their learning, making children more likely to mistakenly believe that real animals have human-like traits (Ganea, Canfield, Simons-Ghafari, & Chou, 2014). These studies demonstrate that children are more likely to export (learn) information from realistic than from fantastical stories.

To further investigate how children export information from stories into reality, after hearing their assigned story, all children in Study 1 were asked, "In real life, can cats say meow? Hello? Chit-chit?" Responses in the conditions where the cat says "meow" or speaks human language should not differ based on the type of story, since children at this age already know that cats in real life say "meow" and also understand that cats in real life cannot speak human language. The crucial condition for testing children's export is thus the one in which that cat says "chit," since this is information that children do not already know but that could potentially be applied to real life. If children indeed learn better from realistic stories, as suggested by prior research, then they should be more likely to export this fact from our realistic story.

Asking about children's generalizations from the story also provides an important check on children's extensions within the story: Children should be willing to say that impossible events can happen within the context of the story when they are internally consistent with how the story world is presented (e.g., if one cat can speak like a person, then other animals likely can do so as well), but they should not report that these events can happen in real life. We thus expect to find that children's judgments about extension and export will not be related.

3 | STUDY 1

3.1 | Method

3.1.1 | Participants

The final sample included 120 preschool-aged children (64 girls, mean age = 57.1 months, range = 36 to 72 months). We recruited an additional 25 children who were not included in the final analysis for failing to complete the procedure (5), not speaking enough English to understand the instructions or questions (13), and failing a memory check (7, see below for details). The distribution of these excluded participants was not significantly different across conditions, $\chi^2(2, N = 120) = 0.46$, $p = .79$.

Child participants were recruited from and tested at preschools ($n = 90$), at a public playground ($n = 26$), in the lab ($n = 2$) or in their own homes ($n = 2$).[1] In preschools, children were interviewed in quiet spaces such as empty classrooms; at the playground, children were interviewed in a secluded area away from the equipment. No differences in performance were found based on testing site for either the extension questions considered together, $\chi^2(12, N = 120) = 11.76$, $p = .47$, or the three export questions, all χ^2 values <3.34, all p-values >.34. Children's testing sessions were video- or audio-recorded when parents gave permission for this. All children received a sticker to thank them for their participation.

There were 20 children in each of the six conditions of the study (described below). Mean ages were similar across these conditions. Although our participants' ages ranged from 36 to 72 months, only six participants were younger than 44 months; the remainder were 47 months old or older.[2] Because the younger participants were not equally distributed across conditions, we controlled for age effects in all of our analyses.

We also tested a control sample of 21 children (11 female, mean age 59.9 months, age range 48 to 70 months). These children were recruited from a museum setting and received a sticker and a certificate for their participation. Children were video- or audio- recorded when their parents provided permission.

Finally, we recruited a comparison sample of adults from the psychology participant pool ($N = 93$, 61 female, mean age = 19.3 years, range = 18 to 23 years), who participated for course credit. Two additional adults were run but excluded from the final sample for failing to answer any test questions. There were 14 adults in the Realistic/Ordinary condition, 16 in the Realistic/Anthropomorphic condition, and 16 in the Realistic/Unlikely condition. There were 16 adults in the Fantastical/Ordinary condition, 14 in the Fantastical/Anthropomorphic condition, and 17 in the Fantastical/Unlikely condition.

3.1.2 | Materials

We constructed six stories according to a 2 (story type: Realistic or Fantastical) × 3 (fact type: Ordinary, Anthropomorphic, or Unlikely) design; both variables were between-subject. Each story followed the same basic framework: the main character (Jenn or Nate, gender-matched to the participant; we use the female character to illustrate) woke up in the morning and got ready to go to school by getting dressed, brushing teeth and eating breakfast with her family. She then had trouble finding her backpack, but eventually located it under the bed and was able to go to school. After school, the character returned home.

In the Realistic story, all of the events conformed to real-world laws and could have happened in real life. In the Fantastical story, the same events occurred but in ways that violated some laws of reality. For example, the character in the Realistic story poured herself cereal for breakfast, but in the Fantastical story the cereal box floated off the table and poured its cereal into the character's bowl. The two stories were matched for number of pages and number of words per page (see Appendix for the full story texts). Each set of story events was accompanied by a picture. The story text and its pictures were put into plastic sheet protectors and collected in a binder to make a storybook.

At two points in the story, the main character talked to her cat, Mittens, and Mittens responded. The nature of Mittens's response varied by condition. In the Ordinary Fact condition, Mittens said "meow meow" on both occasions. In the Anthropomorphic Fact condition, Mittens once said "good morning" and once said "goodbye." In the Unlikely Fact condition, Mittens said "chit chit" on both occasions.

Each story was followed by three additional pages, in which the main character encounters another cat, a mouse, and a frog. These pages were identical across the six stories.

3.1.3 | Procedure

Children were tested individually. Due to the nature of the stimuli, the experimenter could not be blind to condition. Children first listened to their assigned story, which was either realistic or fantastical and in which were embedded two instances of their assigned fact (Mittens says "meow," Mittens speaks like a person, or Mittens says "chit"). At the end of each story, the character returned home from school and saw Mittens sitting in the window of her house. The character said, "Hi, Mittens!"

Children were then asked four within-story extension questions. First, they were asked about the cat that had appeared in the story: "What does Mittens say?" Then, children were presented with three additional extension events, in which the main character says "hi" to a different cat, a mouse, and a frog (order randomized). After each of these three encounters, we asked children, "What does the [animal] say?"

At the end of the story, children in all conditions were asked the same set of memory questions and general knowledge questions. The order in which these two blocks of questions appeared was counterbalanced and order of questions within each block was randomized. The memory questions asked children to recall 5 aspects of the story: what the cat said, whether the character could walk, what the character was looking for, where the character found the item she was looking for, and whether the teacher could do magic. Children who incorrectly answered 4 or more of these questions were excluded from the final dataset (n = 7); of the remaining children, 1 child incorrectly answered 3 questions, 16 children incorrectly answered 2 questions, 46 children incorrectly answered 1 question and 57 children incorrectly answered 0 questions.

The general knowledge questions asked whether two events from the story (eating cereal, a crying backpack) could happen in real life. Crucially, this set of questions also contained three questions asking about what cats can say in real life: "In real life, can cats say 'meow'? Can cats say 'hello'? Can cats say 'chit-chit'?" Children in all conditions were asked all three questions to determine the extent to which hearing their assigned story affected their beliefs about real cats.

Adults received the same stories and questions in an online survey, where they clicked through the pages of the stories at their own pace. They responded to the questions by clicking on radio buttons or typing in text boxes. They also reported their date of birth, gender, race/ethnicity, class year and intended major.

3.1.4 | Control procedure

Children in our control sample were asked to sort 9 picture cards into "real" and "not real" boxes. These pictures all showed events from the stories presented in Study 1 and Study 2 and used the images from those stories. They were

presented to all children in the same pre-determined semi-random order, constructed so that the same response (real or not real) was never the correct answer more than twice in a row. The set of pictures included three events that were meant to be definitely real (e.g., children sitting on a rug and listening to their teacher), three events that were meant to be definitely impossible (e.g., a backpack crying), and our three target events (one in Study 1 and two in Study 2), which were meant to be ambiguous or unlikely (e.g., a cat saying "chit"). For each picture, the experimenter described it (e.g., "This is a picture of a backpack crying") and then asked the child to sort it ("Do you think that's real or not real?"). Children could respond verbally or by placing the picture card in the corresponding box.

Following the sorting task, children were asked to provide a confidence rating for each item. To do this, the experimenter showed them each card again in the same order, reminded them of how they had sorted it, and asked them to report how sure they were: "You said that a backpack crying is not real. Are you really sure, a little sure, or not sure that a backpack crying is not real?" This rating question was accompanied by three drawings of a child who looked certain ("really sure"), thoughtful ("a little sure"), and confused ("not sure") (taken from Woolley, Boerger, & Markman, 2004). The experimenter pointed to these pictures as she asked the confidence question, and children could respond verbally or by pointing to a picture.

4 | RESULTS

The data that support the findings of this study and Study 2 are openly available at the Open Science Framework at https://osf.io/er5xh/.

4.1 | Extension within the story

Children's responses were recorded on-line by two researchers during testing sessions. A third researcher double-checked the responses after testing sessions by comparing them to each other and to the video or audio recording.

To code children's responses to the within-story extension questions, we looked at whether a child said that each animal at the end of the story (Mittens, second cat, mouse, frog) would speak in the same way as Mittens did at the beginning of the story. For the Ordinary Fact condition where Mittens said "meow," children were coded as extending the fact if they said that the other animal would make its canonical sound (squeak, ribbit). For the Anthropomorphic Fact condition where Mittens spoke like a person, children were coded as extending the fact if they said that the other animal would say "hello" or any other linguistic phrase (e.g., "hi"; "I love you"). For the Unlikely Fact condition where Mittens said "chit-chit," children were coded as extending the fact if they said that the other animal would say "chit."[3]

4.1.1 | Extension to Mittens

We first conducted a logistic regression predicting whether children extended the fact to Mittens at the end of the story (Figure 1). The regression included story type (realistic vs. fantastical), fact type (ordinary, anthropomorphic or unlikely), and their interaction as predictors. The regression included planned contrasts between the ordinary and unlikely fact conditions and between the anthropomorphic and unlikely fact conditions. We controlled for both age and gender in this analysis but found no effect of either.

We found no effect of story type nor a significant story type by fact type interaction: Children matched Mittens's sound at the end of the story to what they had heard at the beginning of the story, both in the realistic (78% of children) and fantastical conditions (77%; $B = 0.27$, $SE = 0.66$, $p = .688$). However, regardless of story type, children were significantly more likely to extend the ordinary fact (90%) than the unlikely fact (63%; $B = 1.89$,

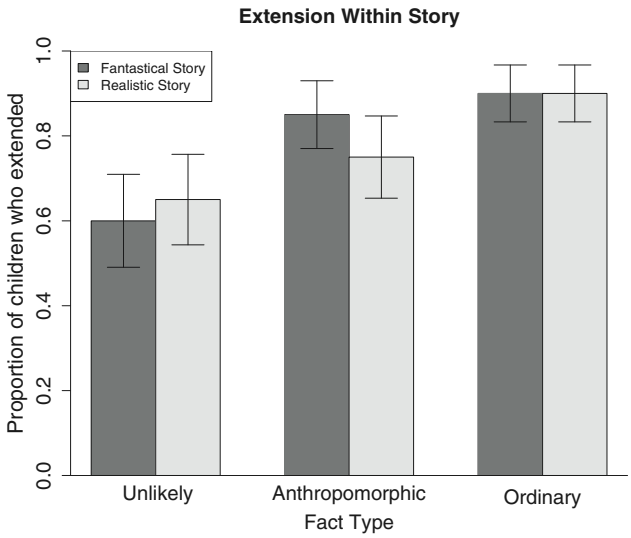

FIGURE 1 Proportion of children who extended the novel fact to Mittens at the end of the story, by fact type and story type. Error bars represent ±1 *SE*

SE = 0.88, p = .033, odds ratio = 5.40). They were not significantly more likely to extend the anthropomorphic fact (80%) than the unlikely fact (B = 1.29, *SE* = 0.79, p = .098,[4] odds ratio = 2.40). A post-hoc comparison showed that there was no significant difference between extending the ordinary and the anthropomorphic facts, $\chi^2(1, N = 80) = 1.57$, p = .210, odds ratio = 2.25.

Unlike the child participants, almost all adults matched Mittens's sound at the end of the story with her sound at the beginning of the story, regardless of fact type, so regression analysis was not feasible. Only 2 out of 47 (4.3%) of adults in the fantastical condition and 3 out of 46 (6.5%) in the realistic condition did not extend this fact. Across both story types, the anthropomorphic fact was least likely to be extended (4 out of 30 adults did not extend), followed by the ordinary fact (1 out of 30); all adults extended the unlikely fact.

4.1.2 | Extension to other animals

We next repeated this same analysis for the other animals in the story: the second cat in all three fact type conditions, and the mouse and the frog in the Anthropomorphic and Ordinary conditions only. For this analysis, we conducted separate mixed-effects logistic regressions for each animal, predicting extension from story type (realistic vs. fantastical), fact type (ordinary, anthropomorphic or unlikely), and their interaction, as in the analysis of Mittens above. These analyses included planned comparisons between the unlikely fact and the anthropomorphic fact conditions and between the anthropomorphic fact and the ordinary fact conditions. All regressions also controlled for both age and gender; there was no effect of either variable in any of these three analyses (Table 1).

As with extension to Mittens, there was no effect of story type nor a significant story type × fact type interaction on children's extension for any of the other three animals (Table 2). When asked to extend to a second cat, children were marginally less likely to extend the anthropomorphic fact (72%) compared to the ordinary fact (93%; B = −2.04, *SE* = 1.17, p = .079, odds ratio = 4.68). They were significantly less likely to extend the unlikely fact (28%) compared to the anthropomorphic fact (B = −2.46, *SE* = 0.77, p = .001, odds ratio = 6.95). A post-hoc comparison revealed that children were significantly less likely to extend the anthropomorphic fact as compared to the ordinary fact: $\chi^2(1, N = 80) = 35.21$, $p < .001$, odds ratio = 32.52, $\Phi = 0.66$. There were no significant differences between the ordinary and anthropomorphic facts for either extension to the mouse or extension to the frog; as noted above, we did not analyse the unlikely fact for these two animals.

TABLE 1 Regression results for children's extension to the other animals in Study 1

Predictor	Cat	Mouse	Frog
Intercept	−1.46	2.48	1.49
Age	0.04	−0.02	−0.00
Gender	0.08	0.58	0.45
Story type	0.02	−0.43	0.34
Fact type			
Anthropomorphic	−2.04*	−0.37	−0.31
Unlikely	−2.46**	—	—
Story type × fact type			
Anthropomorphic	0.72	0.05	−0.85
Unlikely	0.85	—	—

Note: This table gives regression coefficients and significance levels for three separate logistic regressions, one for each animal. Fact type is coded to compare each level to the one before it; the ordinary fact is the reference level. The unlikely fact was not included in the mouse and frog models because of the interpretation issue described in the text.

*$p < .10$.

**$p < .01$.

TABLE 2 Percent of participants extending the target sound to the other animals by story type in Study 1

	Second cat	Mouse	Frog
Realistic story	Children: 65.0% Adults: 60.9%	Children: 58.3% Adults: 41.3%	Children: 56.7% Adults: 41.3%
Fantastical story	Children: 63.3% Adults: 74.5%	Children: 56.7% Adults: 51.1%	Children: 53.3% Adults: 51.1%

For adults, there were no significant main effects of story type or fact type for any of the animals (Table 2). However, there were some marginally significant interactions between story type and fact type. When asked to extend to the other cat, the difference between extension in the fantastical story and in the realistic story was larger for the anthropomorphic fact (79% in fantastical condition, 38% in realistic condition, odds ratio = 6.11) than for the unlikely fact (65 vs. 63%, odds ratio = 1.04); $B = 1.94$, $SE = 1.15$, $p = .091$). Similarly, when asked to extend to the frog, the difference between extension in the fantastical story and in the realistic story was larger for the anthropomorphic fact (79% in fantastical condition, 38% in realistic condition, odds ratio = 6.11) than for the ordinary fact (81 vs. 93%, odds ratio = 3.00); $B = -1.48$, $SE = 0.76$, $p = .05$).

4.1.3 | Comparing Mittens to the other animals

Finally, we examined how extension to the other three animals compared to extension to Mittens (Figure 2). We conducted analyses separately for each fact, including random intercepts for each subject to account for the repeated measures per child. In the unlikely fact condition, children were significantly more likely to extend the fact to Mittens (63%) than to the other cat (28%; $B = -19.03$, $SE = 3.69$, $p < .001$, odds ratio = 4.39); as noted above, we did not analyse responses to the mouse and the frog in this condition. There were no significant differences by animal for either the anthropomorphic or the ordinary fact, but children were marginally less likely to extend the ordinary fact to the frog (70%) than to Mittens (80%: $B = -2.18$, $SE = 1.14$, $p = .055$,[5] odds ratio = 1.71).

In the adult sample, when we compared extension to the other animals with extension to Mittens, we found differences for each fact type (Figure 3). Similar to the children, adults in the Unlikely condition extended the "chit"

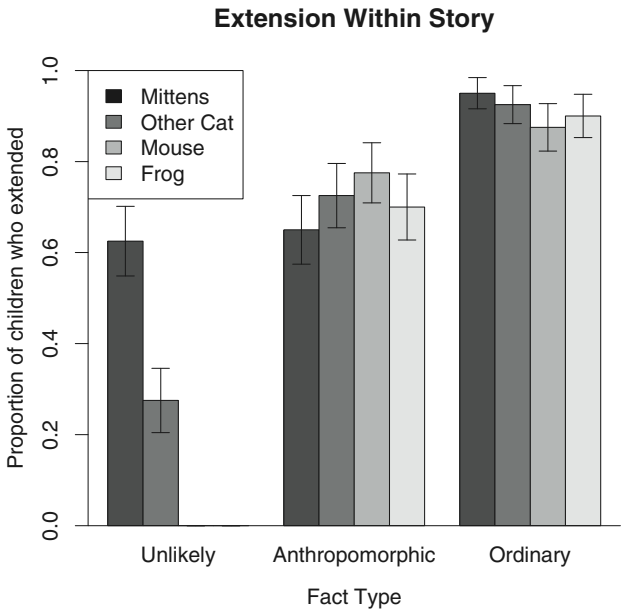

FIGURE 2 Proportion of children who extended the novel fact within the story, by fact type and target animal. Error bars represent ±1 *SE*

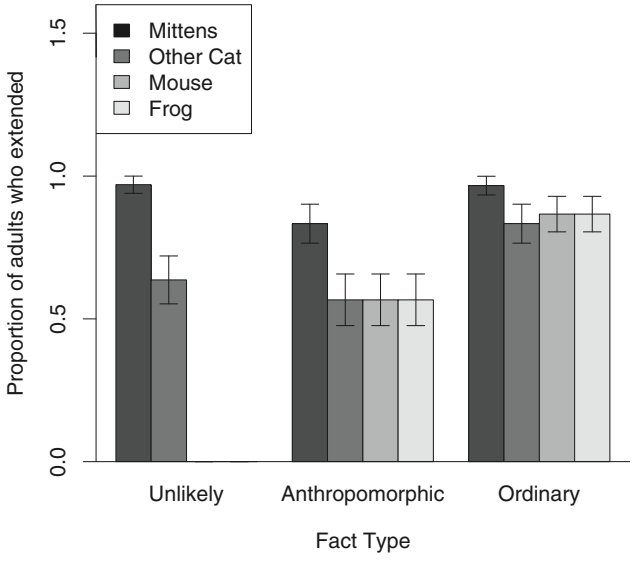

FIGURE 3 Proportion of adults who extended the novel fact within the story, by fact type and target animal. Error bars represent ±1 *SE*

sound to Mittens (100%) significantly more than to the other cat (64%), χ^2 (1, N = 66) = 14.67, p < .001, Φ = 0.47. Adults never extended the unlikely fact to the mouse or frog.[6] However, in the Anthropomorphic condition, adults' levels of extension to the other cat, the mouse, and the frog were all significantly lower than to Mittens (for all three animals, 56.7%, B = −3.70, SE = 1.21, p = .002, odds ratio = 4.97). In the Ordinary condition, we unexpectedly found that adults were marginally less likely to extend this sound to the other cat (83%) than to Mittens (97%; B = −7.03, SE = 4.102, p = .087, odds ratio = 5.80), but there were no differences for the other two animals.

4.2 | Export from story to reality

We wanted to investigate whether children who heard Mittens speak in a certain way in the story would be more likely to say that cats in real life could make this sound, and whether this tendency would vary based on the type of story. To do so, we examined the proportion of children who agreed that cats in real life could say meow, hello or chit-chit (Figure 4). In addition to comparing degree of export of each fact between the realistic and fantastical stories, we also compared these responses to those of children in the other two conditions, who did not hear Mittens make that particular sound (no exposure). These children served as a control for children's general willingness to say that cats could make certain sounds in real life.

We conducted separate logistic regressions for each fact type predicting whether children said the fact was true in real life. Each regression included age and gender as well as story type (realistic vs. fantastical), exposure (heard vs. not heard), and their interaction as predictors. There were no significant effects of any of these variables for either the anthropomorphic or the ordinary fact.

For the unlikely fact, there were no significant effects of age, gender, or story type: Children were equally likely to say the unlikely fact was true in real life if they heard a realistic (22%) or a fantastical (28%) story (B = 0.08, SE = 0.56, p = .885). Unsurprisingly, there was a significant effect of exposure: Children were significantly more likely to say the unlikely fact was true in real life if they heard it in the story (33%) than if they did not (21%; B = 1.22, SE = 0.60, p = .043, odds ratio = 1.78). The story type x exposure interaction was not significant (B = −1.31, SE = 0.91, p = .149).[7] However, exploratory tests reveal that children who heard the cat say “chit” in the Fantastical story were marginally more likely to say that cats in real life do so than those who heard the cat say “chit” in the Realistic story: $\chi^2(1, N = 40) = 2.85$, p = .09,[8] odds ratio = 3.27, Φ = 0.27 (a medium-sized effect). We return to this issue in the General Discussion.

Finally, parallel analyses on the adult sample reveal no effects of story type, exposure or gender on participants' willingness to say that cats in real life could make any of the three sounds. That is, these stories did not affect adults' beliefs about any of these sounds.

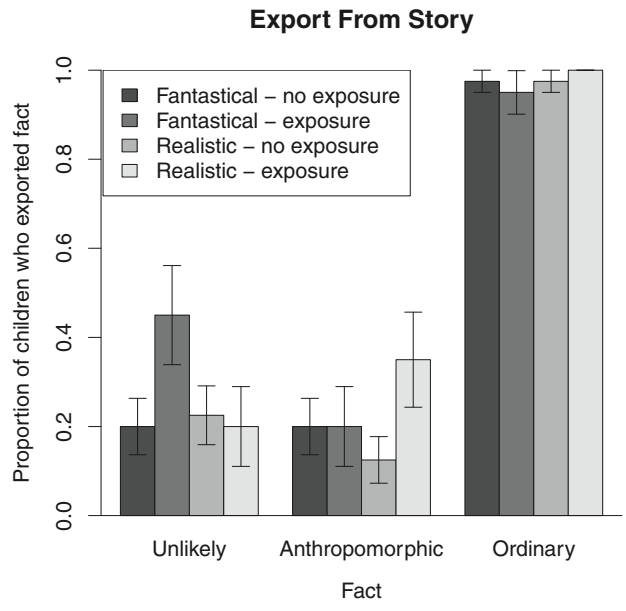

FIGURE 4 Proportion of children who exported the novel fact from their story to reality, by fact type, story type, and exposure. Error bars represent ±1 *SE*

4.3 | Responses to control task

One concern about interpreting these results is that it is not clear how children would respond to our target events outside of a story context, specifically whether they would indeed view our unlikely event as unlikely, rather than as obviously possible or impossible. The sorting task performed by our control sample addresses this issue. Children's responses to these questions were coded as 1 if they had initially sorted the card into the "real" box and as −1 if they had initially sorted the card into the "not real" box. We found that 18 participants (86%) initially sorted the "cats say chit" item as not real and 3 (14%) sorted it as real. In comparison, 96% of children initially sorted the three events that were meant to be definitely real as real, and the same percentage initially sorted the three events that were meant to be definitely fictional as not real.

To obtain a fuller picture of how children view the target unlikely item, their initial ratings (−1 for "not real" and 1 for "real") were multiplied by their confidence ratings, which were coded as 3 for "really sure," 2 for "a little sure" and 1 for "not sure." This created a scale from "real—really sure," coded as 3, to "not real—really sure," coded as −3. Analysis of these ratings show that children rated the "cats say chit" item as −1.71 (*SD* = 1.65). This was significantly lower than children's average rating of the three obviously real items [*M* = 2.76, *SD* = 0.46, $t(20) = -11.32$, $p < .001$, $d = 3.69$] and significantly higher than children's average rating of the three obviously fictional items [*M* = −2.30, *SD* = 0.90, $t(20) = 2.45$, $p = 0.024$, $d = 0.44$]. Children indeed viewed this target event as unlikely, as intended.

4.4 | Linking extension and export

We additionally examined whether each child's level of extension connected to their export: Would children who said that the animals made a particular sound in the story also be more likely to say that animals in real life could make that sound? To answer this question, for the anthropomorphic and unlikely sounds, we analysed whether children's extension of the sound to Mittens or the other cat in the story was related to whether they said cats could make the sound in real life. Because only one child said that cats in real life did not say "meow," we could not run these analyses for the ordinary fact.

Table 3 reports odds ratios for each comparison. An odds ratio of 1 indicates no relation between the two variables (i.e., children are just as likely to export the fact whether they extended it in the story or not). Values larger than 1 indicate that the odds of exporting the fact are larger if a child had extended it in the story than if they had not extended it; values smaller than 1 indicate the opposite. The only relation that approaches significance is for extension of the unlikely fact to the other cat: Children who said that the other cat in the story would say "chit" were less likely to say that cats in real life could say "chit" (1 out of 11; 9%) compared to children who had not extended the fact within the story (12 out of 29; 41%). Therefore, as predicted, children who extended facts within the story were not necessarily more likely to say that those facts could be true in real life.

TABLE 3 Odds ratios for the relationship between children's extension and export in Study 1

Extension	Unlikely	Anthropomorphic
Mittens	0.58 (.50)	0.56 (.66)
Other cat	0.14 (.07)	2.03 (.69)

Note: The values in parentheses are the *p* values for Fisher's Exact test.

5 | DISCUSSION

When considering children's interactions with fictional stories, it is important to determine how they think about events that happen within the context of these stories: Can children reason appropriately from fictional premises? We found that children do understand that stories should be internally consistent and that events within stories should be governed by a coherent set of rules. When the story included one animal that spoke like a person, children extended this anthropomorphic premise within the context of the story, regardless of story genre, and regardless of the type of animal to which they were asked to extend this premise, contrary to our predictions. This indicates that, when children are familiar with the premises presented in a story, even if the premise is impossible in real life, children tend to accept that premise and to use it to make inferences about new instances. This is somewhat in contrast to adults, who tended to extend this premise more often in the fantastical story in than the realistic story, indicating that sensitivity to genre in extension develops after the preschool years.

In contrast, when the real-world status of the premise was unknown (the cat in the story says "chit"), children were significantly more conservative in their extension of the fact to other instances. Indeed, children were so conservative that they were even unlikely to say that the same cat (Mittens) who had made this unusual sound at an earlier point in the story would make this sound later. Additionally, both children and adults were reluctant to extend this information to a second cat, doing so significantly less often than they extended to the same cat later in the story. These results indicate that children may require much more evidence about an unusual premise (as compared to a familiar one) before using it as the basis for making inferences, even within a biological kind. This finding aligns with prior work showing that children do not automatically extend fantastical premises in stories, and indeed often default to assuming that story worlds should closely resemble reality (e.g., Weisberg et al., 2013).

It is somewhat surprising that children were less likely to extend the ambiguous "chit" sound than the more clearly unrealistic fact about animals speaking like people. However, animals with anthropomorphic characteristics are very common in children's stories (Geerdts, 2016; Marriott, 2002), so children may have been more familiar with this kind of violation of real-world rules. Importantly, children who extended the anthropomorphic fact within the story were not more likely to export it than those who did not extend it, so children's willingness to extend this fact within the story does not represent confusion about whether animals can speak like people in real life. Further, these patterns did not vary by story type, indicating that children's decisions about how to construct story worlds rely primarily on the information they are being asked to extend and not the nature of the broader story context.

However, this study only investigated one type of information that children could hear in a story: facts about animal sounds. Because canonical animal sounds are already highly familiar to children, and because children already expect different animals to make different sounds, this limits the conclusions that we can draw about how children think about information in stories in general. Study 2 was conducted to address these issues by presenting children with two new possible, but unknown, facts, modelled on the Unlikely condition in the current study. As in Study 1, these facts were embedded either in realistic or fantastical stories, and we asked children whether these facts would continue to hold at other points within their assigned story. Study 2 used a within-subjects design, allowing us to compare how each participant responded to the two novel facts.

Second, Study 1 asked under what circumstances children would learn, that is, export information from a story context to real life. With respect to this issue, as with extension within a story, we found that children's export is affected primarily by the information they are asked to export. Children already knew that cats could say "meow" and could not say "hello" in real life. The story context did not significantly affect the former beliefs or any of children's responses to the other general knowledge questions, although hearing a story in which the cat said "chit" did make them more likely to say that this was possible in real life. In Study 2, we again asked about children's export of new information from realistic and fantastical stories to further explore this process. We specifically focused on unlikely information in Study 2 in order to gain more insight into how children treat this kind of information, which does not strictly conform to or conflict with their prior knowledge.

6 | STUDY 2

6.1 | Method

6.1.1 | Participants

This study included 72 preschool-aged children (38 girls, mean age = 56.4 months, range = 42 to 71 months). An additional 5 children were recruited but not included in the final analyses for failing to finish the study (2) or for failing a memory check (3, described below). As in Study 1, participants were recruited from and tested at local preschools (n = 50) or a public playground (n = 22); no differences in responses were found for the two types of test site for either the extension questions (both χ^2 values <0.37, both p-values >.54) or the export questions (both χ^2 values <1.9, both p-values >.17). We video- or audio-recorded the testing sessions when parents provided their permission. At the end of the procedure we gave children stickers to thank them for their participation.

Children were divided into two conditions: Realistic story (n = 36, mean age = 56.39 months, range = 42–71 months) and Fantastical story (n = 36, mean age = 56.42, range = 47–66 months).

6.1.2 | Materials

As in Study 1, we constructed a Realistic story that contained no violations of real-world rules and a Fantastical story that contained several such violations (see Appendix for full story texts). In the story, the main character goes to school and engages in a variety of activities in the classroom. We made two versions of each story, one with a female protagonist and one with a male protagonist; children heard the story with the protagonist whose gender matched their own. Each story event was accompanied with a picture, and the text and pictures were assembled in a binder.

Within each story we embedded two target pieces of educational information. These were both meant to parallel the Unlikely Fact used in Study 1 in that they both described unusual but not impossible events. One piece of information was about a painting that the character made with paint that never dried, and the other was about a character who experienced physical pain in her chest after another character said something mean to her (see Schulz, Bonawitz, & Griffiths, 2007).

To choose these events, we recruited a pilot sample of children in the target age range (N = 37; 20 female, mean age = 53.6 months, range = 38 to 68 months). We asked these children whether a set of 6 events could happen in real life. We chose the two target events for this study because this pilot group judged both of these events as relatively unlikely overall, and because their judgement of the two events was the same (14/37, or 38% for both).

These target events occurred in the middle of the story in a counterbalanced order. Some participants heard the paint information first and some heard the psychosomatic pain information first.

6.1.3 | Procedure

Children were read their assigned story either in a quiet space at their school or in a corner of the playground. In the middle of the story, each child heard the two target pieces of information. Immediately following the presentation of each piece of information in the story, children were asked a memory question about it (pain: “When Tiffany hurt Jenn's feelings, how did that make Jenn's chest feel?”; paint: “When Jenn checked the painting, was it still wet?”) and an extension question (pain: “Later, Jenn's friend called Jenn a mean name. Did that make Jenn's chest hurt?”; paint: “A week later, Jenn came back to check on the painting. Was Jenn's painting still wet then?”). These questions occurred in a fixed order with the memory question always coming first to ensure that the child had accurately processed the story event before responding to the extension question.

Following the story, children were asked a set of memory questions and a set of general knowledge questions. The order of the two sets was counterbalanced and the order of questions within each set was randomized. There were 4 memory questions, which asked about auxiliary events in the story (e.g., "What did the Student of the Day bring for show and tell?") and never about the target educational information. Children who responded incorrectly to 3 or more of these questions were removed from the sample (n = 3). There were 6 general knowledge questions, all of which asked whether events from the story could happen in real life. This set crucially included 2 key questions about the new unknown facts: "In real life, can there really be paint that never dries?" and "In real life, can hurting someone's feelings really make that person's chest hurt?"

7 | RESULTS

7.1 | Extension within the story

To analyse children's willingness to extend novel events within the context of the fictional story, we looked at whether children agreed that a similar event could take place later in the story world. We conducted a mixed-effects logistic regression predicting whether children extended the fact, using age and gender along with story type (realistic, fantastical), fact type (paint, pain) and their interaction as predictors; the regression also included random intercepts for each subject to account for the repeated measures per child. There were no significant effects of age or gender. There was also no effect of story type: Children were equally likely to extend the fact in the realistic condition (50% of children) as in the fantastical condition (60%; B = −0.45, SE = 0.56, p = .427, odds ratio = 1.48). However, there was a difference by fact type: Children were significantly less likely to extend the paint event (42%) than the psychosomatic pain event (68%; B = −1.20, SE = 0.55, p = .030, odds ratio = 2.98). The Story Type × Fact Type interaction was not significant (B = −0.09, SE = 0.74, p = .906).

7.2 | Export from story to reality

We analysed children's responses to the two questions that referred to the two target events in the story (Figure 5). We conducted a mixed-effects logistic regression predicting whether children exported the fact to reality, using age and gender along with story type (realistic, fantastical), fact type (paint, pain) and their interaction as predictors; the regression also included random intercepts for each subject to account for the repeated measures per child. There were no significant differences by age, gender or order of fact presentation. There was also no significant effect of story type: Children were equally likely to export facts into reality from the realistic (32%) and fantastical stories (46%; B = −0.40, SE = .61, p = .505, odds ratio = 1.80).

As with the extension questions, we found a marginally significant difference in children's overall willingness to export the two different pieces of information from the story into reality: paint (26%) versus psychosomatic pain (51%, B = −1.04, SE = 0.58, p = .074, odds ratio = 2.95). The Story Type × Fact Type interaction was not significant, and there were no differences between the realistic and fantastical stories for participants' rates of exporting the information about psychosomatic pain, $\chi^2(1, N = 72) = 0.50$, p = .48, odds ratio = 1.40, Φ = 0.08. However, participants were marginally more likely to export the information about never-drying paint to reality from the fantastical story than from the realistic story, $\chi^2(1, N = 72) = 3.50$, p = 0.06, odds ratio = 2.83, Φ = 0.22 (a small-to-medium effect size).

7.3 | Responses to control task

We again examined the responses of the control sample (same participants as in Study 1) to ensure that our chosen facts were indeed considered unlikely (rather than impossible) by children of this age. Eleven children out of the

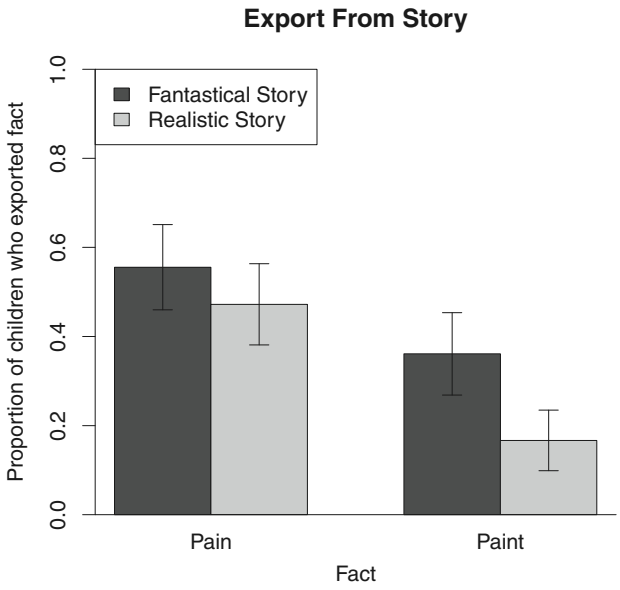

FIGURE 5 Proportion of children who exported the novel information from their story to reality, by fact type and story type. Error bars represent ±1 *SE*

21 in the control sample claimed that feeling sad could make someone's chest hurt in real life, but only 3 claimed that there could be never-dying paint in real life.

Children's ratings for both the psychosomatic pain item (M = 0.52, SD = 2.29) and for the never-drying paint item (M = −1.29, SD = 1.90) were significantly lower than their ratings for the obviously real items (paired t tests, both p-values <.001, d = 1.36 and 2.93 respectively) and significantly higher than their ratings for the obviously fictional items (paired t tests, both p-values <.04, d = 1.62 and 0.68 respectively). Thus, as in Study 1, these items were seen as unlikely, as we had intended. However, as reflected in children's responses to our extension questions in the main study, psychosomatic pain was rated significantly more likely to be real than never-drying paint, paired $t(20)$ = 3.10, p = .006, d = 0.86.

7.4 | Linking extension and export

As in Study 1, we additionally asked whether children who extended facts within the story would be more likely to export them to reality. However, we found no such relation either for the paint fact [$\chi^2(1, N = 72) = 1.28$, p = .26, odds ratio = 1.83, Φ = 0.13] or for the pain fact [$\chi^2(1, N = 72) = 0.17$, p = .68, odds ratio = 1.23, Φ = 0.05].

8 | DISCUSSION

This study was designed to further test how children extend information within fictional stories and export it from these stories, specifically to see how the nature of the information and the nature of the story may affect these processes. As in Study 1, we found that story genre (realistic or fantastical) did not affect children's extension of novel information within the context of a fictional story.

However, we found that children were more willing to both extend and export an unusual fact about psychosomatic pain than one about paint that never dries. One possible reason for this, supported by the data from the control group, is that children were more familiar and comfortable with the idea of psychosomatic pain; the common phrase “she hurt my feelings” already encodes this concept in a way that might make it more accessible to children.

Because this fact may have been somewhat familiar to children (like the Anthropomorphic fact from Study 1), their responses to it may not have been as affected by the events of the story.

9 | GENERAL DISCUSSION

Stories play a major role in young children's lives, serving as sources of entertainment and education throughout the preschool and elementary school years. Given the ubiquity of stories in development, much previous research has focused on how children conceptualize events within fictional contexts (Dias & Harris, 1990; Van de Vondervoort & Friedman, 2014; Weisberg et al., 2013) and whether children can learn new information from these fictional sources (see Hopkins & Weisberg, 2017, for review). However, prior work has not tended to focus on the role of story genre in these processes; the two current studies aimed to fill this gap. We investigated children's extension of new information within the context of realistic and fantastical stories and children's export of new information from these stories to reality. This work thus allows us to determine how a story's realism impacts children's understanding of story events and their learning of information from stories. Further, this work combines investigations into these two issues for the first time, allowing us to determine the effects of exactly the same manipulated variables on these two processes.

9.1 | How do children conceptualize events within a story?

In terms of extension, the crucial variable is the type of information that children are asked to extend, as evidenced by differences between different facts in both studies. Comparing children's responses with the performance of the adult sample in Study 1 demonstrates that children generally have mature intuitions about story frameworks in that they expect both realistic and fantastical stories to be internally consistent. However, children (though not adults) were more willing to extend familiar information (e.g., about cats speaking like humans) than unfamiliar information (e.g., about cats saying chit). Because their prior knowledge of reality provides context for their judgments about fictional stories, future work should investigate this interaction more directly, aiming to test a broader range of novel facts and to discover how a child's strength of belief in a particular fact may affect that child's interpretation of a story containing that fact.

Importantly, however, children who extended these facts within the stories did not do so because they were confused about whether they were true in real life, as evidenced by the general lack of a relation between extension and export. Rather, children's extension more likely represents an understanding that events within a story world should be consistent, even if those events are inconsistent with reality.

These questions of which kinds of events children believe can happen in a given fictional context are relevant not only to our understanding of how children think about fictional stories, but also to our understanding of how children's imaginative processes work in general. Because these processes are recruited for counterfactual reasoning and future planning as well as for story comprehension (Weisberg & Gopnik, 2013), learning more about children's abilities to infer the structure of a fictional world and to make inferences about that world can help us to understand their reasoning processes. Their abilities to do so in fantastical contexts may be especially relevant to the development of their scientific reasoning, since thinking about possibilities in a scientific context often requires considering unusual situations (see Weisberg, 2019).

9.2 | How do children learn new information from stories?

In terms of export, we found that overall rates of learning new information from our stories were low. This suggests a somewhat pessimistic conclusion about the potential role for stories as educational tools. However, in these stories

the new information was presented only once (Study 2) or twice (Study 1), and this information received no special attention or reinforcement for the sake of experimental control. Against a backdrop of other work showing that children can learn from stories (Hopkins & Weisberg, 2017), we would caution against the broad conclusion that stories are poor teaching tools. Rather, it is more prudent to conclude that the information that we were trying to teach in these stories requires additional support to learn. Future work should examine what kind of support is most effective for teaching this sort of information.

Although a large body of prior work shows that children learn better from realistic contexts (Brown et al., 1986; Holyoak et al., 1984; e.g., Richert & Smith, 2011; Walker et al., 2015), our studies unexpectedly failed to replicate this effect. Rather, we generally found that children learned equally well from our realistic and fantastical stories. Importantly, we do not wish to conclude on the basis of these two studies alone that realistic stories do not facilitate children's learning. This null effect in the current work may simply reflect uncertainty on behalf of our participants: Hearing a fantastical story may have made them more likely to guess about the reality status of the unknown fact, rather than state more definitively that it cannot happen in reality, explaining why performance in these conditions was close to 50%. This may have particularly been the case because we tested a preschool-aged sample; older children might not show the same effects.

Within this context of generally equivalent learning from realistic and fantastic stories, however, we noticed an interesting trend: For two of our three events (cats saying chit and never-drying paint), children were marginally more likely to learn from the fantastical story than the matched realistic story. This was a weak and unexpected effect, but it does align with a small body of recent literature finding advantages to fantastical stories for learning in children of this age. For example, a large-scale study of preschoolers enrolled in Head Start programs found that these children learned new vocabulary words better when they were embedded in stories that had some fantastical content (Weisberg et al., 2015). Similarly, seeing impossible events (e.g., invisible displacement) leads children to learn new words better than seeing ordinary events (Stahl & Feigenson, 2017; see also Stahl & Feigenson, 2015). Under some circumstances, children are more likely to transfer a problem solution into real life from a story that contains fantasy elements (Hopkins & Lillard, 2020; Richert & Schlesinger, 2017). Further, children perform better on a memory task when they are asked to remember moderately fantastical entities rather than ordinary ones (Banerjee, Haque, & Spelke, 2013), and even adults show advantages in source monitoring and learning from science-fiction stories compared to realistic stories (Rapp, Hinze, Slaten, & Horton, 2014). These results certainly do not overturn the established body of literature on the utility of realism for learning, especially given that the current work found only marginal significance in this direction. However, future work should continue to examine the possibility that realistic stories may not always be superior teaching tools, paying particular attention to what kinds of educational information might benefit most from such events (see Weisberg, Hirsh-Pasek, Golinkoff, & McCandliss, 2014) and at what ages different amounts of fantasy might be beneficial.

In general, the current studies indicate that the most important variable in children's understanding of stories is the type of information they are presented with, rather than the type of story in which this information is embedded. The current results particularly suggest that a key variable is prior familiarity with the target educational information. In cases where children were familiar with the information, as in the Ordinary and Anthropomorphic conditions of Study 1, they show adult-like abilities to use this information in their inferences about the story world. But in cases where children were more tentative about the information, as in the Unlikely condition of Study 1 and in Study 2 (especially for the never-drying paint item), they were unlikely to say that other events in the story would align with these premises. These results support prior work showing that children prefer to include realistic events in fictional stories (e.g., Weisberg et al., 2013) and suggest further that unusual events with which children are familiar (e.g., anthropomorphic animals) can become part of their repertoire for constructing stories. Further, we found no significant relations between children's extension of a fact within a story and their willingness to export that fact to reality, suggesting that these two processes are independent; children may use different principles to determine when to extend a fact and when to export it, as adults do.

Given this, future work should focus on investigating the interaction between children's prior knowledge and the new information presented in a story context for children's extension of novel information within a story and their inclusion of that information in their general knowledge banks. How much knowledge do children have to have about the target educational information before they will sanction its inclusion in fiction and before they will learn it (see discussion in Sobel & Weisberg, 2014)? New work from our lab implements a pre-test/post-test design to address this question directly (Hopkins & Weisberg, 2020). More broadly, these results indicate that story contexts can be an effective tool for probing the strength of children's beliefs in various real-world facts, opening up new avenues for investigating the growth of children's knowledge.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

ENDNOTES

[1]Since there were only 4 children recruited in these latter two locations, we ran all of our analyses with them both included in and removed from the sample. As this generally did not affect our results, we chose to include them; we note in the Results section the few occasions that their exclusion affected our *p*-values.

[2]Removing these younger children from the sample did not substantially alter the pattern of results.

[3]We had initially intended to use the questions about the mouse and the frog to investigate how far children would extend novel premises presented in the story. But it's not clear what sounds mice or frogs might make in a world where cats say "chit"; they may also say "chit" or they may make a different novel sound. There were thus conceptual issues with interpreting children's responses and so we did not include data from these two animals in our analysis of children's extension in the Unlikely condition. Those analyses focused only on extension to the other cat.

[4]This *p*-value is .08 when excluding the 4 children tested in the lab or at home.

[5]This *p*-value is .041 when excluding the 4 children tested in the lab or at home.

[6]The fact that adults never extended this novel sound to the mouse and frog further supports our conclusion that it would be difficult to interpret responses to these questions for the child participants.

[7]This *p*-value is .098 when excluding the 4 children tested in the lab or at home.

[8]This *p*-value is .07 when excluding the 4 children tested in the lab or at home.

DATA AVAILABILITY STATEMENT

The data that support the findings of these studies are openly available at the Open Science Framework at https://osf.io/er5xh/.

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APPENDIX A.

Note: The female version of the stories, which was read to girls is provided here; boys heard a version of the stories with a male main character (Nate).

Full text of stories used in Study 1

Realistic story

Jenn got out of bed in the morning to get ready for school. She stretched her arms and yawned very loudly. Mittens, her pet cat, jumped off the sheets.

Jenn said, "Good morning, Mittens!"

Ordinary fact condition: Mittens said, "Meow, meow."

Unlikely fact condition: Mittens said, "Chit, chit."

Anthropomorphic fact condition: Mittens said, "Good morning."

Jenn put on her pants and t-shirt for school. She made her bed.

She went to the bathroom to brush her teeth.

She walked to the kitchen to eat breakfast with her family. Mittens followed her.

Jenn poured herself cereal for breakfast. When she finished eating, she got up from her chair and washed her bowl.

Jenn was about to leave, but she couldn't find her backpack.

“I need my backpack for school,” she said. “I wonder where it is.”

Everybody looked for Jenn's backpack. Mom and Dad looked under the table. Jenn looked in the bathroom.

Finally, Jenn found the backpack under her bed, stuck in a corner.

“Now I'm ready for school,” said Jenn. “Goodbye, Mittens! See you later!”

Ordinary fact condition: Mittens said, “Meow, meow.”
Unlikely fact condition: Mittens said, “Chit, chit.”
Anthropomorphic fact condition: Mittens said, “Goodbye!”

Jenn and her friends went to school. At the beginning of class, Jenn pulled out her chair and sat down at her desk. Jenn's teacher practiced writing letters on the board with chalk.

When Jenn came home that day, she was very tired. Mittens was sitting by an open window, watching. Jenn shouted, “Hi, Mittens!”

Fantastical story

Jenn's bed started to sing very loudly and stretch its arms. Jenn's pet cat, Mittens, jumped off the sheets.

Jenn said, “Good morning, Mittens!”

Ordinary fact condition: Mittens said, “Meow, meow.”
Unlikely fact condition: Mittens said, “Chit, chit.”
Anthropomorphic fact condition: Mittens said, “Good morning.”

Jenn put on her flying suit for school. Her bed made itself.

Jenn's toothbrush jumped off a shelf and climbed onto her shoulder to brush her teeth.

Jenn walked to the kitchen to eat breakfast with her family. Mittens followed her.

A cereal box floated into the air and poured Jenn her cereal for breakfast. When she finished eating, her chair threw her off and her bowl jumped off the table.

Jenn was about to leave, but she couldn't find her backpack.

“I need my backpack for school,” said Jenn. “I wonder where it is.”

Everybody looked for Jenn's backpack. The table floated into the air. Mom and Dad looked under it.

Finally, Jenn found the backpack crying under her bed because its foot was stuck.

“Now I'm ready for school,” said Jenn. “Goodbye, Mittens! See you later!”

Ordinary fact condition: Mittens said, “Meow, meow.”
Unlikely fact condition: Mittens said, “Chit, chit.”
Anthropomorphic fact condition: Mittens said, “Goodbye!”

Jenn and her friends flew to school. At the beginning of class, Jenn's chair walked away from the desk to let Jenn sit down. Jenn's teacher practiced writing letters in the sky with a teaching wand.

When Jenn came home that day, she was very tired. Mittens was sitting by an open window, watching. Jenn shouted, “Hi, Mittens!”

Full text of stories used in Study 2

Realistic story

Jenn woke up in the morning and drove to school with her mom.

When she got to her school, she gave her mom a hug goodbye and walked through the door of her classroom.

Jenn took off her blue coat, straightened out its sleeves, and hung it up in her cubby.

She then walked over to the classroom aquarium and looked at the goldfish swimming in their bowl before class began.

Insert first extension page (see below)

Jenn took her seat on the rug and her teacher, Mrs. Smith, greeted the class. Mrs. Smith called on Jenn to read today's date from the calendar on the bulletin board.

Mrs. Smith asked the class to describe the weather that day so they could update their weather chart. The class chose the words “sunny,” and “windy.” Mrs. Smith picked up the picture of the sun and the picture of wind from the bin and pinned them to the weather chart.

Next, Mrs. Smith asked the “Student of the Day,” Renee, to share her show-and-tell item. Renee took her stuffed zebra out of her cubby and showed it around the circle so that all of the students could see. After show-and-tell, Mrs. Smith announced that it was time to begin the day's activities.

Insert second extension page (see below)

At the end of the day, Mrs. Smith held circle time and read a story aloud to Jenn and her classmates. Mrs. Smith told the class that tomorrow would be a very special day, because they were going on a field trip to the science museum. Mrs. Smith reminded everyone that they needed a permission slip to take the school bus to the museum.

When circle time was over, Jenn took her coat out of her cubby, made sure it was facing the right way, and put it on.

Mrs. Smith flipped the switch on the wall to turn off the classroom lights. Jenn waved goodbye to Mrs. Smith and her classmates, went back home, and told her mom all about her day at school.

Fantastical story

Jenn woke up in the morning and flew to school with her mom.

When she got to her school, she gave her mom a hug goodbye and walked through the wall of her classroom.

Jenn took off her blue coat, shrunk it to the size of a pea, and put it in her pocket.

She then walked over to the classroom aquarium and looked at the dragons swimming in their bowl before class began.

Insert first extension page (see below)

Jenn took her seat on the rug and her teacher, Mrs. Smith, greeted the class. Mrs. Smith called on Jenn to read today's date from the magic crystal ball on the counter.

Mrs. Smith asked the class to describe the weather that day so they could update their weather chart. The class chose the words “sunny” and “windy.” The picture of the sun and the picture of wind grew tiny wings and flew from the bin and pinned themselves to the weather chart.

Next, Mrs. Smith asked the “Student of the Day,” Renee, to share her show-and-tell item. Renee's stuffed zebra jumped out of Renee's cubby and walked around the circle so all of the students could see. After show-and-tell, Mrs. Smith announced that it was time to begin the day's activities.

Insert second extension page (see below)

At the end of the day, Mrs. Smith held circle time and read aloud to Jenn and her classmates. Mrs. Smith told the class that tomorrow would be a very special day, be-cause they were going on a field trip to the science museum. Mrs. Smith reminded everyone that they needed to bring a permission slip to ride the magic carpet to the museum.

When circle time was over, Jenn took her coat out of her pocket, stretched it out to its normal size, and put it on.

Mrs. Smith blinked her eyes twice to turn off the classroom lights. Jenn waved goodbye to Mrs. Smith and her classmates, flew back home, and told her mom all about her day at school.

Extension pages (order counterbalanced)

Never-drying paint: A few days ago, Jenn painted a picture of a beautiful field of flowers and trees. She hung it up to dry when she finished. The next day, she went to get her painting off the wall, but it was still wet. And today, 3 days later, Jenn decided to check again, but the paint was still wet.

Psychosomatic pain: During arts and crafts, Jenn sat next to her best friend, Tiffany. She asked her if she could help colour in the lines of the picture, but Tiffany said that she preferred to work alone. What Tiffany said hurt Jenn's feelings, and that made Jenn's chest hurt.