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Can that really happen? Children's knowledge about the reality status of fantastical events in television



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ABSTRACT

Although popular children's cartoons are replete with fantastical events, we know little about whether children understand that these events are fantastical rather than real. In Study 1, 54 children ages 4 to 6 years and 18 adults were shown 10 real and 10 fantastical events portrayed in 4 s video clips from a popular cartoon. After viewing each clip, participants were asked to judge the reality status of the event and to explain their judgments. Results indicated that even 4-year-olds have a fairly good understanding of fantastical events in animated cartoons but that they underestimate the reality status of real events in such cartoons. In Study 2, 35 4- to 6-year-olds and 18 adults watched video clips of 10 real and 10 fantastical events performed by real people from a Chinese television show. Once again, 4-year-olds underestimated the reality status of real events shown on television. However, against the "real" backdrop in this study, 4-year-olds also judged nearly half of the fantastical events to be real. The implications for children's reality–fantasy discrimination and their media viewing are discussed.

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Introduction

Watching television is a common activity for children; one recent study showed that American children under 9 years of age watch nearly 2 h of television a day (Holloway, Green, & Livingstone, 2013). For many children, this television includes animated cartoons, from long-running Looney Tunes entertainment cartoons such as *Road Runner* to newer cartoons aimed at teaching children such as *Super Why*. One feature of animated cartoons is that they easily can, and often do, include magical content. For example, animated cartoons might show a character suspended in mid-air, defying the laws of gravity, or suddenly appearing in a different location, violating the principle of continuity. Past research has shown that some animated cartoons reduce children's levels of executive function immediately after viewing (Li, 2014; Lillard & Peterson, 2011) and that what disrupts executive function are likely the fantastical events (Lillard, Drell, Richey, Boguszewski, & Smith, 2015). An interesting question that arises is whether children watching magical events on television know that what they are watching is not real. When young children watch a show like *SpongeBob SquarePants* that is replete with fantastical events, do they know that some of the events they are watching cannot really happen, whereas others can?¹ And how do they make such judgments?

There is a dearth of research addressing this issue with animated cartoons. Some previous studies (summarized in Table 1) on children's understanding of fantasy examined still pictures or actual events (Johnson & Harris, 1994; Sharon & Woolley, 2004; Shtulman & Carey, 2007). As an example of one earlier study using pictures, Taylor and Howell (1973) simply asked 3- to 5-year-olds to judge whether humans, animals in their natural environments, and anthropomorphized animal characters were real or not. Children's ability to distinguish reality from fantasy in still pictures was poor in young preschoolers but improved with age, with mean scores of 0.69, 2.6, and 4.6 out of 6.0 in 3-, 4-, and 5-year-olds, respectively. Morison and Gardner (1978) asked somewhat older children (kindergarten and Grades 2, 4, and 6) to categorize 40 still pictures of real and fantasy figures as pretend or real. Children were generally quite good at such judgments, correctly sorting 86% of the items. Performance was lowest in the kindergarten group, which still correctly sorted 70%. Overall, approximately a third of errors occurred when unfamiliar real entities (e.g., dinosaur, knight) were deemed to be pretend, and two thirds of errors occurred when fantasy entities (e.g., Big Bird) were deemed to be real. Sharon and Woolley (2004) used both a categorization task and a property attribution task to test 3- to 5-year-olds' differentiation of real and fantasy entities, and they found that correct categorization of real entities improved significantly with age but that all age groups performed at chance levels when categorizing the fantastical entities. However, some of their items, such as a knight, were perhaps not familiar to 3-year-olds. The results from the property attribution task were far better and suggested that 4- and 5-year-olds clearly distinguish fantasy from real entities. In sum, children's basic categorizations of pictured entities into real and pretend categories tends to be accurate by 4 or 5 years of age, although this is less often the case for entities with which children are less familiar or with familiar characters that are anthropomorphized like Big Bird.

Two studies used still pictures of events, rather than mere entities, to address children's categorizations of pretend and real; both studies also examined the influence of emotional valence. Samuels and Taylor (1994) showed 3- to 5-year-olds pairs of real and fantasy events that were emotionally neutral (a woman picking an apple and a moose mixing batter in a bowl) or emotionally charged (robbers threatening a person with a knife and a giant chasing a child), and they asked children to state which could really happen. Children were generally apt at correctly stating which events were real and which were not; when they erred, it was typically to refute the reality status of emotionally charged real events, in essence denying that scary things can happen. Carrick and Quas (2006) found that 3- to 5-year-olds also judged happy events, whether fantastical or real, to be real significantly more often than events that were frightening or conveyed anger. Thus, two studies have shown that preschoolers are competent at categorizing events in still pictures as pretend or real, although these children err in a Pollyanna-like fashion when the events are emotionally charged.

¹ Looking time studies suggest that infants implicitly differentiate between some possible and impossible events. Here we examined verbal children's explicit judgments about what can actually happen.

Table 1

Prior studies of children's reality judgments.

Stimulus type	Study	Age	Results
Live events	Johnson and Harris (1994)	3- to 5- and 7-year-olds	Most young children make distinctions between magical and ordinary outcomes but vary in their level of credulity regarding magical outcomes
Still pictures of entities	Taylor and Howell (1973)	3- to 5-year-olds	Young children's ability to categorize items as real or fantasy was poor but improved with age
	Morison and Gardner (1978)	Kindergartners and Grades 2, 4, and 6	Children were generally quite good at discriminating real and fantasy entities, but the kindergarten group performed worst
	Sharon and Woolley (2004)	3- to 5-year-olds	4- and 5-year-olds made a clear distinction between fantasy and real entities on a property attribution task and had some trouble with unfamiliar entities on a categorization task
Still pictures of events	Samuels and Taylor (1994)	3- to 5-year-olds	Children were generally able to discriminate between real and impossible events yet denied the reality of emotionally negative events
	Carrick and Quas (2006)	3- to 5-year-olds	Children judged happy events to be real more often than frightening events or events involving anger
Stories	Shtulman and Carey (2007)	4- to 8-year-olds	Children judged many of the improbable events to be impossible
	Woolley and Van Reet (2006)	3- to 6-year-olds	5- and 6-year-olds more often categorized a novel entity presented in a familiar or scientific context as real
	Woolley and Cox (2007)	3- to 5-year-olds	Children were skeptical of the existence of characters in storybooks, and this tendency increased with age
	Corriveau, Chen, and Harris (2014)	5- and 6-year-olds	Children used realistic contexts to conclude that a character was real but differed according to religious exposure when presented with religious and fantastical stories
	Van Reet, Pinkham, and Lillard (2015)	10-year-olds and adults	Both adults and children discriminated between real and imagined entities but were generally skeptical of novel entities
Filmed events	Flavell et al. (1990)	3- to 5-year-olds	54% of 3-year-olds reliably responded that real filmed objects would not fall out of an upside-down television
	Wright et al. (1994)	5- and 7-year-olds	Bias to report what happened on television was not real
	Ma and Lillard (2013) , Richert and Lillard (2004)	4- and 5-year-olds	Children were reasonably proficient at judging real and pretend snacking behaviors as real or pretend; when they erred, they tended to say that real snacking is pretend
	Goldstein and Bloom (2015)	3- to 5-year-olds	By 5 years of age, children are beginning to understand that actors are not the characters they portray

Extending from studies in which still pictures portray isolated events are studies that use stories to convey fantastical events. In the only study to look at explanations as well as judgments, [Shtulman and Carey \(2007\)](#) showed 4- to 8-year-olds and adults a storybook depicting three types of events: ordinary (e.g., eating an apple), improbable (e.g., drinking onion juice), and impossible (e.g., walking through a brick wall). After reading the storybook, children were asked whether they had experienced each of the events depicted, whether the event in question could happen in real life, and (if not) why. Participants of all ages typically said that the ordinary events were possible and that the impossible events could not happen in real life. Developmental differences arose with the improbable events; children judged the improbable events to be impossible significantly more often than adults. Shtulman and Carey concluded from this that children and adults use different criteria to distinguish between possible and impossible events. An event was regarded as impossible when adults identified a fact about the world that would preclude its occurrence. For example, adults explained that the fantastical event “walking through a wall” could not happen due to physical laws or properties (e.g., “The wall is solid”). Only when children were able to conjure the circumstances that would allow an improbable event to occur did they judge such events to be possible. For example, children have

trouble identifying drinking onion juice as a possible event because they cannot think of any circumstance where it would happen (see also Woolley, 1997). Despite erring by often judging improbable events to be impossible, even young children were quite good at categorizing impossible and possible events in stories.

Other research suggests that the frame within which events and characters are presented has a strong influence on children's reality status judgments. Woolley and Van Reet (2006) asked 3- to 6-year-olds to judge the reality status of novel entities presented with fantastical, scientific, and everyday descriptions. At each age, children used context to assign reality status to novel entities, with the older children more often categorizing a novel entity as real when it was presented in a familiar or scientific context. Woolley and Cox (2007) asked about the reality status of characters and events in stories that were realistic, fantastical, or religious. Regardless of whether described characters and events were actually possible or not, preschoolers judged events that were embedded in realistic stories as more likely to happen in real life than events embedded in fantastical stories. Corriveau, Chen, and Harris (2014) also examined the effect of realistic stories, religious stories, and fantastical stories on 5- and 6-year-olds' judgments of the reality status of the protagonist. They found that children were able to use realistic contexts to conclude that a character was real but differed on how they judged the protagonist in the religious and fantastical stories according to the children's exposure to religion; specifically, children with a religious upbringing were more likely to claim that religious events were real. Finally, Van Reet, Pinkham, and Lillard (2015) asked 10-year-olds and adults about the reality status of known real, known imagined, and novel entities presented in simple and elaborate stories. Both the 10-year-olds and adults made correct ontological judgments about real and imagined entities and were generally skeptical of novel entities. However, when such entities were presented in more elaborate contexts, children more often judged the entities to be real.

These prior studies all show that frames influence children's reality status judgments for entities and events shown in still pictures or described in stories. Here we focused on televised events using different frames. Briefly, in Study 1 we examined children's understanding of televised real versus fantastical events when those events are framed in the context of cartoon characters. Study 2 extended these results by examining children's understanding when the events instead involve a real person in a television show. Although no prior studies (to our knowledge) have directly examined children's reality status judgments in filmed stimuli, several studies have addressed close issues.

In one study with film, preschoolers were asked to watch dynamic events such as juice being poured into a glass (Flavell, Flavell, Green, & Korfmacher, 1990). When asked whether the juice would spill out when the television set was turned upside down, 54% of 3-year-olds gave the correct answer in response to at least six of the eight videos, but on a significant number of trials children reported that real objects were actually present and, hence, would spill out if the television were inverted. In another study showing difficulty with real-pretend categorization in film, Goldstein and Bloom (2015) showed that 3- and 4-year-olds fail to differentiate well between filmed actors and the characters they portray; by 5 years of age, children did make more explicit differentiation. In both of these studies, then, children erroneously judged filmed content to be real. Three other studies showed the opposite error with filmed stimuli. In one, 5-year-olds displayed a judgment bias by tending to report that television content was unreal. In addition, they were not apt at differentiating news from fictional programs (Wright, Huston, Reitz, & Piemyat, 1994). In two other studies, participants were asked to categorize filmed real and pretend snacking behaviors (Ma & Lillard, 2013; Richert & Lillard, 2004). Preschoolers did fairly well, but when they erred it was typically by claiming that real snacking behaviors in the films were pretend. These studies all suggest that, particularly at younger ages, children are confused about the reality status of televised events, sometimes viewing them as more real than they actually are and on other occasions viewing them as less so.

To summarize, although research with still pictures suggests that young children are fairly good at judging what is real or fantastical, studies with filmed stimuli suggest that these children might be less proficient with television. Furthermore, research with stories suggests that the context matters a good deal and, therefore, the context or frame of an animated cartoon might be particularly challenging.

The current studies were designed to examine children's understanding of fantastical and real events in children's television shows. We defined fantastical events as physically impossible actions, ones that violate physical laws such as gravity. Popular children's programs are often animated

cartoons, and they contain many fantastical events such as wingless characters flying. Due to both the popularity of animated cartoons and the surplus of fantastical events therein, Study 1 investigated how children and adults judge real and fantastical events depicted in short clips taken from a very popular children's cartoon. Because context was shown to be important to reality status judgments in prior studies, in Study 2 we changed the context from an animated cartoon to a television show with human actors who perform real fantastical events. In both studies, participants gave justifications for their judgments, basis (Wellman, Fang, & Peterson, 2011).

Both studies were conducted in mainland China. As in the United States, television is the dominant form of media use for Chinese 3- to 6-year-olds. One recent study showed that 93.39% of Chinese preschoolers watch television every day and for an average of 90.88 min (Li, Wu, & Zhou, 2014). This high rate of television use is comparable to that of American children of these ages.

Study 1

Study 1 was designed to address children's understanding of fantastical events (e.g., a woman appear out of thin air) and real events (e.g., two men talking) performed by cartoon characters in animated cartoons. Children and adults judged the reality status of fantastical and real events depicted in video segments taken from a popular children's cartoon.

Method

Participants

There were 72 participants, 18 in each of four age groups: 4-year-olds ($M = 56.00$ months, $SD = 2.40$, range = 51–59; 9 girls), 5-year-olds ($M = 63.00$ months, $SD = 4.19$, range = 60–71; 8 girls), 6-year-olds ($M = 72.61$ months, $SD = 0.70$, range = 72–74; 8 girls), and adults ($M = 284.50$ months, $SD = 14.59$, range = 264–313; 9 women). Participants were recruited from a preschool affiliated with the psychology department of a university in central China. All children were from Chinese middle-class families and were given a sticker as thanks for their participation. The adults were undergraduate students who volunteered for the study in response to a flyer posted on a bulletin board in the same psychology department; they received a notebook for their participation.

Design and procedure

Each participant was shown 20 short video clips in succession on a laptop computer. Each clip portrayed a central event; of the 20 events, 10 were realistic and 10 were fantastical, and all were shown to all participants in a single random order. All of the clips were taken from the popular cartoon *SpongeBob SquarePants*. Because this was an initial investigation and prior studies showed that emotionality of stimuli influences judgments, here we used only emotionally neutral events. Appendix A gives clip descriptions in the order that the clips were shown. Each clip was followed by a set of questions prior to the next clip being shown.

First, to ensure that participants perceived the focal event in the clip as intended, they were asked to describe what happened. In their responses, terms referring to persons (e.g., “he,” “a person,” “a man”) were seen as interchangeable; event descriptions were key. If an answer did not correspond to the intended event, the experimenter replayed the clip and asked for a description again. Descriptions relaying only part of the intended event or an irrelevant aspect of the event (e.g., “That man is ugly”) also resulted in a clip being replayed and the question was asked again. If a participant did not give the intended description after the second viewing, the experimenter gave the participant the intended description for that clip.

Next, participants were asked (a) whether they had seen the described event in real life (e.g., “Have you ever seen two people taking a boat ride in real life?”), (b) whether they thought the event possible (“Do you think it is possible that two people can take a boat ride in real life?”), and (c) why they thought the event was or was not possible (“Why couldn't two people take a boat ride in real life?”).

At the end of the procedure, participants' familiarity with the cartoon was assessed by asking, "Have you ever watched *SpongeBob* before?" and "Have you ever watched any of these video clips before?"

Coding of justifications

All justifications were coded independently by both the first author and a research assistant according to the coding scheme used by [Shtulman and Carey \(2007\)](#), in which all justifications were categorized as being one of three types. Factual justifications referenced facts about the world that would preclude an event's occurrence (e.g., "Two men jumped up and stayed floating in the air could not happen in real life because of gravity"). Hypothetical justifications referenced hypothetical events that could occur, or would occur, in place of the actual event under consideration (e.g., "A man appeared out of some smoke could happen in real life if it was in a movie studio"). Finally, redundant justifications provided no information beyond what was already mentioned in the description or what was already discernible from a participant's initial judgment (e.g., "It is not real"). Of the 1440 justifications provided, the two coders agreed on 1336; inter-rater agreement was 92.78% (Cohen's kappa = .87). The disagreements were resolved through discussion.

Results

Below, we first review the results for event descriptions. Next we examine the pattern of correct responding for each type of item, and then we look in a descriptive manner at event categorizations to determine whether particular events were problematic. Next, following [Woolley and Ghossainy \(2013\)](#), we use signal detection theory (SDT) to examine response patterns, then we consider separate analyses of variance (ANOVAs) for the real and fantasy items. Finally, we examine the justifications that participants gave for their categorizations and the effect of prior experience with *SpongeBob*.

Event descriptions

Participants described the events shown in the video before they were asked about the reality status of the event. All 18 adults gave a correct description of every event at first viewing, suggesting that the focal events were clear for them. Across the 20 items, the average number of participants (out of 18) who gave the correct description at the first viewing was 14.40 ($SD = 2.99$) for 6-year-olds, 11.70 ($SD = 3.81$) for 5-year-olds, and 10.95 ($SD = 3.13$) for 4-year-olds. Thus, for each event, on average more than 60% of the participating children gave a correct description at first viewing. This number increased to 92.15% after a second viewing. In sum, children were quite proficient at describing what they had seen.

Individual event categorizations

The number of correct categorizations (out of 10) for each type of item at each age level is shown in [Table 2](#) and [Fig. 1](#). As can be seen, even 4-year-olds were quite good at categorizing the fantasy events as impossible. To examine whether particular items posed unusual difficulty, Kruskal–Wallis tests were done looking at specific items by age level. These showed age level differences for two particular fantasy items (1 and 10; see [Appendix A](#)) and a trend for two others (16 and 19). We do not know why these particular events were mistaken for real by some children. Oddly, one adult also said that one fantasy event (7) was real: "A man appeared out of some smoke." A review of the audio indicated that she had seen this occur after a factory fire. No other adult judged that the event portrayed in this clip could really happen, so this was idiosyncratic.

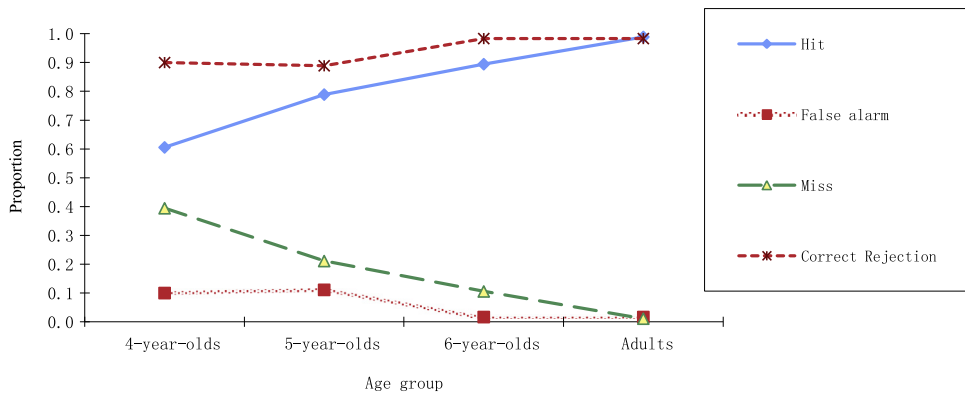
For real items, there were seven tokens on which significant age level differences were seen, and a trend occurred for an eighth item. Indeed, the only two real items that did not generate age-level differences were "A man got off a bus" and "Two friends are talking on the phone." Thus, younger children were not nearly as competent regarding real items, claiming that they were fantastical significantly more often than adults. This finding is explored more fully below.

First, however, it is informative to look at individual patterns to determine whether these results are generated by few or many children. Of the 18 4-year-olds, 4 answered incorrectly by claiming that none of the real events could really happen, and 3 of these 4 children also (correctly) made this claim

Table 2

Mean number of correct reality status judgments (and standard deviations) for each item type by age level: Study 1.

	Real events	Fantasy events
4-year-olds	6.67 (3.87)	8.28 (2.87)
5-year-olds	8.00 (3.29)	9.17 (2.48)
6-year-olds	9.22 (2.34)	9.72 (0.96)
Adults	10.00	9.78 (0.55)

**Fig. 1.** Proportion of each type of response for each age group: Study 1.

for the fantasy items. This raises the possibility of a “no” bias among a small number of young children. However, these children’s justifications offer evidence against a low-level “no” bias because 3 of these children often used reasonable hypothetical justifications to explain why fantasy events were not real. Rather, these children appeared to correctly understand the television frame and to be interpreting the real events as acted. Perhaps reflecting a growing awareness that television is generally not real, many 4-year-olds had some confusion about the real items, with 14 of the 18 having at least one real item error (claiming it could not happen in real life). Performance was better, but not perfect, on fantasy items, with 9 4-year-olds miscategorizing at least one fantasy event as real.

Analysis using signal detection theory

SDT was used to arrange children’s responses into four categories: hit (real event as possible), miss (real event as impossible), false alarm (fantastical event as possible), and correct rejection (fantastical event as impossible). The prevalence of each category across the ages tested is depicted in Fig. 1. As is clear from this figure, misses and hits were the most problematic because young children showed some tendency to misjudge real events as impossible (reducing their hit score and adding to their miss score). Here d' was calculated as an index of reality sensitivity ($d' = Z_{\text{hit}} - Z_{\text{false alarm}}$); this result is shown in Fig. 2. There were significant age differences for d' , $F(3, 68) = 8.37$, $p < .001$, $\eta_p^2 = .27$. Post hoc Tukey’s tests indicated that 4-year-olds’ reality sensitivity was lower than that of 6-year-olds (mean difference = 1.51, $p < .001$) and adults, and 5-year-olds’ reality sensitivity was lower than that of adults (mean difference = 1.27, $p < .05$).

Analysis of reality status judgments

Next we focus on each type of event separately, beginning with real events.

Real events. A one-way ANOVA on reality status judgments for real events, comparing across age levels (4-year-olds, 5-year-olds, 6-year-olds, and adults), showed a significant effect of age level,

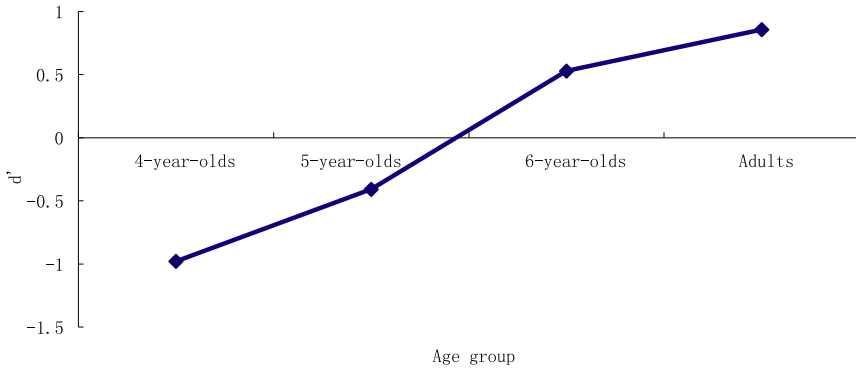


Fig. 2. Reality sensitivity d' across age: Study 1.

$F(1, 68) = 4.90, p < .01, \eta_p^2 = .18$. Post hoc Tukey's tests showed mean differences between 4-year-olds and 6-year-olds (mean difference = 2.56, $p < .05$) and also between 4-year-olds and adults (mean difference = 3.33, $p < .01$).

Fantasy events. An ANOVA on the reality status of fantasy events showed a trend-level effect of age group, $F(1, 68) = 2.23, p = .09, \eta_p^2 = .09$. Post hoc Tukey's tests showed no mean differences between the age groups for fantasy events.

Event experience

Fig. 3 shows that children claimed to have seen 7.63 ($SD = 3.12$) of 10 real events and 0.70 ($SD = 1.84$) of 10 fantastical events. Adults were statistically similar, claiming to have experienced 9.89 ($SD = 0.32$) of the 10 real events and 0.17 ($SD = 0.38$) of the 10 fantastical events. A repeated measures ANOVA with age (4-year-olds, 5-year-olds, 6-year-olds, and adults) as the between-participants variable and event type (real and fantastical) as the within-participants variable was conducted on experience judgments. As would be expected, participants claimed that they had experienced more real events than fantastical events, $F(1, 68) = 543.53, p < .001, \eta_p^2 = .89$. There was also a significant main effect of age, $F(3, 68) = 2.96, p < .001, \eta_p^2 = .12$, and a significant interaction of Event Type \times Age, $F(3, 68) = 9.66, p < .001, \eta_p^2 = .29$. A simple effects analysis indicated that there was a significant event type effect at each age level: 4-year-olds, $t(17) = 6.65, p < .001, d = 1.89$; 5-year-olds, $t(17) = 7.84, p < .001, d = 2.50$; 6-year-olds, $t(17) = 15.27, p < .001, d = 5.03$; and adults, $t(17) = 71.80, p < .001, d = 27.67$. In addition, there was a significant age effect in regard to experiencing the real events, $F(3, 68) = 7.49, p < .001, \eta_p^2 = .25$, but not the fantasy events. Post hoc Tukey's test results

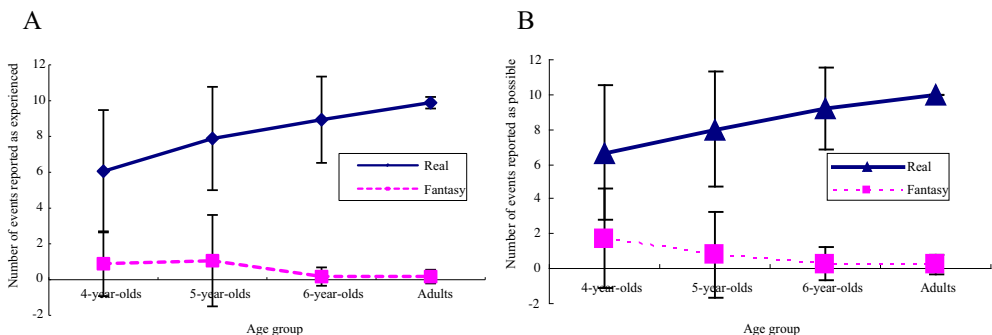


Fig. 3. Average number of events (out of 10) reported as experienced (A) and possible (B) by each age group: Study 1.

indicated that 4-year-olds reported having experienced fewer real events than 6-year-olds (mean difference = 2.89, $p < .01$) or adults (mean difference = 3.83, $p < .001$). Moreover, when children made correct judgments, the results indicated that there were significant correlations between children's experience of both real events ($r = .89$, $p < .001$) and their reality judgments.

Participants' justifications for their categorization judgments

A series of ANOVAs was conducted on the different types of justification (factual, hypothetical, or redundant) given for each event type (real or fantastical) with age (4-year-olds, 5-year-olds, 6-year-olds, or adults) as the between-participants factor; these data are shown in Fig. 4. Factual justifications for judging real events as real increased with age, $F(3, 68) = 14.33$, $p < .001$, $\eta_p^2 = .39$. Post hoc Tukey's tests showed differences between 4-year-olds and 6-year-olds (mean difference = 3.44, $p < .001$) as well as between both 4-year-olds and adults (mean difference = 5.50, $p < .0001$) and 5-year-olds and adults (mean difference = 4.22, $p < .0001$). Thus, with age, there is an increased tendency to say that real events can happen for factual reasons. For example, a 6-year-old claimed that two people could watch television because, "there was a TV set at home and they could watch together," and a 5-year-old claimed that two people could talk because, "they have a mouth which could let them talk."

The same pattern was seen regarding factual justifications for judgments about fantasy events, $F(3, 68) = 22.89$, $p < .001$, $\eta_p^2 = .50$, although here the difference between 6-year-olds and adults was also significant (mean difference = 3.06, $p < .001$). For example, a 6-year-old claimed that coffee could not change into a man because "there are no bones in coffee and a man needs bones." Other examples included a 4-year-old who said, "Two men jumped up and stayed floating in the air" could not happen in real life because "they were too heavy," and another 4-year-old gave the same explanation for why "Somebody lifted himself up by his nose" could not happen in real life, adding, "Take me as an example – I could not do that." Although children did give some factual responses, these increased with age, and as in Shtulman and Carey (2007), adults tended to give factual justifications even more than children.

There were no age differences in the number of hypothetical explanations given for real events, but there were for fantasy events, $F(3, 68) = 2.90$, $p = .04$, $\eta_p^2 = .11$; the use of hypothetical explanations gradually declined with age, with the only significant difference being between 4-year-olds and adults. For example, a 4-year-old said, "Two men jumped up and stayed floating in the air" could not happen in real life because "if they do that, they could fall down and hurt themselves." Another 4-year-old said this event could not happen in real life because "if that could happen, the world would not be the world as it is." A 5-year-old explained that "Somebody lifted himself up by his nose" could not happen in real life because "if that could happen, it would be really dangerous." Again, this is consistent with Shtulman and Carey (2007), who found that for improbable events, children were more likely to say that such events could happen if the children thought of circumstances in which the

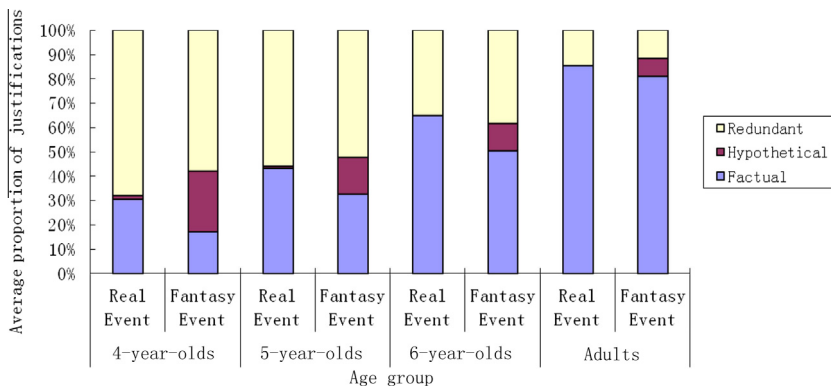


Fig. 4. Average proportion of children's justifications provided by each age group: Study 1.

events could occur. Adults tended to use factual explanations, whereas children tended to use hypothetical ones.

Finally, there were also reductions in the use of redundant explanations (e.g., “I have no idea,” “It is impossible”) at each age level for both real events, $F(3, 68) = 14.08$, $p < .001$, $\eta_p^2 = .38$, and fantasy events, $F(3, 68) = 12.55$, $p < .001$, $\eta_p^2 = .36$. For real events, the significant differences were at all non-adjacent age levels; for fantasy events, they were between adults and all other age levels.

Our last questions were about viewership of the show. Most children (87.04%) reported that they had watched *SpongeBob* before. Because these numbers were so high, we could not do analyses on the influence of having seen the show. Indeed, 51% of children reported having previously watched one or more of the very episodes from which the video clips were extracted.

Discussion

In Study 1, children’s ability to differentiate between real and fantastical events in an animated cartoon was fairly good even at 4 years of age, and it improved with age. Children actually tended to err more in claiming that real (possible) events in animated cartoons could not actually happen in real life. This is consistent with prior research in which children have used story frames as indicators of whether events and characters in stories are real. Our results appear to support the idea that television is itself a frame that may bias children to categorize televised content as fantasy; it appears that, to some degree, children decide that events cannot be real because they occur on television. Even the youngest children tended to correctly claim that fantastical events in the cartoon, such as eyes popping out of one’s head and a person turning into a cup of coffee, could not actually happen in real life. That children know these fantastical events in cartoons are impossible is important. Although watching full shows with many such events depletes their executive function (Lillard et al., 2015), young children can process individually portrayed fantasy events in an animated cartoon correctly on some level and can explicitly judge those events to be unreal.

There were strong developmental trends in explanations for the reality status judgments, and these trends were consistent with what Shtulman and Carey (2007) found using events portrayed in storybooks. With age, participants increased in their use of factual explanations and decreased in their use of redundant ones. Hypothetical explanations were very rare at any age for real events but decreased with age for fantasy events.

The results indicated that 4-year-olds are different from adults when judging real events in a cartoon. However, there are some limitations to Study 1. The cartoon used in this study showed a fictional cartoon, and the events were performed by fictional and fantastical characters. Having fantastical characters perform actions might have affected how children judged the possibility of the events. Many popular children’s cartoons contain real events performed by fantastical characters, so it is useful to know how these types of events are viewed and understood by children. However, children may be more likely to categorize any events portrayed by a fantastical character as impossible. Study 2 examined children’s reality judgments when the events are sometimes fantastical but the characters involved are real humans.

Study 2

Method

Participants

There were 53 participants: 17 4-year-olds ($M = 53.71$ months, $SD = 2.26$, range = 48–57; 6 girls), 18 6-year-olds ($M = 72.39$ months, $SD = 0.50$, range = 72–73; 5 girls), and 18 adults ($M = 236.44$ months, $SD = 16.24$, range = 216–283; 10 women). Recruitment procedures were the same as in Study 1.

Design and procedure

Participants were shown 20 short video clips, each of which portrayed a central event; of the 20 events, 10 were realistic and 10 were fantastical. All of the clips were taken from the Chinese

television program *Happy Satellite*, which features real people who sometimes enact fantastical events (see Appendix B for descriptions of events). The basic procedure was identical to that of Study 1.

Of the 1060 justifications provided, the two coders agreed on 1054; inter-rater agreement was 99.43% (Cohen's kappa = .96). The disagreements were resolved through discussion.

Results

The results are reported in the same order as for Study 1 except that we do not give results for simple event categorizations, focusing instead on the SDT results as the clearest indicator of categorization patterns.

Event descriptions

All 18 adults gave a correct description of every event at first viewing, the same as in Study 1. Across the 20 items, the average number of participants who gave the correct description at the first viewing was 12.95 (out of 18, $SD = 4.14$) for 6-year-olds and 10.65 (out of 17, $SD = 2.99$) for 4-year-olds. Thus, for each event, on average more than 60% of the participating children gave a correct description at first viewing, as in Study 1. This number increased to 91.17% after a second viewing. In sum, children in Study 2 were as proficient as those in Study 1 at describing the events.

Analysis using signal detection theory

An ANOVA revealed significant age differences for d' , $F(2, 50) = 65.81$, $p < .001$, $\eta_p^2 = .73$. Post hoc Tukey's tests showed mean differences between 4-year-olds and 6-year-olds (mean difference = 2.31, $p < .001$) and also between 4-year-olds and adults (mean difference = 2.74, $p < .001$), as shown in Fig. 5.

Analysis of reality status judgments

As for Study 1, we next focus on each type of event separately, beginning with the real events.

Real events. A one-way ANOVA on children's judgments for real events, comparing across age levels (4-year-olds, 6-year-olds, and adults), showed a significant effect of age level, $F(2, 50) = 12.50$, $p < .001$, $\eta_p^2 = .33$. Post hoc Tukey's tests showed mean differences between 4-year-olds and 6-year-olds (mean difference = 2.97, $p < .01$) and also between 4-year-olds and adults (mean difference = 3.41, $p < .001$).

Fantasy events. An ANOVA on the reality status judgment of fantasy events also showed a significant age effect, $F(1, 50) = 16.05$, $p < .01$, $\eta_p^2 = .39$. Post hoc Tukey's tests also showed mean differences

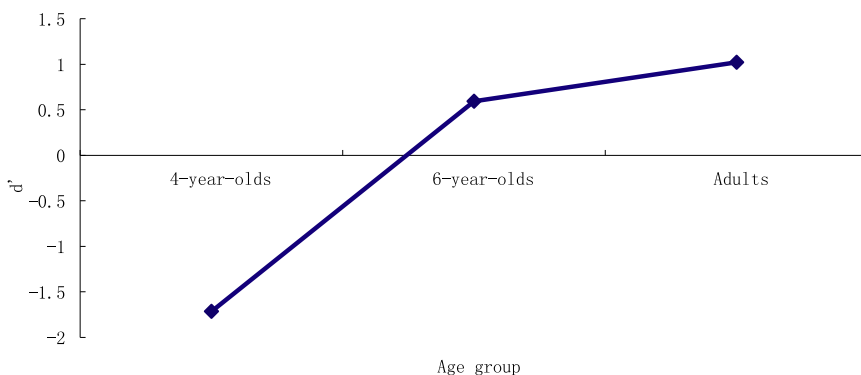


Fig. 5. Reality sensitivity d' across age: Study 2.

Table 3

Mean number of correct reality status judgments (and standard deviations) for each item type by age level: Study 2.

	Real events	Fantasy events
4-year-olds	6.59 (3.79)	5.54 (3.52)
6-year-olds	9.56 (0.71)	8.17 (1.30)
Adults	10.00	9.67 (0.77)

between 4-year-olds and 6-year-olds (mean difference = 3.29, $p < .001$) as well as between 4-year-olds and adults (mean difference = 4.01, $p < .001$), as shown in [Table 3](#).

Event experience

A repeated measures ANOVA with age (4-year-olds, 6-year-olds, and adults) as the between-participants variable and event type (real or fantastical) as the within-participants variable was conducted on experience judgments. The results indicated a significant main effect of event type, $F(1, 50) = 607.20$, $p < .001$, $\eta_p^2 = .92$, and a significant interaction of Event Type \times Age, $F(1, 50) = 49.15$, $p < .001$, $\eta_p^2 = .66$. A simple effects analysis indicated a significant event type effect at each age level: 4-year-olds, $t(16) = 5.10$, $p < .001$, $d = 5.96$; 6-year-olds, $t(17) = 13.55$, $p < .001$, $d = 5.17$; and adults, $t(17) = 75.66$, $p < .001$, $d = 19.35$. In addition, there was a significant age effect in regard to experiencing the real events, $F(2, 50) = 16.98$, $p < .001$, $\eta_p^2 = .40$, and the fantasy events, $F(2, 50) = 7.05$, $p = .002$, $\eta_p^2 = .22$. As for real events, post hoc Tukey's tests showed mean differences between 4-year-olds and 6-year-olds (mean difference = 2.58, $p < .01$) and also between 4-year-olds and adults (mean difference = 4.30, $p < .001$). Moreover, when children made correct judgments, the results indicated that there were significant correlations between children's reality judgments and their experience of both real and impossible (or fantastical) events ($r = .78$, $p < .001$), as shown in [Table 4](#).

Participants' justifications for their categorization judgments

An ANOVA was conducted on each of the different justification types (factual, hypothetical, or redundant) for each event type (real or fantastical) with age (4-year-olds, 6-year-olds, and adults) as the between-participants factor, as shown in [Fig. 6](#). Factual justifications for judging real events as real increased with age, $F(2, 50) = 20.23$, $p < .001$, $\eta_p^2 = .45$. Post hoc Tukey's tests showed differences between 4-year-olds and adults (mean difference = 4.97, $p < .001$) and between 6-year-olds and adults (mean difference = 3.28, $p < .001$). The same pattern was seen regarding factual justifications for judgments about fantasy events, $F(2, 50) = 16.69$, $p < .001$, $\eta_p^2 = .40$. Post hoc Tukey's tests showed differences between 4-year-olds and 6-year-olds (mean difference = 3.04, $p < .001$) and between 4-year-olds and adults (mean difference = 5.09, $p < .001$). There were no age differences in hypothetical explanations for real or fantasy events. Finally, there were significant age differences in the use of redundant explanations for both real events, $F(2, 50) = 19.61$, $p < .001$, $\eta_p^2 = .44$, and fantasy events, $F(2, 50) = 19.61$, $p < .001$, $\eta_p^2 = .44$. For real events, post hoc Tukey's tests showed differences among all groups: between 4-year-olds and 6-year-olds (mean difference = 2.63, $p < .001$), between 4-year-olds and adults (mean difference = 4.85, $p < .001$), and between 6-year-olds and

Table 4

Mean number of events experienced (and standard deviations) for each item type by age level: Study 2.

	Real events	Fantasy events
4-year-olds	5.53 (0.53)	2.41 (3.44)
6-year-olds	8.11 (0.51)	0.44 (0.86)
Adults	9.78 (0.51)	0

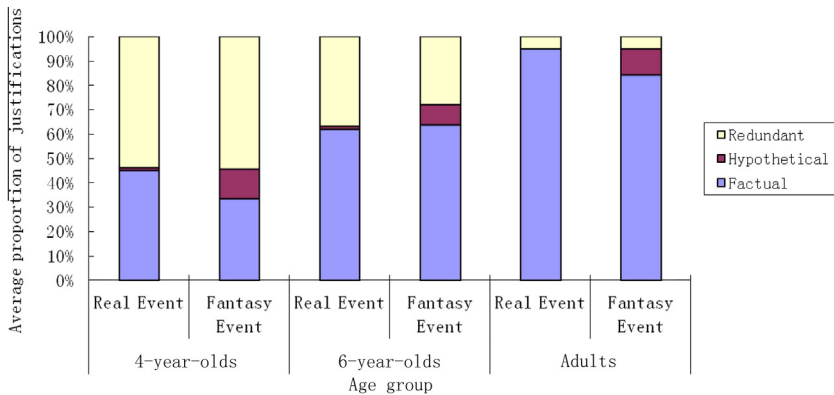


Fig. 6. Average proportion of children's justifications provided by each age group: Study 2.

adults (mean difference = 3.17, $p < .005$). The same was true for fantasy events, with post hoc Tukey's tests showing differences among all groups: between 4-year-olds and 6-year-olds (mean difference = 2.63, $p < .001$), between 4-year-olds and adults (mean difference = 4.91, $p < .001$), and between 6-year-olds and adults (mean difference = 2.28, $p < .005$).

Finally, 8 children (out of 35) reported that they had watched *Happy Satellite* before, and 7 of them reported having previously watched one or more of the video clips shown in this study. In this case, the numbers are too small to justify formal analyses.

Discussion

Study 2 confirmed the main finding of Study 1, namely that 4-year-olds judged real events as possible less often than both 6-year-olds and adults. In Study 1, on approximately 30% of trials, young children judged real events performed by cartoon characters to be impossible, and in this second study they made that error at a similar rate even though the televised real events were performed by real people. It appears, then, that there is some tendency to say that events occurring on television cannot occur in real life and that this tendency is gone by 6 years of age.

In this second study, unlike Study 1, age differences also emerged for fantastical events; the key difference across studies that appears to explain this is that in Study 2 the events were performed by real people (compared with an animated cartoon figure in Study 1). Under these conditions, 4-year-olds judged nearly half of the fantastical events to be possible, whereas 6-year-olds performed like adults in judging them to be impossible. Fantastical events were judged to be real by 4-year-olds somewhat less often than real events, but the error rate was still rather high.

As in Study 1, factual explanations for why events were real or fantastical also gradually increased from 4 years to 6 years to adulthood, whereas redundant justifications decreased. This aligns with other research showing improving abilities to explain judgments with age. In this study, there were no age differences in hypothetical justifications, but these were rare at any age.

General discussion

Past research has looked at children's ability to make fantasy–reality distinctions using still pictures and stories but not filmed stimuli. Children are watching increasing amounts of television, including animated cartoons in which fantastical events are often portrayed. Here we asked whether young children are able to discriminate between real and fantastical events in cartoons as well as in a show that was otherwise realistic.

First, we found that when fantasy events were presented in a cartoon context, even 4-year-olds were quite good at judging them to be fantastical, but when fantasy events were presented in a real context, 4-year-olds were essentially at chance. By 6 years of age, however, judgments were adult-like. This suggests that “special effects” and other ways of showing fantastical events in film media can be particularly misleading for young children when the background context is realistic rather than an animated cartoon.

On the other hand, whether performed by cartoon or real characters, televised realistic events were judged by 4-year-olds to be impossible approximately 30% of the time; again, by 6 years of age judgments of such events were adult-like. This reveals an overriding tendency to think that what is on television is not real; the error with fantastical events (done by real characters) occurs despite this tendency to think that all television is unreal. Taken together, these two studies highlight the importance of frames for children’s judgments of reality status (Woolley & Cox, 2007; Woolley & Van Reet, 2006; Lillard & Woolley, 2015). The television frame seems to predispose younger children to thinking that events are unreal; however, when the characters within that frame are realistic, there is a (relatively) increased tendency to think that portrayed fantastical events actually can happen.

Experience appears to be one important factor in developing a correct understanding of what is real and not real on television. The significant correlations in both studies between having experienced events and judging them to be real suggest that children rely on their experience to judge televised events as real. Perhaps there is an initial tendency to assume that what happens on television cannot be real and that event by event, as children’s experience with those events grows, children come to see real events as real.

One possible explanation for young children’s difficulty with making these judgments could be executive function (EF), which improves greatly over the preschool period (Best & Miller, 2010; Davidson, Amso, Anderson, & Diamond, 2006). One component of EF, set shifting, may be particularly important to reality status judgments. The video clips used here portrayed both real and fantastical events in cartoons and realistic television shows. When asked about reality status, children may need to shift their mental sets between the pretend context of the cartoon or television show to the real world in order to respond correctly. Difficulty with shifting and applying real-world physical laws to events presented in a fantastical context may explain why children had difficulty with judging the real events. Young children’s difficulty with set shifting has been well documented (Garon, Bryson, & Smith, 2008). Future research should test whether EF is implicated in the reality status judgments of events depicted in cartoons and whether it accounts for the age differences found in this study.

Overall, the current studies found that young children are skeptical of the reality status of real events in television and tend to categorize them as impossible. They displayed this response pattern when judging the real events from both cartoons and a television program using real actors. However, when real characters were associated with fantastical events on television, 4-year-olds erroneously claimed that those fantastical events were real. This suggests that special effects and other ways of manipulating reality on-screen are particularly misleading for children when the show is not a cartoon.

More research is needed to compare young children’s understanding of fantastical events across different types of media. For instance, do children judge real and fantastical events in cartoons the same way as they do in fictional storybooks? If there is a difference, what is it about presentation type that results in this disparity in reality status judgments of real and fantastical events? Due to the fact that fantastical content is common in children’s media, how children understand real and fantastical events in such media is an important topic for continued research.

Appendix A. List of stimulus item descriptions

Categorization	Event
Fantasy	1. Some coffee changed into a man
Fantasy	2. A man's stomach suddenly became larger than a hot balloon
Real	3. Two people watched television
Fantasy	4. Two men jumped up and stayed floating in the air
Real	5. Two men were talking
Real	6. Two people were talking on the phone
Fantasy	7. A man appeared out of some smoke
Fantasy	8. A woman appeared out of thin air
Real	9. A man was reading a book
Fantasy	10. Wind came out of a man's fingers
Real	11. Two people were shaking hands
Fantasy	12. A man lifted himself up by his nose
Real	13. A man got off a bus
Fantasy	14. A man suddenly grew a third arm out of his shoulder
Real	15. Someone unfolded a chair
Fantasy	16. Someone's eyes popped out of their head and went through their hand
Real	17. Two people took a boat ride
Real	18. Two people said hello
Fantasy	19. Someone stayed somersaulting in the air for a long, long time
Real	20. Someone delivered a package

Appendix B. List of stimulus item descriptions in Study 2

Categorization	Event
Real	1. A boy was cleaning the floor
Fantasy	2. A girl made two men stand still with light
Fantasy	3. A boy was jumping from the computer
Real	4. Two children were talking while walking
Fantasy	5. Two children remained in a flying bubble
Real	6. A teacher said hello to her student
Fantasy	7. A boy made two girls appear by pressing a button
Real	8. A boy is waiting while his friend gets out of the car
Fantasy	9. A boy was flying on a broom
Real	10. A boy was calling his friend
Real	11. Two children were arm wrestling
Real	12. A woman tried to get on a bus
Real	13. A boy was having dinner with his mother
Fantasy	14. A girl was moving a man by magic
Real	15. A teacher was teaching a class
Real	16. A boy was talking with his mother
Fantasy	17. Lights from someone's fingers were shooting the computer
Fantasy	18. A boy disappeared into the computer
Fantasy	19. A boy waved a feather over a picture and it changed color
Fantasy	20. A boy was flying in the sky

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