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Is it real or is it fiction? Children's bias toward reality

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Abstract

Children aged 3 to 8 years old and adults were tested on a reality–fantasy distinction task. They had to judge whether particular entities were real or fantastical, and response times were collected. We further manipulated whether the entity is a specific character or a generic fantastical entity. The results indicate that children, unlike adults, show a tendency to err by judging fantastical entities as real (response bias toward reality). All children were significantly slower when categorizing fantastical stimuli compared with real stimuli. We conclude that the process of classifying items into real versus fantastical categories develops at least until children are 7 to 8 years old.

Is it real or is it fiction? Children's bias toward reality

The distinction between reality and fantasy is crucial in everyday life. Even though we can vividly imagine flying on an oriental rug, riding a motorbike at 250 mph, or having dinner with a famous pop star, we are also simultaneously aware of the fact that we will most likely never ever experience any of these situations for real. Nowadays, however, adults and children can immerse themselves in virtual worlds and interactive video games with compellingly realistic visual scenarios, the content of which is scarcely related to what people can experience in reality. Objects or scenarios originally belonging to the realm of fantasy or daydreaming can now become, in a rather compelling manner, a perceivable reality. However, although we can visually experience something when immersed in computer games or simulator rides, it does not imply that the same scenario will ever happen in real life. Given the fact that unrealistic visual scenarios can now be displayed with a high degree of realism, it is at least conceivable that the border between fantasy and reality can become more fragile. Still, however, confusions between fantasy and reality are rather rare. Even though we tend to believe what we see, we are at the same time fully aware that not everything we see is real. The question now arises as to what criteria we use in reliably determining, visually, what is real and what is not. As our technological world continues to advance, our ability to discriminate between reality and fantasy becomes ever more essential. What are the criteria we take into account when we judge whether what we see does in fact exist or not? To date, still relatively little is known about how our discriminative abilities develop. The aim of this experiment is to explore how children learn to distinguish between reality and fantasy.

Terms like fantasy, fiction, and imagination are often used interchangeably. In the context of this article, we will use the term ''fantasy'' as a rather broad category, which includes objects and beings that are incompatible with our ordinary expectancies about real-life events. This definition is in line with Woolley (1997), who suggests that all phenomena violating naïve theories of the world should be included in a ''fantasy category.'' Previous studies have shown that 2- to 3-year-old children begin to distinguish between fantasy and reality and that the development continues until at least 7 years old (DiLalla & Watson, 1988; Morison & Gardner, 1978). At the age of 3 to 4 years, children start to explore, in a more refined manner, the limits of fantasy. They begin to distinguish between appearance and reality (Flavell, Flavell, & Green, 1983) and between real objects and the mental images that represent the objects (Estes, Wellman, & Woolley, 1989; Woolley & Phelps, 1994; Woolley & Wellman, 1993). Moreover, at this age, children establish the ability to correctly attribute false beliefs (Wimmer & Perner, 1983).

In previous research on the reality–fantasy distinction, children reported the ontological status of different entities during a forced-choice task, with verbal or pictorial support. Woolley (1997) reviewed the literature in this area and concluded that children do not fundamentally differ from adults when it comes to the distinction between fantasy and reality. The model of belief proposed by Gilbert (1991) suggests that a response bias can play a role when people distinguish between fantasy and reality. According to this model, we initially encode everything we see and hear as real, and only during secondary stages can we disconfirm and thus reject the initial evaluation (see also Gilbert, Tafarodi, & Malone, 1993). Gilbert's theory is based on a Spinozian point of view (Spinoza, 1677/1982, as cited in Gilbert et al.), according to which believing and understanding occur simultaneously: We are unable to understand without believing. It has to be noted that Gilbert's research is based on an adult population, but prior developmental studies revealed results that support the idea that seeing leads to believing (see, for example, Sodian & Wimmer, 1987; Wimmer, Hogrefe, & Perner, 1988). Wimmer et al. showed that 4-year-old children think that people only know a fact when they see it (informational access). Flavell et al. (1983) studied judgments on the appearance of an object in children aged around 3 years and showed that when they realize that an object that looks like a rock is in reality a sponge, they tend to claim that it looks like a sponge. Therefore, young children in a reality–appearance task show a reality bias. Although Gilbert's (1991) and Woolley's theories come from different research areas, the conclusions are similar: Both theories emphasize that adults and children do not differ much when it comes to the reality–fantasy distinction. Woolley (1997) points out that children and adults do not differ qualitatively in terms of how they distinguish between reality and fantasy—for example, adults also believe in supernatural entities. Children and adults judge some fantastical entities as real, and thus, even though Woolley does not explicitly mention it, the findings suggest a reality bias.
The aim of this study is to investigate the distinction between fantasy and reality in more detail. This was achieved by using a single-interval forced-choice task, including, for the first time, the use of response time (RT) measures. In addition, we used signal detection theory to analyze the responses, thus allowing for the extraction of a possible response bias. Due to the fact that previous studies have only measured correct responses, it remains unclear as to what extent the children are sensitive to the fantasy–reality distinction.

In addition to the response bias, we wanted to explore two specific hypotheses related to the ''fantasy category.'' The first hypothesis concerns the role of familiarity on the reality–fantasy distinction. To the extent that Sobel and Lillard (2001) and Sobel (2006) found that performance in a pretense task is improved by specific fantastical stimuli (fantasy effect), we wanted to explore whether this effect is of a more general nature. In other words, do young children perform better on a reality–fantasy distinction task when they are exposed to specific fantastical stimuli such as Spiderman compared with generic fantastical stimuli that they have not seen before? In an attempt to answer this question, we compared performance between generic and specific fantastical stimuli. The participants had no prior experience of the generic fantastical stimuli, whereas the specific fantastical stimuli are taken from existing movies, cartoons, or fantasy literature.

Secondly, we investigated whether there is an influence of perceptual knowledge on the reality–fantasy distinction. The fantastical stimuli were defined by their shape (e.g., strange features such as an unusually shaped screwdriver) or by anthropomorphism (e.g., an ant with a humanoid mouth and eyes). Human beings in general—young children in particular—tend to anthropomorphize (i.e., they make human-like attributions to other animate and inanimate entities, such as toys, machines, or other beings; Mitchell, Thompson, & Miles, 1997). It has been demonstrated that the perception of objects with animate properties is rather automatic and develops early in infancy; for example, infants are capable of recognizing animate properties such as movement, goal direction, and intention of figures (see Csibra, Gergely, Bíró, Koós, & Brock- bank, 1999; Gergely, Nádasdy, Csibra, & Bíró, 1995; Kuhlmeier, Wynn, & Bloom, 2003). Thus, we hypothesize that children at the ages used in this study are experienced with anthropomor- phized figures and that they are able to use anthropomorphism as a cue to distinguish between reality and fantasy.

Despite the fact that much can be learned from previous studies, their results are based on explicit verbal responses. On the one hand, this is not surprising given that children already possess some reasonable language skills. On the other hand, findings based solely on verbal reports are sometimes not as conclusive as one would wish and are often dissociated from the child's actual behavior (Woolley, 2006). Yet other studies using implicit (Implicit Association Test [IAT]) and explicit (self-reports) measures have demonstrated that these measures are sometimes not correlated (Asendorpf, Banse, & Mucke, 2002). In the study presented here, we included measurements of RTs, which are more automatic, less susceptible to demand characteristics, and less dependent on verbal abilities. Recent research has shown that RTs can be measured successfully in 3- to 4-year-old children and that they can provide important insights into implicit attitudes (Thomas, Smith, & Ball, 2007) and selective attention (Pastò & Burack, 1997). In addition, pre- vious research suggests that developmental trends can be assessed by measuring RTs (Kail, 1991; Kiselev, Espy, & Sheffield, 2009; Ridderinkhof, van der Molen, Band, Bashore, 1997); for example, Kiselev et al. (2009) investigated performance in RT tasks in 4- to 6-year-olds. They validated their measure by varying the time interval (randomly between 500 ms and 2,000 ms) between key press and the appearance of the next stimulus to avoid anticipatory responding and found global age-related differences but also task-specific differences. Therefore, the use of implicit measures has the potential to contribute to a more profound understanding of the distinction between reality and fantasy and its development in children aged 3 to 4 years old, 5 to 6 years old, and 7 to 8 years old, as well as in adults.

Method

Participants

A total of 63 children (age range = 2;11–8;11) and 7 adults (age range = 26; 8–66;11; M = 34;6) participated in this study. The children were divided into a younger group (N = 22) aged 2;11 to 4;11 (M = 3;10), an intermediate group (N = 21) aged 5;0 to 6;11 (M = 5;8), and an older group (N = 20) aged 7;2 to 8;11 (M = 8;2). The young group attended a day care center, the intermediate group attended kindergarten, and the 7- to 8-year-olds were selected from a primary school. The 7 adults were staff at the university and were used as a control group. Participants were predominantly Caucasian and from middle-class families living in the French-speaking part of Switzerland. Approximately equal numbers of boys and girls were included in each group of children (11 girls and 9 boys in the 3- to 4-year-old group, 12 girls and 9 boys in the 5- to 6-year-old group, 9 girls and 11 boys in the 7- to 8-year-old group, and 5 women and 2 men in the adult group). They were naïve to the purpose of the study. Prior to the experiment, we tested 12 adults (pretest for choosing the stimuli), discarded ambiguous stimuli from an adult point of view, and then carried out the experiment that we report in this manuscript with 63 children and 7 new adults. The study was approved by the ethics committee of the university.

Stimuli

The stimuli included 40 real and 40 fantastical pictures (see Figure 1 for an example and Appendix A for a list of all the stimuli used in this study). We decided to keep the emotional value expressed by the stimuli as neutral as possible. Indeed, some authors (Carrick & Quas, 2006; Samuels & Taylor, 1994) have highlighted the role of emotional material in the reality–fantasy distinction; children are attracted by positive stimuli, while they avoid negative ones, and as a consequence they tend to say more often that positive stimuli exist when compared with negative stimuli. The stimuli were all generic, with the exception of 10 prominent fantastical stimuli. They were colored photographs modified with Adobe Photoshop, and we used SuperLab software (http://www.superlab.com) for stimulus presentation. The images were displayed in the center of the screen (gray background) of a MacBook (12-inch) until the participant responded by operating one of two buttons on the keyboard.

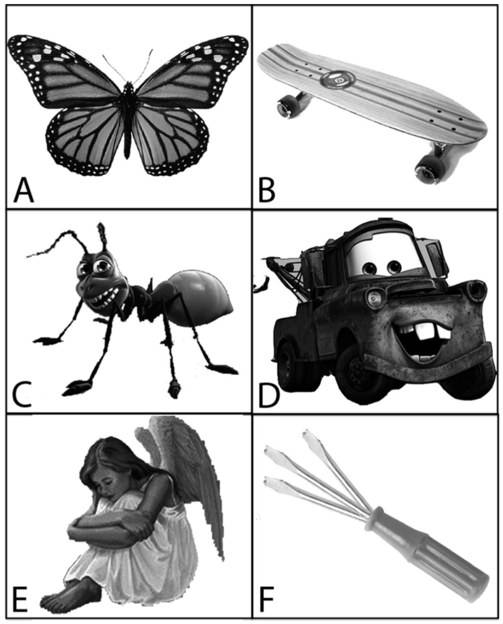

Figure 1. An example of stimuli used during the tasks: a real and animate (A), a real and inanimate (B), two fantastical and animate (C is a generic stimulus that violates reality because of anthropomorphism and E is a specific stimulus that violates reality because of its shape), and two fantastical and inanimate stimuli (D is a specific stimulus that violates reality because of anthropomorphism and F is a generic stimulus that violates reality because of its shape).

Procedure

Each participant completed a reality–fantasy distinction task on the 80 images, which were presented in random order. The instructions were: ‘‘Does this really exist on earth? Something that really exists is something that somebody may have encountered somewhere on earth. Notice that not everything that you see on TV or in books does in fact exist.’’ We used the term somebody in agreement with Estes et al. (1989), who showed that children include items that are perceptually accessible to someone else (‘‘publicness’’) as belonging to the reality category. Moreover, Harris, Pasquini, Duke, Asscher, and Pons (2006) used a similar instruction: ‘‘Are there really . . . (dogs, green cows, etc.) in the world?’’ (p. 79).

Each participant was sitting in front of a computer laptop, with their hands positioned on the relevant buttons to answer to the stimuli. They had to answer as quickly as possible by operating one of two prelabeled buttons (blue or red) on the keyboard. Prior to the experiment, the children completed four test trials (with feedback) to assure that they understood the task. The test trials were a duck, a hammer, a hamster with horns, and a mermaid. All participants completed the training trials with more than 90% correct responses (see Appendix B). Before the experiment began, the instructions were repeated and the experiment lasted in total about 15 minutes.

Results

Of the 22 children from the young age group, 20 completed the reality–fantasy task and were included in the analysis (aged 2;11–4;11; M = 3;10). All of the children from the intermediate age group (aged 5;0–6;11; M = 5;8), older age group (aged 7;2–8;11; M = 8;2) and all participants from the adult control group completed the reality–fantasy distinction task and were thus also included in the analysis.

Analyses of RTs are based on correct responses only. Outliers with exceedingly long RTs (RTs > M + 3 x SD for each participant) were eliminated—in total, 2% of all trials. No lower boundary was established because no responses were considered too fast. We report analyses conducted with non-transformed RTs. Nevertheless, we computed all analyses of RTs with log-transformed and rank-transformed RTs. None of these transformations yielded substantial differences in the results.

The reality–fantasy distinction

Judgments and RTs of the reality–fantasy distinction task are presented first. Subsequent tests concern more detailed analyses of the fantasy category (familiarity and perceptual knowledge).

Responses. The choices were analyzed by means of signal detection theory and thus were corrected for false alarms. As participants classified each stimulus as real or fantastical in a single-interval forced-choice task, we used the following formula for determining the sensitivity: $d' = z^{-1}(\text{Hit}) - z^{-1}(\text{False Alarm})$, where z^{-1} is the inverse of the standard normal function, Hit is the proportion of real stimuli correctly categorized as real, and False Alarms are the proportion of fantastical stimuli erroneously categorized as real. All d' values (d' M = 1.4, SD = 1.3 in the 3- to 4-year-old group; d' M = 2.8, SD = 0.8 in the 5- to 6-year-old group; d' M = 3.1, SD = 0.7 in the 7- to 8-year-old group; and d' M = 4, SD = 0.5 in the adult group) were above chance level (d' = 0) at $p < .001$ (one-sample t-tests) and thus suggest that all groups were able to perform the reality–fantasy distinction. We conducted a one-way analysis of variance (ANOVA) with the d' values as the dependent variable and age as the between-subjects factor (the four groups of age). The analysis revealed a significant effect of age, $F(3, 64) = 18.65$, $p < .001$. Post-hoc tests (Tukey's honestly significant difference [HSD]) indicated that the performance of 3-to 4-year-old children was worse than all other groups ($p < .001$).

Performance of 5- to 6-year-olds did not differ from performance of the 7- to 8-year-olds (p = .87). While the 5- to 6-year-olds (p = .02) significantly differed from the adult group (best performance), the difference between 7- to 8-year-olds and adults did not reach statistical significance (p = .09).

To the extent that we are not only interested in children's ability to master the reality–fantasy distinction, but also in the tendency to choose one category more often than the other, we calculated the response bias c = -0.5 x $[z^{-1}$ (Hit) + z^{-1} (False Alarm)]. The bias toward reality is thus defined by the bias toward pressing the real button. All children age groups showed a significant negative bias (c M = -0.5, SD = 0.5 in the 3- to 4-year-old group; c M = -0.3, SD = 0.3 in the 5- to 6-year-old group; and c = -0.3, SD = 0.3 in the 7- to 8-year-old group), indicating a bias toward reality (p < .001, one-sample t-tests), whereas there was no such bias in the adult group (c M = 0.06, SD = 0.1, p = .28). A one-way ANOVA with the c values as the dependent variable revealed a significant effect of age, F(3, 64) = 5.5, p = .002. Post-hoc tests (Tukey's HSD) showed that the 3- to 4-year-olds differed significantly from the adult group (p < .001). This was also true for the 7- to 8-year-olds (p = .048), whereas the difference between 5- to 6-year-olds and adults did not reach statistical significance (p = .1). The differences between 5- to 6-year-olds and 7- to 8-year-olds and between 3- to 4-year-olds and 7- to 8-year-olds were not significant (p>.28).

D' and c values are illustrated in Figure 2. It is worth mentioning that d' and c are independent measures even though they appear correlated in Figure 2 (the higher the sensitivity, the smaller the bias). Percentages of correct responses show a similar pattern of results and are reported in Appendix C. Performance of the 3- to 4-year-olds during the first 20 stimuli (M = 68%, SD = 15.4%) was compared to performance during the last 20 stimuli (M = 71.5%, SD = 15.7%), t(19) = 1.03, p = .314, paired-t-test; the results show no decrease in performance with increasing task duration, thus speaking against an effect of fatigue.

Response times. We conducted a mixed-model ANOVA with a random factor of subjects, a fixed factor of age (four groups), a fixed factor of category (fantasy vs. reality), and a fixed factor of stimulus (within category). We found a significant effect of age, F(3,63) = 33.97, p < .001 (post-hoc tests with Bonferroni adjustment revealed that the 3- to 4-year-olds were slower than all other groups, p < .001); a significant effect of category, which is caused by the difference between the RTs for the fantastical (M = 4088 ms) and for the real stimuli (M = 3490 ms), F(1,4,346) = 68.11, p < .001; and a significant effect of stimulus, F(78, 4,335) = 1.93, p < .001. Moreover, the factors of age and category interacted, F(3, 4,346) = 30.06, p<.001. To better understand the significant interaction between category and age, we computed univariate ANOVAs with subjects as a random factor and category (reality vs. fantasy) as a fixed factor for each age group. The analyses indicated that RTs for fantastical stimuli are longer than RTs for real stimuli in all the children age groups ($p < .001$), whereas there was no significant difference between the RTs for fantastical stimuli and the RTs for real stimuli in the adult group ($p = .58$). The results are summarized in Table 1. It is noteworthy that although 3- to 4-year-olds are generally slow, standard errors of the mean (see Hits) are similar in all groups, showing that the variances are comparable. No statistical analyses were carried out on the false alarm trials because there were too few errors in the older groups. Visual inspection of the data shows that RTs for false alarms were longer than RTs for real stimuli correctly categorized (Hits).

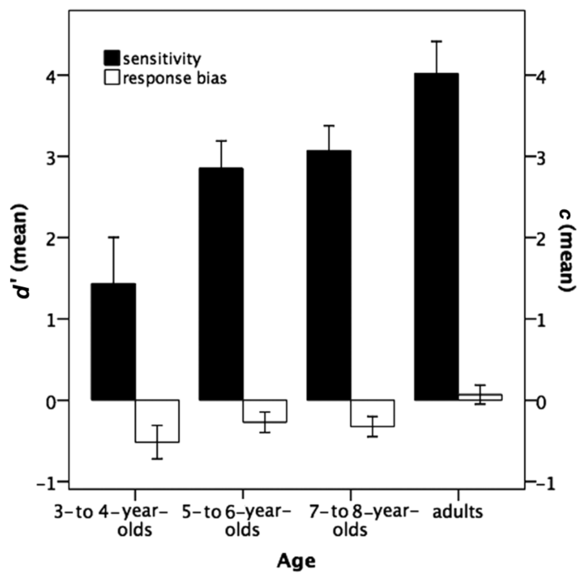

Figure 2. Sensitivity (black bars) and response bias (white bars) for the reality–fantasy distinction in the four groups. Errors bars indicate standard error of the mean. The figure shows the full functional range of d0, from 0 (chance) to 4.5 (perfect sensitivity). The range of the response bias c goes from þ2.25 (perfect fantasy bias) to 2.25 (perfect reality bias), with 0 being the absence of any response bias.

	3- to 4-year-olds	**5- to 6-year-olds**	**7- to 8-year-olds**	**Adults**
Fantastical stimuli correctly categorized (Hits)	M = 7370 ms (SEM = 306)	M = 3546 ms (SEM = 287)	M = 3090 ms (SEM = 294)	M = 2348 ms (SEM = 494)
Real stimuli correctly categorized (Hits)	M = 5577 ms (SEM = 294)	M = 3148 ms (SEM = 286)	M = 2817 ms (SEM = 293)	M = 2419 ms (SEM = 494)
Fantastical stimuli erroneously categorized as real (False Alarms)	M = 8188 ms (SEM = 561)	M = 4923 ms (SEM = 685)	M = 4576 ms (SEM = 723)	M = 3518 ms (SEM = 3142)
Real stimuli erroneously categorized as fantastical (False Alarms)	M = 6290 (SEM = 730)	M = 3622 ms (SEM = 937)	M = 3309 ms (SEM = 1187)	M = 4969 ms (SEM = 3324)

Table 1. Participants' Mean RTs (and Standard Error of the Mean) for Correct Reality–Fantasy Categorizations, by Age

The Influence of perceptual knowledge

No significant effects (responses and RTs) of category (anthropomorphized stimuli vs. uncon- ventionally shaped stimuli) and no significant interactions between category and age were found.

Discussion

The results from this study illustrate that all children show a tendency toward reality (response bias). Children have greater difficulty in correctly classifying fantastical stimuli than they do real stimuli. The analyses also revealed a developmental trend in children's sensitivity to the reality–fantasy dis- tinction. The 3- to 4-year-olds had poorer performance than all other groups, and the 5- to 6-year-olds and 7- to 8-year-olds performed worse than adults. However, all d' values were above chance level, thus confirming the results from earlier studies showing the ability of young children to master the reality–fantasy distinction (DiLalla & Watson, 1988; Morison & Gardner, 1978).

We used signal detection theory to analyze the responses, thus allowing for the extraction of a possible response bias. In comparison to accuracy (percentages of correct responses), signal detection theory allows for separating sensitivity (d') and response bias (c); therefore, it is a useful method for studying decisions where participants of different ages have to discriminate between two categories.

The use of RT measures has also provided important additional information about children's choices. The analysis of RTs revealed longer latencies for the fantastical stimuli in all child groups. The children were slower but also gave fewer correct responses to fantastical stimuli in comparison with real stimuli. This result speaks against a speed–accuracy trade-off (this is the optimization of speed or accuracy, i.e., fast RTs at the expense of accuracy or more accurate responses at the expense of time). It appears that the children were able to identify and evaluate both real and fantastical components of the fantastical items, and finally, in the end, they were able to make a decision for one or the other category. The processing of contradictory information (i.e., real and fantastical properties) makes the fantastical stimuli more difficult to classify. In fact, it is only in the adult group that RTs for reality and fantasy stimuli are approximately the same, suggesting that participants were equally confident when judging these two types of stimuli. RTs provide an interesting and novel quantitative measure to study the reality–fantasy distinction, but their interpret- ation cannot rule out other possible influences. Further research will need to investigate in more detail the role of yet other variables, such as experience or theory-of-mind abilities, to explain the difference between children and adults and between 3- to 4-year-olds and older children.

Both the longer RTs for fantastical stimuli and the bias toward reality are in line with Gilbert et al.'s model (Gilbert, 1991; Gilbert et al., 1993). It is therefore conceivable that children first encode the stimuli as real, and only in a second step do they disconfirm the reality status for the fantastical stimuli. This would explain the longer RTs for the fantastical items (hits and false alarms) because children are able to proceed to the second step but then sometimes fail to successfully evaluate the stimuli. Consequently, it results in the response bias toward reality. Thus, it is important to point out that children do not merely confound reality and fantasy. The longer RTs suggest that children are in the process of constructing the reality–fantasy distinction. Therefore, the results we found in this study do not support Gilbert's (1991) argument that children are simply more credulous regarding fantastical entities.

In this study, the youngest age group was more accurate and slower at correctly classifying nongeneric fantastical stimuli compared with generic fantastical stimuli. Thus, we can conclude that specific knowledge plays an important role in the reality–fantasy distinction and that young children are able to use this knowledge to correctly classify the images. This result confirms previous research (Harris & Koenig, 2006; Harris et al., 2006) highlighting the role of knowledge in the reality–fantasy distinction. Skolnick and Bloom (2006) showed that young children are able to distinguish between different fictional worlds and reality, suggesting that by 4 to 6 years of age children already have knowledge about different fictional characters and can correctly use this knowledge.

To the extent that the influence of familiarity differs between groups, we conclude that children of different ages do have different concepts in mind when they make the reality–fantasy distinction. Young children associate fantasy with specific fantastical figures, whereas older children perform better with generic stimuli (i.e., they are able to correctly evaluate the fantasy status of items not seen before). Cook and Sobel (2011) have investigated the role of familiarity with real items. They demonstrated that children (4- and 6-year-olds) correctly categorized real familiar stimuli (the authors used machines as stimuli), whereas they were at chance level with real unfamiliar stimuli. The overall tendency to classify familiar stimuli as real was not confirmed by results we found in this study; children were aware that familiar stimuli can belong to the reality or to the fantasy category. Nevertheless, Cook and Sobel's (2011) study and the results from this study point out the importance of experience in the reality–fantasy distinction.

Yet another line of research related to the familiarity findings are the studies on the development of understanding generic nouns. Gelman and Bloom (2007) showed that young children respond to nongeneric nouns similarly to adults, whereas there are differences between young children and adults when it comes to generic nouns. Gelman and Bloom interpret their results in terms of categorical differences between age groups. The effect of familiarity we found in our study is in agreement with this interpretation.

Although we expected perceptual knowledge to influence the reality–fantasy distinction, we did not find any evidence in this study. It is noteworthy that we found a tendency to perform better with anthropomorphized stimuli in all age groups ($p= .16$), which is in line with our hypothesis; participants seem to use anthropomorphism as a cue while performing the distinction between reality and fantasy. More research needs to be carried out to better understand the role of anthropomorphism in the reality–fantasy distinction.

The results from this study are also in line with Sharon and Woolley (2004), who gave young children (aged between 3 to 5 years old) the possibility to express uncertainty. They found that instead of classifying fantastical entities as real, they mainly categorize them as ‘‘not sure,’’ thus indicating that they are still in the process of constructing the fantasy category. An important aim of our study was to investigate the reality–fantasy distinction in older children. The response bias and the RT data suggest that the fantasy category undergoes much elaboration throughout the development until a later age; the reality–fantasy distinction has a longer period of development than previously shown. A large amount of recent research investigates the reality–fantasy distinction in children aged between 3 and 6 years old, but much less research has been carried out including older children. We found no difference between 5- to 6-year-olds and 7- to 8-year-olds. Indeed, only in the adult group did we find roughly equal RTs and no response bias. Woolley (1997) pointed out that the ages between 6 years of age and adulthood have been rather neglected in studies on the reality–fantasy distinction, probably because older children tend to believe much less in typical fantastical figures such as Santa Claus. We agree with Woolley (1997) that more research is needed to better understand what happens between 6 years old and adulthood. Indeed, it is in this period of time that children start to play different types of video games, and it is by all means interesting to study how the reality–fantasy distinction relates to the use of video games. Moreover, the results from this study encourage using RT measures to tap into the mechanisms that underlie how children categorize fantasy and reality. Future research will need to include yet other methods, such as neuroimaging, to complement behavioral findings to ascertain a more complete under- standing of the mechanisms that underlie the distinction between reality and fantasy.

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Appendix A

List of the 80 images used during the tasks. The 40 real stimuli included 20 objects, 10 animals, and 10 human beings. The 40 fantastical stimuli consisted of objects, animals, or human beings that violated expectancies about reality because of shape (see, for example, Image C in Figure 1) or because of anthropomorphism (see, for example, Image D in Figure 1). Ten of the fantastical stimuli were specific and are marked with an asterisk in the following table. Robot-like figures could be considered specific (see items with an asterisk in brackets). These 3 stimuli were not included in the analysis presented in the article. However, we computed separate analyses including these stimuli, and the results showed no substantial difference.

Real Animate	Real Inanimate	Fantastical animate	Fantastical inanimate
Bear	Ball	Bull form	Fork form
Butterfly	Boat	Cat form	Key form
Dog	Brush	Ostrich form	Can form
Donkey	Car	Panda form	Cookware form
Elephant	Chair	Zebra form	Object form
Fox	Chupa Chups	Woman form	Screwdriver form
Gull	Cream	Giraffe form	Shelf form
Hedgehog	Fire Extinguisher	Unicorn	Umbrella form
Lamb	Grater	Angel*	UFO (cartoon)*
Monkey	Hole punch	Shiva*	Starwars*
Parrot	Lamp	Mickey*	Martin (movie)*
Squirrel	Pan	Nemo*	M&M Red figure*
Tiger	Pen	Spiderman*	Robot-like figure (*)
Child	Plane	Chicken Little*	Robot-like figure (*)
Cook	Racquet	Horse anthropomorphized	Robot-like figure (*)
Guitarist	Scissors	Dog anthropomorphized	Ball anthropomorphized
Referee	Skateboard	Frog anthropomorphized	Pan anthropomorphized
Federer	Stapler	Giraffe anthropomorphized	Peg anthropomorphized
Law	Toothbrush	Goat anthropomorphized	Book anthropomorphized
Lopez	Vase	Ant anthropomorphized	Courgette anthropomorphized

Appendix B

Participants' percent correct (and standard deviations) for the four training trials, by age

	3- to 4-year-olds	5- to 6-year-olds	7- to 8-year-olds	Adults
Percent correct for the four training trials	M = 90% (SD = 22.1%)	M = 97.6% (SD = 7.5%)	M = 96.3% (SD = 9.2%)	M = 92.9% (SD = 18.9%)

Appendix C

Participants' percent correct (and standard deviations) for reality–fantasy categorizations, by age

	3- to 4-year-olds	**5- to 6-year-olds**	**7- to 8-year-olds**	**Adults**
Fantastical stimuli correctly categorized (Hits)	M = 55.5% (SD = 26%)	M = 85.8% (SD = 9.7%)	M = 85.9% (SD = 12.9%)	M = 98.6% (SD = 2%)
Real stimuli correctly categorized (Hits)	M = 84.4% (SD = 84.4%)	M = 93.8% (SD = 7.3%)	M = 96.5% (SD = 3.2%)	M = 97.1% (SD = 3.7%)
Fantastical stimuli erroneously categorized as real (False Alarms)	M = 44.5% (SD = 25.9 %)	M = 14.3% (SD = 9.5%)	M = 14.2% (SD = 12.8%)	M = 2.1% (SD = 1.3%)
Real stimuli erroneously categorized as fantastical (False Alarms)	M = 15.8% (SD = 15.8%)	M = 6.5% (SD = 7%)	M = 3.8% (SD = 2.8%)	M = 3.3% (SD = 3.2%)