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Monkey business: Children's use of character identity to infer shared properties

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ABSTRACT

Children's toys provide a rich arena for investigating conceptual flexibility, because they often can be understood as possessing an individual identity at multiple levels of abstraction. For example, many dolls (e.g., Winnie-the-Pooh) and action figures (e.g., Batman) can be construed either as characters from a fictional world or as physical objects in the real world. In two experiments, 72 4- and 5-year-olds took part in a property extension task, the results of which provide evidence of an understanding that (1) two representations of a character share certain properties in virtue of their shared character identity, and this sharing does not stem simply from having the same name, and (2) one representation of a character is more likely to share properties with another representation of the character if the properties were acquired by the character than if they were acquired by the representation. Children's understanding of a representational object's abstract character identity thus enabled them to transcend using its unique spatio-temporal history as a sole basis for inferring its idiosyncratic properties.

1. Introduction

Research in cognitive development has begun to explore not only children's knowledge of kinds (e.g., dog) but also their understanding of individuals (e.g., Fido). A key finding in this recent work is that young children show a strong reliance on spatiotemporal history when making judgments that pertain to individual identity. For example, one line of research has revealed that children as young as 20 months old will use an object's spatiotemporal history, rather than its visible properties, as a basis for extending its proper name. At this age, children will continue to apply a proper name to a doll after it undergoes a displacement, failing to extend it to another doll, even one that looks identical (e.g., Bélanger & Hall, 2006; Hall, Lee, & Bélanger, 2001; Liittschwager & Markman, 1993; Sorrentino, 2001). Another line of studies has revealed that young children will often extend a proper name (or a unique identifying phrase) to an individual object that maintains a spatiotemporal path, even if it undergoes extensive changes in appearance, form, and/or material (e.g., Gutheil & Rosengren, 1996; Hall, 1998; Hall, Waxman, Brédart, & Nicolay, 2003; Liittschwager, 1995; see also Blok, Newman, & Rips, 2005; Rhemtulla & Hall, 2009; Rhemtulla & Xu, 2007; Rips, Blok, & Newman, 2006). Recently, Hood and Bloom (2007) showed that preschoolers treat some valuable artifacts as having greater worth than exact replicas, which are identical in everything but spatiotemporal history. Similarly, Gutheil, Gelman, Klein, Michos, and Kelaita (2008) reported that preschoolers distinguish the knowledge states of individual objects that are the same in every respect but spatiotemporal history.

One outstanding question about children's concepts of individuals pertains to objects that can be construed as possessing an individual identity at more than one level of abstraction. It is striking that many highly familiar objects in children's daily lives – their toys – fall into this category. A Batman action figure, for example, has many of Batman's features (e.g., wearing a mask, having big muscles) that arise in virtue of sharing Batman's character identity; but it also has many idiosyncratic features (e.g.,

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being made of plastic, having ketchup stains) that arise in virtue of its unique spatiotemporal history. Many toys are representations of fictional characters from movies or books, and as such, they are objects that share an individual identity with countless other representations of the same character, while remaining numerically distinct individual objects in and of themselves. Gutheil et al. (2008) used character toys (e.g., Winnie-the-Pooh dolls) to investigate children's reliance on spatiotemporal history when inferring the knowledge state of individual objects. On one trial of their task, one Pooh "watched" as children played a game in one room; then children moved to another room where an identical Pooh doll was present. Children were asked whether the second Pooh knew about the events that the first Pooh had watched. Children's responses showed that they considered spatiotemporal history to be necessary for attributions of an individual's knowledge state: Pooh 2, though physically identical to Pooh 1, was not credited with knowledge of the earlier events.

Gutheil et al.'s (2008) study is important because it reveals that preschoolers are able to view two representations of the same character as distinct individuals with distinct properties. In the current research, we looked at the flip side of this issue: can children view numerically distinct (and perceptually distinctive) representations of the same character as having properties in common in virtue of sharing a character identity? Gutheil et al.'s evidence that children rely on spatiotemporal history when judging the knowledge states of individual objects suggests that it may be difficult for children to use a shared character identity as a basis for inferring shared properties. In order to construe two representations of the same character as sharing an individual identity, children must overcome differences not only in the toys' appearance but also in their spatiotemporal history.

In Experiment 1, we asked whether preschoolers recognize the individual identity shared by two toys that look different but represent the same fictional character, and use this identity to infer that the toys share certain character-based properties. We tested children's ability to use shared character identity in this way by comparing their property extensions in two conditions where a pair of toys had the same proper name: one where the shared name reflected the fact that the two toys represented the same character, and one where the shared name arose by mere coincidence. Prior research in developmental psychology has documented the important role of a shared label in promoting inductive inferences across objects, but that work has also highlighted the importance of the word's lexical form class in licensing such inferences (e.g., Gelman & Coley, 1990; Keates & Graham, 2008). Of particular note, Heyman and Gelman (2000) found that preschoolers were likely to judge that two dissimilar-looking people shared certain psychological properties if the people were labelled with the same trait adjective (e.g., "shy") but not if they were labelled with the same proper name (e.g., "Anna"). Experiment 1 provided a test of whether preschoolers will extend certain properties across objects that share a proper name, if the shared proper name reflects a shared character identity.

In Experiment 2, we further explored children's understanding of the properties shared by representations of the same fictional character. We pitted properties that arose in virtue of one representation's character history against those that arose in virtue of its unique spatiotemporal history, and we explored children's willingness to generalize these properties to another representation of the character. A number of recent findings from the developmental psychology literature have revealed the importance of the origin of an object's properties in children's decisions about its category membership (e.g., Ahn, Gelman, Amsterlaw, Hohenstein, & Kalish, 2000; Gelman & Wellman, 1991) and in their judgments about whether the properties extend to other objects of the same category (e.g., Gelman, 1988; Kalish & Gelman, 1992; Nguyen & Murphy, 2003). For example, Gelman (1988) found that 4-year-olds who saw a picture of an object (e.g., a rabbit) failed to generalize properties that arose in virtue of the object's unique spatiotemporal history (e.g., is cold) but extended across pictures of other category members those properties that arose in virtue of its category membership (e.g., likes to eat alfalfa). Experiment 2 examined whether preschoolers show sensitivity to property origins when reasoning about representations of fictional characters, by restricting properties arising from the representation's unique spatiotemporal history but extending properties arising from the character's history to another representation of the character.

The reasoning ability under investigation in Experiment 2 is a specific case of a more general capacity to think flexibly about an object under multiple conceptual descriptions. Several recent studies using inductive projection tasks have found evidence of this flexibility in preschoolers. For example, Gelman's (1988) results suggest that 4-year-olds can appropriately reason about an object (e.g., a rabbit) either as a unique individual (e.g., as a particular rabbit) or as an instance of an object category (e.g., as a rabbit). Furthermore, Kalish and Gelman (1992) uncovered evidence that 4-year-olds are able to reason aptly about an object (e.g., a metal bow) either as an instance of an object category (e.g., as a bow) or as a portion of a material category (e.g., as metal). More recently, Nguyen and Murphy (2003) found evidence that 4-year-olds have a nascent ability to think appropriately about a food object (e.g., a piece of toast) either as an instance of a taxonomic food category (e.g., grains) or as an instance of a script food category (e.g., breakfast foods). Experiment 2 provided an opportunity to determine whether children's conceptual flexibility extends to the case of reasoning about representational objects: can children think appropriately about these objects either as unique individuals or as fictional characters?

In these experiments, we examined character toys because of their familiarity to preschoolers, but children (at least those in Western societies) regularly encounter many other objects that possess an abstract individual identity on top of their unique object identity. These include books, DVDs, and CDs (which are representations of intellectual objects: stories, movies, and songs), as well as other common objects, such as items of clothing, electronic goods, and vehicles (which are representations of individual

brand models). Moreover, although many of the people in children's daily experience (e.g., their parents, their friends, their teachers) are not representations of abstract individuals, children routinely come across people who embody a dual individual identity, including actors playing the role of fictional characters on television, in film, and on stage. Our examination of children's reasoning about character toys thus holds relevance for understanding their capacity to think flexibly about a wide range of everyday objects understood to possess an individual identity on multiple levels of abstraction.

2. Experiment 1: shared character identity, but not shared name, as a basis for property extension

2.1. Method

2.1.1. Participants

Twenty-four children participated: 12 4-year-olds (mean age = 4;5; 8 girls) and 12 5-year-olds (mean age = 5;8; 6 girls). We focused on 4-year-olds because prior research indicates that children of this age have the ability to reason flexibly about objects under multiple conceptual descriptions (e.g., Gelman, 1988; Kalish & Gelman, 1992; Nguyen & Murphy, 2003), and we included 5-year-olds in order to assess any increase in this flexibility in a slightly older group. Equal numbers of each age group were randomly assigned to either the *character-shared name* ($N = 12$; 7 girls) or the *accidentally-shared name* ($N = 12$; 7 girls) condition. A further nine children participated but were excluded for failing the mapping test ($N = 3$), failing to answer at least three of the four filler questions correctly ($N = 2$), or because of experimenter error ($N = 4$).

2.1.2. Materials

We created two versions of an illustrated storybook, entitled "Boris and the Tiger's Trap." (See Appendix for both versions of the text.) In the *character-shared name* condition, the story was the tale of a purple, freckled, toothless monkey, named Boris, who was rescued from a tiger by his two best monkey friends, named Igor and Fred. In the illustrations, Igor was depicted as similar in appearance to Boris (purple, freckled, and toothless); Fred was depicted as dissimilar in appearance to Boris (pink, unfreckled, and buck-toothed). In the *accidentally-shared name* condition, the story and illustrations were identical, with one exception. In the text, Boris' purple monkey friend was also named Boris, not Igor; in other words, two of the characters happened to share the same name.

Page two of the storybook contained a written description of four of the main character's, Boris', idiosyncratic properties. Boris was described as having (1) a banana on his ear that he got when he was a baby, (2) a pink heart on his back that he got from his mother, (3) a mark on his back that he got from being chased by a tiger, and (4) a dark patch on his bum that he got from falling out of a tree. On this page and on all other pages in the storybook, Boris was depicted facing forward, so that none of these properties was ever visible. We kept the properties out of sight in the storybook to encourage children in the property extension task (described next) to associate the properties of the target toy (a representation of the main character, Boris) with the *character* rather than with his illustrated representation.

We also used three toys to represent the storybook characters. The *target* toy was a purple, freckled, toothless monkey that represented the main character, Boris. It was large, furry, and stuffed. This toy had on its back-side the four physical properties described in the previous paragraph. These properties could not be seen from the front. The *distracter* toy was a pink, unfreckled, buck-toothed monkey that represented Boris' friend, Fred. Like the target toy, it was large, furry, and stuffed. The distracter toy thus matched the target toy in size, texture, and material. The *name-match* toy was another freckled, toothless, purple monkey. It was small (less than half the size of the target), smooth, and made of hard modelling clay. The name-match toy thus matched the target toy in facial features and color. The name-match toy was described differently to children in the two conditions. In the *character-shared name* condition, it was said to be *another* representation of the main character, Boris. In the *accidentally-shared name* condition, it was said to be a representation of Boris' friend, Boris. See Fig. 1.

We also used three stuffed toys of familiar kinds – a bear, a dog, and a rabbit – for the practice phase.

2.1.3. Procedure

2.1.3.1. Practice phase. The child sat at a small table across from the experimenter. The experimenter explained that they were going to play a game that had one rule: the child was allowed to point and look at the toys, but was not allowed to touch them. She placed the three familiar stuffed animals on the table: the bear and the dog beside each other on one side of the table, and the rabbit on the other side. The experimenter explained that she would ask the child some questions that would require pointing to either the bear or the dog. The experimenter asked, "Which one of these is a dog?" and "Which one of these is a bear?" For both these practice questions, the child was encouraged to point. He was praised for pointing correctly, and he was corrected for pointing to the wrong animal, pointing to both objects, or touching the toys. This set-up and these questions were meant to familiarize children with what they would encounter later in the test phase, and to give them experience in picking both objects that occupied the positions where the test objects would later appear.

2.1.3.2. Storybook phase. The experimenter brought out the version of the storybook, "Boris and the Tiger's Trap," appropriate for the condition and read it to the child, pointing out each character on every page of the book as she read. After hearing the story, the child was asked to recall the names of the three characters, making reference to each character's illustrated representation on the front page of the storybook. If he could not do this, the experimenter reminded him of each character's name.

The experimenter then said, "I was in a toy store the other day, and guess what I found! Look! I found Boris!"

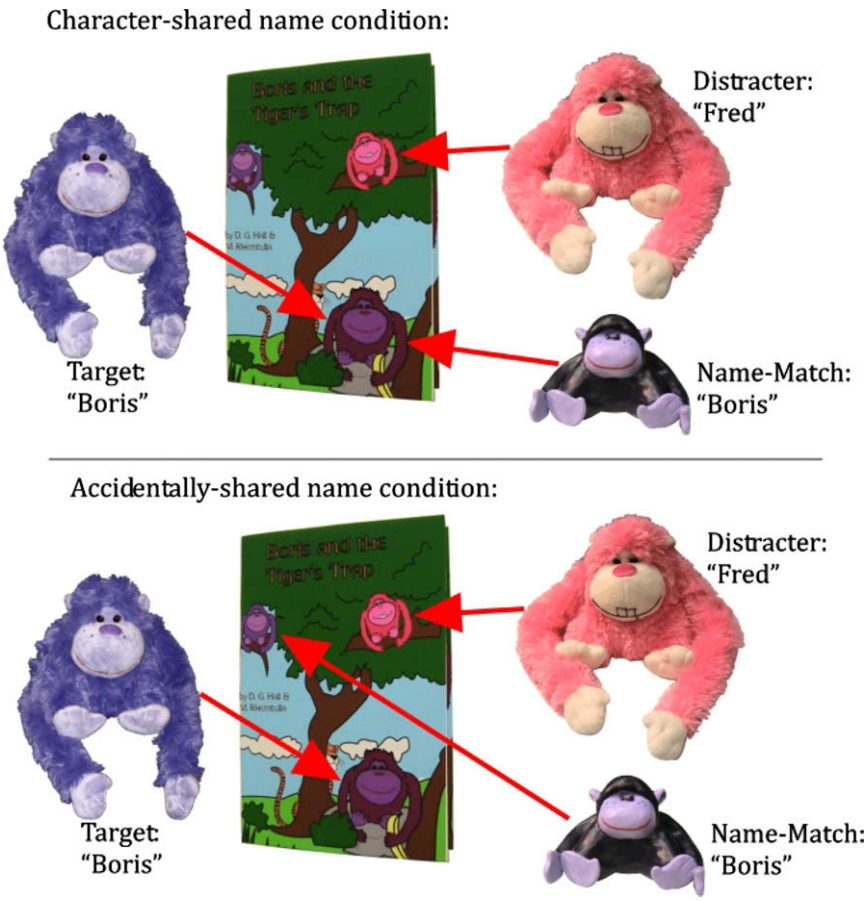

Fig. 1. Materials from Experiment 1.

She presented the target toy and placed it on one side of the table. She then presented the name-match toy and placed it on the other side of the table. In the *character-shared name* condition, the experimenter declared, "Look what else I found! It's *another* Boris! See, so *this* [*target*] is Boris, and *this* [*name-match*] is *another* Boris!" In the *accidentally-shared name* condition, she declared, "Look what else I found! It's *the other* Boris! See, so *this* [*target*] is Boris, and *this* [*name-match*] is *his friend* Boris!" Finally, the experimenter brought out the distracter toy and placed it next to the name-match toy. The experimenter then said, "And I also found Fred!" The left-right placement of the name-match and distracter toys was counterbalanced between children.

In the *accidentally-shared name* condition, notice that each toy represented a different character from the story: the target toy was Boris (the main character); the name-match toy was Boris (Boris' friend); and the distracter toy was Fred (Boris' other friend). In the *character-shared name* condition, two of the toys represented the same character from the story: the target toy was Boris (the main character); the name-match toy was Boris (another representation of the main character); and the distracter toy was Fred (Boris' other friend). To clarify for children in the *character-shared name* condition that there was no toy surrogate for the third character from the story, Igor, the experimenter made a brief comment, noting that she couldn't find Igor in the toy store.

The experimenter asked the child to recall the names of the three toys on the table. If he could not, he was reminded of each toy's name.

The experimenter then administered a mapping test to ensure that the child understood the connections between the toys and the story characters, as represented by their illustrations in the storybook. For each toy on the table, the experimenter asked the child to point to the representation of the corresponding character on the cover of the storybook. By passing this mapping test, children in the *accidentally-shared name* condition revealed a grasp of the one-to-one mapping between toys and characters and, in particular, that the two toys named "Boris" corresponded to different characters in the story. Children who passed this test in the *character-shared name* condition revealed an understanding of the two-to-one mapping between the Boris toys and the main character in the story. The three children who failed the mapping test were excluded from the experiment. The experimenter then removed the storybook from the table.

2.1.3.3. Test phase. The experimenter asked four test questions, interspersed with four filler questions. The order of the four test questions and the order of the four filler ques-

tions were counterbalanced across participants within each condition. Before asking each test question, the experimenter picked up the target toy and showed the child one of the four hidden properties on its back-side. For example, the experimenter said, "Remember in my story, Boris had a banana on his ear. He got that when he was a baby. And look! *This Boris* has a banana on [the back-side of] his ear! See?" The experimenter then pointed to the two other test toys (the name-match and the distracter), looked at the child, and asked, "What about these two? Which one of *these* do you think has a banana on his ear? *This Fred*, *or this Boris*?" The order of mentioning the two options was counterbalanced between participants within each condition. The experimenter continued to look only at the child's face until the child pointed to one of the test toys. If the child expressed doubt, he was encouraged to guess.

The filler questions were similar to the test questions, but they queried properties that were clearly visible from the front of the toys. Two properties applied to the name-match (i.e., has freckles, is purple), and two applied to the distracter (i.e., has teeth, is pink). The two children who answered more than one filler question incorrectly were excluded from the experiment.

2.2. Results and discussion

We predicted more choices of the name-match toy in response to test questions in the *character-shared name* condition, where the name-match was another representation of the same character as the target, than in the *accidentally-shared named* condition, where it was a representation of a different character. In the *accidentally-shared name* condition, we expected random choosing between the toys, anticipating that the perceptual similarity between the target toy and the distracter toy (in size, texture, and material) would make the distracter toy a salient alternative to the name-match toy.

Children received a score out of 4 corresponding to the number of choices of the name-match toy they made in response to the test questions. The results were clear. Children in the *character-shared name* condition overwhelmingly extended the properties to the name-match toy ($M = 3.92$, $SD = .29$), while those in the *accidentally-shared name* condition did not ($M = 1.58$, $SD = 1.73$). To examine the effect of our manipulation as well as the effect of age on children's choices, we conducted a 2 (age) by 2 (condition) between-subjects ANOVA. This analysis revealed a main effect of condition, $F(1, 20) = 20.63$, $p < .001$, $\eta_p^2 = .51$, but no effect of age, $F(1, 20) = .42$, $p > .50$, $\eta_p^2 = .02$, and no interaction, $F(1, 20) = .95$, $p > .25$, $\eta_p^2 = .05$.

Two single-sample *t*-tests allowed us to compare the means of each condition to chance. If children had no systematic basis for making their toy choices, they should have chosen the name-match toy on 2 of 4 trials, on average. The mean in the *accidentally-shared name* condition did not differ from chance, $t(11) = -.83$, $p > .25$, $d = .24$, whereas the *character-shared name* condition mean was significantly higher than chance, $t(11) = 23.00$, $p < .001$, $d = 6.62$.

Finally, non-parametric analyses allowed us to compare the numbers of children in each condition who showed a strong tendency to choose the name-match toy. All 12 of the children in the *character-shared name* condition chose the name-match toy on at least 3 of 4 test trials. In the *accidentally-shared name* condition, just 4 children chose the name-match toy on at least 3 trials. This difference is highly significant according to a chi-square test, $\chi^2(1, N = 24) = 12.00$, $p < .001$, $\varphi = .71$.

In Experiment 1, 4- and 5-year-olds who learned a character-based physical property of a toy representation of a character tended to extend the property to another toy with the same name if the second toy was described as another representation of the same character. In contrast, children did not do so if the second toy was described as a representation of a different character who happened to share the same name. The results offer evidence that children as young as four years can look beyond a representational object's unique spatiotemporal history to its abstract character identity to infer some of its properties. Furthermore, our finding that children did not extend the properties across objects that accidentally shared a proper name is consistent with the results of Heyman and Gelman (2000), who found that preschoolers did not expect two girls who happened to share a proper name to share psychological properties. At the same time, our discovery that children did generalize the properties across objects that shared a proper name when the objects represented the same character extends and qualifies those prior findings.

3. Experiment 2: shared character identity as a basis for extending character-based, but not representation-based, properties

Do children expect objects that share a character identity to share *all* the same properties? Clearly they do not. In Experiment 1, children appeared willing to accept that a large, furry, stuffed Boris toy and a small, smooth, clay Boris toy both represented the same character and shared character-based physical properties, despite their differing appearances. In Experiment 2, we examined whether children understand that two representations of a character should have only certain properties in common. As adults, we realize that properties possessed by a representation in virtue of the character it represents (e.g., a heart-shaped birthmark on a toy) should be shared by other representations of the same character. Properties possessed by a representation in virtue of its identity as a unique physical object (e.g., a heart-shaped stain on a toy) should not be shared. In Experiment 2, we investigated children's understanding of this distinction.

The method of Experiment 2 differed from that of Experiment 1. In Experiment 2, we sought to manipulate whether the test properties under consideration pertained to the main character in the storybook or to one representation of the character. As a result, we could not present the properties as belonging to both an illustrated representation of the main character from the storybook and a toy representation of the character, as we did in Experiment 1.

(Doing so would inform children that the properties generalized across representations of the character.) Instead, in Experiment 2 we showed children the test properties directly on one representation of the main character in the storybook, and we varied whether we described these properties as originating from the character's history or from the representation's (i.e., the physical storybook's) history. We then asked children whether they thought the properties could be extended to either of two test toys, one representing the main character and one representing a different character from the story.

3.1. Method

3.1.1. Participants

Forty-eight children participated: 24 4-year-olds (mean age = 4;8; 14 girls) and 24 5-year-olds (mean age = 5;6; 14 girls). Equal numbers of each age group were randomly assigned to participate in either the *character-based properties* ($N = 24$; 15 girls) or the *representation-based properties* ($N = 24$; 13 girls) condition. A further 21 children participated but were excluded for failing the mapping test ($N = 5$), failing to answer at least three of the four filler trials correctly ($N = 10$), touching the objects in an attempt to look for the hidden properties ($N = 2$), failing to point ($N = 1$), or because of experimenter error ($N = 3$).

3.1.2. Materials

We used a modified version of "Boris and the Tiger's Trap" from the *character-shared name* condition of Experiment 1. Recall that the text on page two of that storybook described four properties pertaining to the main character, Boris, and this description was accompanied by an illustration of Boris facing forward. In Experiment 2, we altered this illustration so that Boris now faced away, making his back-side visible. Doing this allowed us to show the four properties directly on the representation of Boris on the page. We then created two versions of this altered storybook for use in the two conditions of the experiment. For the version used in the *character-based properties* condition, the text accompanying the illustration on page two was identical to the text in Experiment 1, involving a description of the four properties, along with a statement of how the character came to possess them. For the version used in the *representation-based properties* condition, we removed the text from the page. Doing so allowed the experimenter to present a description of the same four physical properties as in the *character-based properties* condition, along with an explanation of how the *representation* (i.e., the illustration in the physical storybook) came to possess them. In all other respects, the two versions of the storybook were identical to each other and to the one used in the *character-shared name* condition of Experiment 1.

We used the purple, large, furry, stuffed monkey from Experiment 1 as the *character-match* toy (representing the main character, Boris) and the pink, large, furry, stuffed monkey from Experiment 1 as the *distracter* toy (representing Boris' friend, Fred). In addition, we used a red stuffed bear and a pink stuffed dog for the practice phase.

3.1.3. Procedure

3.1.3.1. Practice phase. The experimenter sat across from the child and explained the no-touching rule, as in Experiment 1. The experimenter then placed the red stuffed bear and the pink stuffed dog beside each other on the table, and asked the child four practice questions: "Is one of these a dog?" "Is one of these a fish?" "Is one of these red?" and "Is one of these green?" When the correct answer was "yes" (i.e., for two questions) the child was encouraged to say "yes" and point to the correct toy. When the correct answer was "no" (i.e., for two questions) the child was encouraged to say "no". Children received praise for right answers and were corrected for mistakes. As in Experiment 1, this set-up and these questions were meant to familiarize children with what they would encounter later in the test phase of the experiment; they were also intended to give children experience in answering both "yes" and "no" to questions.

3.1.3.2. Storybook phase. The experimenter brought out the version of "Boris and the Tiger's Trap" appropriate for the condition and read it to the child, pointing out each character on every page of the book as she read. In the *character-based properties* condition, the experimenter read the description of the properties as written on page two, pointing out each property on the back of the illustrated monkey on the page as she read. Each property was described as originating from the history of the character. For example, pointing to the banana on the back of the illustrated monkey's ear, the experimenter read, "Boris had a banana on his ear; he got that when he was a baby." In the *representation-based properties* condition, there was no text on page two. Instead, the experimenter used similar language to describe the same properties as in the *character-based properties* condition, also pointing out each property on the back of the illustrated monkey on the page as she spoke. Each property was described as originating from the history of the illustrated representation. For example, pointing to the banana on the back of the illustrated monkey's ear, the experimenter said, "Boris has a banana on his ear; my friend drew that on my book." See Table 1 for a full list of test properties and origins in the two conditions. As in Experiment 1, the child was then asked to recall the names of the three characters, making reference to each character's illustrated representation on the front page of the storybook. If he could not do this, the experimenter reminded him of each character's name.

As in Experiment 1, the experimenter then presented the two test toys, in a counterbalanced order, describing them as coming from the toy store, as in Experiment 1. The character-match toy was the large, furry, stuffed, purple monkey, introduced as the main character, Boris. The distracter toy was the large, furry, stuffed, pink monkey, introduced as Boris' friend, Fred.

The experimenter then asked the child to recall the names of the two toys on the table. If he could not, he was reminded of each toy's name.

As in Experiment 1, the experimenter administered a mapping test to ensure that the child understood the connections between the toys and the story characters. For both toys on the table, the experimenter asked the child

Table 1
Test properties and origins from Experiment 2.

Property	Origin of property	
	Character-based properties condition	Representation-based properties condition
Banana on his ear	He got that when he was a baby	My friend drew that on my book
Pink heart on his back	He got that from his mother	My mom drew that on my book
Mark on his back	He got that when the tiger was chasing him	I accidentally drew that with a marker on my book
Dark patch on his bum	He got that from falling out of a tree	I accidentally spilled some ink there on my book

to point to the representation of the corresponding character on the cover of the storybook. The five children who failed the mapping test were excluded from the experiment.

3.1.3.3. Test phase. As in Experiment 1, the experimenter asked four test questions, interspersed with four filler questions. Again, the orders of the test and filler questions were counterbalanced across participants within each condition. The experimenter began by re-opening the storybook to page two. Before asking each test question, the experimenter reminded the child of one of the four properties shown on the back of the illustration of Boris. For example, in the *character-based properties* condition, the experimenter said, "In my book, Boris has a banana on his ear. Remember, he got that when he was a baby." In the *representation-based properties* condition, the experimenter said, "In my book, Boris has a banana on his ear. Remember, my friend drew that on my book." The child was then asked whether he thought the property extended to one of the two test toys on the table. For example, the experimenter asked, "Do you think that one of *these* has a banana on his ear?" The experimenter looked only at the child's face until the child answered. If the child expressed doubt, he was encouraged to guess. The child was free to answer "yes" or "no"; and if he answered, "yes," the experimenter asked him to point to his choice.

As in Experiment 1, four filler questions queried properties visible from the front of the toys. Two of the properties applied to neither toy (i.e., is green, has a bellybutton), one applied to the character-match toy, Boris (i.e., has freckles), and one applied to the distracter toy, Fred (i.e., has teeth). The 10 children (five 4-year-olds, eight boys) who answered more than one filler question incorrectly were excluded from the experiment. We speculate that the number of excluded children was higher in Experiment 2 (10/48) than in Experiment 1 (2/24) because the filler questions in Experiment 2 were more difficult. In Experiment 1, answering a forced-choice filler question correctly simply required children to look for a property on both objects and then point to the object that had that property; one of the objects always had the property. In Experiment 2, answering a yes–no filler question correctly required children to look for a property on both objects and then answer "yes" if one of them had that property (two questions) and "no" if neither of them had it (two questions). Children who were distracted or inattentive could have given a wrong answer if they failed to search carefully for the property on both objects.

3.2. Results and discussion

For the test questions, we predicted more "yes" responses accompanied by choices of the character-match toy in the *character-based properties* condition, where the properties originated with the character, than in the *representation-based properties* condition, where the properties originated with the illustrated representation of the character. In the *representation-based properties* condition, we expected "no" responses.

Children received a score out of 4 corresponding to the number of test questions on which they both answered "yes" and selected the character-match toy. The results supported our prediction. Children in the *character-based properties* condition had an average score of 2.67 ($SD = 1.74$), while those in the *representation-based properties* condition had an average score of 1.21 ($SD = 1.64$). To examine the effects of condition and age, we conducted a 2 (age) by 2 (condition) between-subjects ANOVA. This analysis revealed a main effect of condition, $F(1, 44) = 8.91$, $p < .01$, $\eta_p^2 = .17$, but no effect of age, $F(1, 44) = .18$, $p > .50$, $\eta_p^2 = .00$, and no interaction, $F(1, 44) = 1.64$, $p > .20$, $\eta_p^2 = .04$.

Two single-sample *t*-tests allowed us to compare performance in each condition to chance. For these tests, we used the mean numbers of test questions (out of 4) on which children answered "yes," regardless of what object they subsequently chose. Doing so enabled us to use 2/4 (50%) as our index of chance responding, as children would have been expected to answer "yes" to half of the questions, on average, if they were simply guessing. Children's responses matched our predictions in both conditions. The mean number of "yes" responses in the *character-based properties* condition was significantly higher than chance, $t(23) = 1.88$, p (one-tailed) $< .05$, $d = .39$; moreover, *all* these "yes" responses were accompanied by a choice of the character-match toy. In contrast, the mean number in the *representation-based properties* condition was significantly lower than chance, $t(23) = -1.69$, p (one-tailed) $= .05$, $d = .36$; all but four of these "yes" responses were accompanied by a choice of the character-match toy. This latter result indicates that children had a significant tendency to answer "no" in the *representation-based properties* condition.

Finally, we conducted a chi-square test to compare the numbers of children in each condition who showed a strong tendency to answer "yes" and to choose the character-match toy. Out of 24 children in the *character-based properties* condition, 16 did so on at least 3 of 4 test trials. In the *representation-based properties* condition, just 5 chil-

dren did so. This difference is highly significant according to a chi-square test, $\chi^2(1, N = 48) = 10.24$, $p = .001$, $\varphi = .46$.

In Experiment 2, 4- and 5-year-olds who learned that a physical property shown on an illustrated representation of a character in a storybook arose from an incident in the character's history tended to extend the property to a toy representation of the character. In contrast, children who learned that the same property arose from an incident in the history of the representation itself tended not to extend the property. Depending on its origin, children thus appeared to link the same physical property to different levels of individual identity (i.e., that of a fictional character or that of a unique representation). The findings indicate not only that young children can use a character's identity as a basis for extending properties across representations of the character, but also that they are appropriately selective about which properties they will generalize. These results furnish new support for the claim that children as young as four years are sensitive to the origin of an object's properties in making decisions about their extendibility to other objects (e.g., Gelman, 1988; Kalish & Gelman, 1992; Nguyen & Murphy, 2003; see also Ahn et al., 2000; Gelman & Wellman, 1991).

4. General discussion

In two experiments, 4- and 5-year-olds demonstrated that they could use a fictional character's identity as a basis for inferring the presence of certain physical properties in multiple representations of the character. In Experiment 1, children extended a character-based physical property (e.g., a banana tattoo that a monkey character received when he was a baby) from one toy representation of the character to another same-named toy, when the two toys were described as sharing a character identity, but not when they were described as coincidentally sharing a name. In Experiment 2, children distinguished between properties that belonged to a representation of a character in virtue of its character identity (e.g., a banana tattoo that the monkey character received when he was a baby) and those that belonged to it in virtue of its unique spatiotemporal history (e.g., a banana tattoo that the experimenter's friend drew on a representation of the monkey character in a storybook), extending only character-based properties to another representation of the character.

Our findings indicate that young children are able to look past a representational object's unique spatiotemporal history when inferring some of its idiosyncratic properties. Recent research has revealed that children rely heavily on spatiotemporal evidence when making inferences pertaining to individual identity (Gutheil et al., 2008; Hall et al., 2001; Hood & Bloom, 2007). For example, Gutheil et al. found that children treated two toy representations of the same character as distinct individuals, and attributed to them distinct knowledge-state properties. In the current research, we found that children readily extended character-based physical properties from one representation to another, despite the representations' spatiotemporal distinctiveness, when the representations shared an identity at the level of the character. The abstract character identity thus supplied a further foundation for inferring some of a representation's properties. In addition, the results of Experiment 1 speak to the issue of whether children expect objects that share a proper name to share other properties (cf. Heyman & Gelman, 2000). Our findings indicate that children believe that two representational objects sharing a proper name do share certain properties, if the shared name is connected to a shared character identity. Furthermore, the results of Experiment 2 provide evidence that children are sensitive to the origins of a representational object's properties when making decisions about the extendibility of these properties to other objects (cf. Gelman, 1988; Kalish & Gelman, 1992; Nguyen & Murphy, 2003).

The reasoning ability we examined in this research is a specific example of a more general capacity to think flexibly about an object on multiple conceptual levels. Several previous results from the developmental psychology literature suggest that children as young as four years possess this capacity: their patterns of property extensions in inductive inference tasks indicate that they are capable of construing the same material object as a unique individual, as an instance of an object category, or as a portion of a material category (e.g., Gelman, 1988; Kalish & Gelman, 1992; Nguyen & Murphy, 2003). The current results are consistent with those past findings. At the same time, our findings reveal that young children's conceptual flexibility is even broader in scope, in that it also enables them to reason aptly about certain objects construed either as unique individuals or as fictional characters.

Character toys are examples of representational objects that are familiar in preschoolers' daily lives, but children (at least those in Western societies) regularly encounter many other artifacts that possess a dual individual identity. These artifacts include physical copies of intellectual objects, like novels, movies, and songs. For example, every copy of the novel "Harry Potter and the Deathly Hallows" contains the same plot details (e.g., Voldemort's death), characters (e.g., Harry, Ron, & Hermione), and settings (e.g., Hogwarts school) in virtue of its being a particular work of fiction, but each copy may have dog-ears and creases in its spine in virtue of its unique spatiotemporal history. Moreover, copies of the book may differ drastically in value, depending on these specific histories: a tattered mass-market paperback may sell for just a few dollars, but a first edition hardcover autographed by the author may command a much higher price.

Many other artifacts represent an individual brand model, including articles of clothing, electronic goods, and vehicles. For instance, every Nike Air Skyraider shoe has a mesh upper with supportive overlays, a dual-density mid-sole, and special carbon rubber at the heel in virtue of its identity as a particular model, but each one may have its own flaws, scuffs, and stains in virtue of its unique spatiotemporal history. Furthermore, the brand model identity of these objects depends on the origin of the model-relevant properties. Authentic representations must come to possess these properties through a legitimate process (e.g., production in a Nike factory); objects that acquire the same properties in any other way are mere knockoffs. As in the case of character toys, children must learn to reason

aptly about these other types of artifacts, recognizing which of their properties are relevant to each level of individual identity. The current findings suggest that young children possess the necessary conceptual flexibility to do so, but it remains a project for future research to probe directly children's grasp of the complexity involved in thinking appropriately about these objects.

To be sure, many of the objects in young children's experience are not representations of abstract individuals. In particular, most of the people children encounter on a daily basis are non-representational, including their parents, friends, and teachers. Reasoning about these entities does not require the specific ability we have documented in this research. Despite this fact, the general need to think flexibly about such people (and other non-representational objects) under multiple conceptual descriptions certainly does arise, because these entities can be construed either as unique individuals or as instances of various different categories (e.g., a woman may be construed as Mrs. Jones or as a person, a teacher, a singer, or a vegetarian.) Of course, thinking about representational objects also calls for this flexibility: in addition to being conceptualized as a unique physical object or as Batman, a Batman action toy could be conceptualized, among other things, as a toy, an action figure, or a piece of plastic.

Young children also occasionally need to reason about people as embodiments of abstract individuals, for example, when they observe human actors playing the role of fictional characters on television, on stage, and in film. A particularly interesting avenue for future research would be to examine young children's understanding of cases of multiple individuals instantiated in a single person. The current findings suggest that children may have little trouble distinguishing between the properties that pertain to a fictional character played by an actor (e.g. Voldemort is evil) and those that belong to the actor by virtue of his unique history (e.g., Ralph Fiennes is philanthropic). Teasing apart two sets of human-relevant properties in a single person may, however, turn out to be harder than distinguishing representation-based from character-based properties in toys. Hawkins (1977) reported that children's understanding of the distinction between actors and characters on television increases dramatically between six and 11 years, with younger children more likely to agree that, for example, police offers on television are police officers in real life (see also Nikken & Peeters, 1988; Wright, Huston, Reitz, & Piemyat, 1994). Anecdotal reports of fans requesting medical advice from actors who play fictional doctors on television suggest that the keeping these two identities separate may be a difficult task, even for many adults. Reasoning appropriately about people who possess an individual identity at multiple levels of abstraction thus may present a persistent challenge well beyond early childhood.

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Appendix. Text of illustrated storybook, "Boris and the Tiger's Trap, from Experiment 1

[Page 1] Once, there were three monkeys. One was called Boris, and his best friends were called Igor (in *character-shared name* condition) [Boris (in *accidentally-shared name* condition)] and Fred. Boris, Igor [Boris], and Fred. Isn't that silly? Boris was a monkey who liked to do silly things like swing around in the trees and tease the tigers in the jungle.

[Page 2] Boris had a banana on his ear that he got when he was a baby, and a pink heart on his back that he got from his mother. He also had a mark on his back that he got when the tiger was chasing him, and a dark patch on his bum that he got from falling out of a tree.

[Page 3] There was one tiger in the jungle who really didn't like Boris, and he made a plan to catch Boris in a trap. He dug a big hole, filled it up with wet, sticky mud, and covered it up with sticks and leaves. But guess who was watching? Boris's friends, Igor [Boris] and Fred were watching from up in their tree! They watched as the tiger built his trap.

[Page 4] The tiger started to chase Boris toward the trap so that Boris would fall into the mud hole. But Igor [Boris] and Fred were still watching from their tree, and they knew what the tiger was planning. So when the tiger started to chase Boris toward the trap, Igor [Boris] and Fred swung down from their tree and lifted Boris into the air. They carried him safely into the tree.

[Page 5] The tiger was so surprised that he kept running, and fell into his own trap! Boris, Igor [Boris], and Fred all laughed at the tiger, who was all covered in mud.

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