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Transfer between Picture Books and the Real World by Very Young Children

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Picture book reading is a very common form of interaction between parents and very young children. Here we explore to what extent young children transfer novel information between picture books and the real world. We report that 15- and 18-month-olds can extend newly learned labels both from pictures to objects and from objects to pictures. However, the degree to which they do so is affected by iconicity—how much the objects and pictures resemble one another. The children in these studies more often extended the labels between picture and object when realistic photographs and drawings were involved than less realistic cartoons. These results show that higher levels of perceptual similarity between symbol and referent make the referential relation more transparent, thereby helping children transfer information between them. Thus, the educational function of early picture book interactions may best be served with realistic illustrations.

American parents overwhelmingly endorse the importance of books and reading for their young children's development (Gelman, Coley, Rosengren, Hartman, & Pappas, 1998; Rideout, Vandewater, & Wartella, 2003). Most (92%) of American children below the age of three participate in book-centered interactions several times a week (Rideout et al., 2003). Young children's first book interactions typically involve picture books, books containing pictures either alone or accompanied by very simple text. Pictures are symbols that commonly represent entities from the "real world," a term we use to refer to the unmediated experience of real

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objects, people, and events. Thus, in the research reported here we investigate young children's transfer of information between picture books and the real world.

The vast majority of research on picture book reading has focused on two topics: the nature of the parent–child interaction and the effects of joint picture book reading on development. The research examining parent–child interactions with picture books has primarily been concerned with the nature of the interaction and the developmental changes in the relative contributions of parent and child to this very common activity (e.g., DeLoache & DeMendoza, 1987; Ninio, 1983; Ninio & Bruner, 1978; Sénéchal, Cornell, & Broda, 1995; Snow & Ninio, 1986; van Kleeck, 2003). With very young children, parents assume the primary role in the interaction, and they mainly label depicted objects. Once children are preschool-aged, parents emphasize more complex information, such as categorical relationships among depicted items (Gelman et al., 1998) or information about spatial relations among the objects in the picture book (Szechter & Liben, 2004). With advancing language and knowledge, children's participation increases, but it continues to be scaffolded by their parents for some time.

Several benefits of joint picture book reading have been documented, including enhanced vocabulary development (DeBaryshe, 1993; Sénéchal & Cornell, 1993; Whitehurst, Falco, Lonigan, Fischel, DeBaryshe, Valdez-Menchaca, & Caulfield, 1994). Preschool children who spend more time in picture book interactions with their parents know more words than do children with less book-reading experience. Early experience with picture books is also related to emergent literacy (Adams, 1990; Bialystok, 1995; Justice & Ezell, 2000; Mason, 1980; Sénéchal & LeFevre, 2001; Sulzby, 1985; Teale & Sulzby, 1986; Whitehurst & Lonigan, 1998), as well as oral and written skills (e.g., Bus, van IJzendoorn, & Pellegrini, 1995; Whitehurst & Lonigan, 1998). Along with acquiring vocabulary, young children learn about literacy conventions from picture book interactions. Furthermore, picture book reading has served as the basis for effective intervention programs with educationally at-risk young children with many positive cognitive and behavioral outcomes (e.g., Justice & Ezell, 2002; Whitehurst et al., 1994; Whitehurst & Lonigan, 1998).

In contrast to the many demonstrations of general benefits associated with early picture book interactions, there is a dearth of information about very young children's learning of the *content* of the books with which they interact. We know remarkably little about what information children take away from their book-reading experiences, as well as what information about the real world they bring to bear in interpreting books. The general assumption is that young children's experiences with books contribute to the development of world knowledge. According to van Kleeck (2003),

> Though I know of no specific research on the impact of book sharing on children's general knowledge, this may be because the impact is so basic and obvious. Any time

> children share a book about an experience that they have not personally had, or about a place they have not been, they are undoubtedly learning something new about the world. (p. 293)

But to what extent *do* young children transfer knowledge between picture books and the real world? When parents say the word "zebra" while looking at a picture, do their children infer that the word refers to a real animal with black and white stripes, not just to the creature depicted in the book? On their next trip to the zoo, would children know that the striped animal in front of them is a "zebra," and would they attribute to it whatever factual information they learned about zebras from the book interaction?

Similarly, we know very little about whether children use their real world knowledge to make inferences about what they see depicted in picture books. If they learned something about a real zebra in the zoo, would they apply that information when they see one depicted in a book? What affects the extent to which information gets transferred from book to world and vice versa?

We know that pictorial competence—the full understanding of the nature of pictures and their use—develops gradually in the first years of life (Callaghan, 2000; DeLoache & Burns, 1994; DeLoache, Pierroutsakos, & Troseth, 1996; Robinson, Nye, & Thomas, 1994; Troseth, Pierroutsakos, & DeLoache, 2004). Infants can perceive pictures, recognize the similarity between pictures and their real referents, and discriminate between pictures and objects (DeLoache, Strauss, & Maynard, 1979; Dirks & Gibson, 1977; Slater, Rose, & Morison, 1984). Nevertheless, 9-month-olds manually explore depicted objects (DeLoache, Pierroutsakos, Uttal, Rosengren, & Gottlieb, 1998; Murphy, 1978; Pierroutsakos & DeLoache, 2003; Yonas, Chov, Alexander, & Jacques, 2003). The more realistic the picture is—the more it resembles a real object—the more manual exploration it elicits (Pierroutsakos & DeLoache, 2003). This exploration of depicted objects suggests that at 9 months of age infants have yet to achieve one of the most fundamental aspects of pictorial competence—an appreciation of how pictures differ from their referents.

By 18 months of age, children no longer manually explore pictures; instead, they point at and name depicted objects, treating them as objects of contemplation rather than action (DeLoache et al., 1998; Murphy, 1978). Further, they have begun to understand the referential nature of pictures. Preissler and Carey (2004) taught 18- and 24-month-olds a new label ("whisk") for a line drawing of an unfamiliar object. When the children were subsequently shown the drawing paired with the real object and asked to indicate the "whisk," all of them chose either the object alone or the object *and* its picture. They never selected the picture alone even though they had learned the label for it. Thus, 18-month-old children who hear a new word in relation to a picture of an object appreciate that the word refers to the real object, not simply to its picture.

Nevertheless, young children's understanding of the symbolic nature of picture-referent relations remains relatively fragile for some time. For example, children under the age of 2 years have difficulty choosing which of a set of real objects is the one depicted in a color photograph (Harris, Kavanaugh, & Dowson, 1997). Even 2.5-year-olds fail to choose which of two objects matches a picture they have just seen (Callaghan, 2000).

Further, preschoolers sometimes confuse the properties of depicted and real objects, claiming, for example, that a picture of ice cream would feel cold to the touch (Beilin & Pearlman, 1991) or that shaking a photograph of blocks would cause the blocks to tumble down (Flavell, Flavell, Green, & Korfmacher, 1990). They also assert that a photograph of a set of objects would change if the objects themselves were altered, and vice versa (Robinson, Nye, & Thomas, 1994; Zaitchik, 1990).

The fragile understanding that young children have of the nature of picture-referent relations makes it unclear what to expect with respect to their ability to generalize new information between picture books and the real world. The primary goal of the research reported here was to explore very young children's transfer of new information from pictures to real objects and from real objects to depictions. Early picture book interactions with very young children typically involve parents providing names for novel depicted objects and asking their children to name familiar objects depicted in the book. Thus, the present research focuses on a very common learning opportunity regularly experienced by young children.

Our second goal was to examine the effect of different kinds of pictures on very young children's transfer of information between picture books and their real referents. There could be important practical benefits to knowing more about what kinds of pictures best support learning and generalization. An important dimension on which pictures vary is *iconicity*—the degree of physical resemblance between a picture and its referent. The illustrations in picture books for young children vary widely in terms of how realistic they are. Even in picture books that are designed to teach accurate information about the world, the pictures range from highly realistic color photographs to cartoons that substantially distort what they depict.

There is reason to think that iconicity might matter with respect to young children's ability to relate pictures to reality. For example, 3-year-olds are more successful at identifying the real-object referent of a picture when they look more alike (Callaghan, 2000). Pictorial realism may be especially important with respect to books for very young children. More iconic or realistic pictures might provide better support for the transfer of new information between pictures and the real world than would less realistic ones. This question is especially important given the evidence provided by Preissler and Carey's (2004) study that, even at 18 months, children seem to understand the referential nature of pictures. Thus, we would expect children to be relatively proficient at transferring information between a picture and a real object. The question is whether the iconicity of the

picture makes a difference. In the studies reported here, we tested both 18- and 15-month-olds to obtain information about the developmental course of young children's ability to transfer information between pictures and real objects.

In Study 1, we investigated 15- and 18-month-olds' learning of a novel name from a brief naturalistic picture book interaction with an adult and their extension of the name from the book to the real object. In Study 2, we investigated 15- and 18-month-olds' learning of a novel name for a *real* object and their extension of the name from the object to a depiction of it. In both studies, we asked whether the level of iconicity of the pictures in the books affects how well young children relate depictions and their real-object referents.

STUDY 1

In a naturalistic picture book interaction, we taught young children a novel name ("*blicket*") for a novel object using simple books with pictures of three levels of iconicity. The experimenter simply labeled and talked about the depicted objects the way parents typically do in picture book interactions with very young children (e.g., DeLoache & DeMendoza, 1987; Ninio & Bruner, 1978). The question of primary interest was whether the children would extend the label learned for the picture to the actual object.

Method

Participants

The participants were 96 children, with 48 (24 girls, 24 boys) in each of two age groups: 15-month-olds (range: 15.3 to 16.0, $M = 15.6$) and 18-month-olds (range: 17.9 to 19.2, $M = 18.4$). Equal numbers of children (16) in the two age groups participated in three book conditions: photographs, drawings, and cartoons. Thirty-seven children were excluded, mostly for failure to complete the book-reading interaction (11 15-month-olds and 21 18-month-olds).[1] Five children (four 15-month-olds and one 18-month-old) were excluded for not paying attention during the test phase. An additional three children were excluded for experimenter error.

Children for both studies reported in this paper were recruited through a database of volunteers and birth records published in the local newspaper. Parents were contacted by phone and invited to participate. The majority of participants were white and middle-class.

[1]The loss of participations in both studies was primarily due to children's unwillingness to read the book. It is not uncommon for children of this age to sit for only brief periods of time to look at a particular book. The majority of the children excluded were simply too active to sit down long enough to finish the book.

Materials

Six cardboard books (13 cm × 17 cm) were constructed, two each with color photographs, colored drawings, or colored cartoons (see Figure 1). There were two different orders of pictures for each type of book. The depicted objects were approximately 10 cm × 10 cm. The drawings and cartoons were water-color renderings of the original photographs made by an artist. The drawings were highly detailed and very similar to the photographs. The cartoons had considerably less detail than the photographs and the drawings, and they distorted the overall shapes of the objects to some degree.

Each 16-page book included pictures of eight familiar objects (stuffed dog, toy phone, plastic cup, toy airplane, doll, toy car, toy hammer, and ball) and two novel objects (a chrome wire egg holder and a white plastic egg cup adorned with two red strings). (According to their parents, none of the children had ever seen the novel objects before.) Each novel object served as the target for half of the children in each book condition. Each familiar object was depicted once, and each novel object was depicted four times. When the book was open, pictures of a familiar object and a novel object were visible on opposite pages (see Figure 1). The two novel objects appeared equally often on the left and right side of the book.

Six objects were used during the test phase of the study: the two familiar and two novel objects that were depicted in the books (as described above) and one novel exemplar of each of the novel objects (same shape but differently colored).

Procedure

Training phase. In the first of two phases, the children were taught a novel name for one of the two novel objects in the picture book.

The child sat on a couch, either on the parent's lap or between the parent and the experimenter. The experimenter interacted naturally with the child, occasionally offering comments and asking questions of the sort that typically occur in parent–child book interactions. She named and briefly described each of the eight familiar objects in the picture book. Throughout, she monitored the child's focus of attention and made sure that the child looked at the depicted objects when they were labeled.

Each of the four times that the child saw the picture of the target novel object, the experimenter talked about it, labeling it three times ("Look, this is a *blicket*. See, a *blicket*. It's shiny and goes round and round. Yeah, that's a *blicket*"). The children thus heard the name of the novel target object a total of 12 times. The four pictures of the non-target novel object were talked about to an equal extent, but the object was never named ("Look at this! Wow, this is white and has two strings. Yeah, look at this."). Thus, the same amount of time was spent with each novel depicted object. One of the novel objects was the target item for half of the children in each book condition, and the second novel object served as the target for the other children.

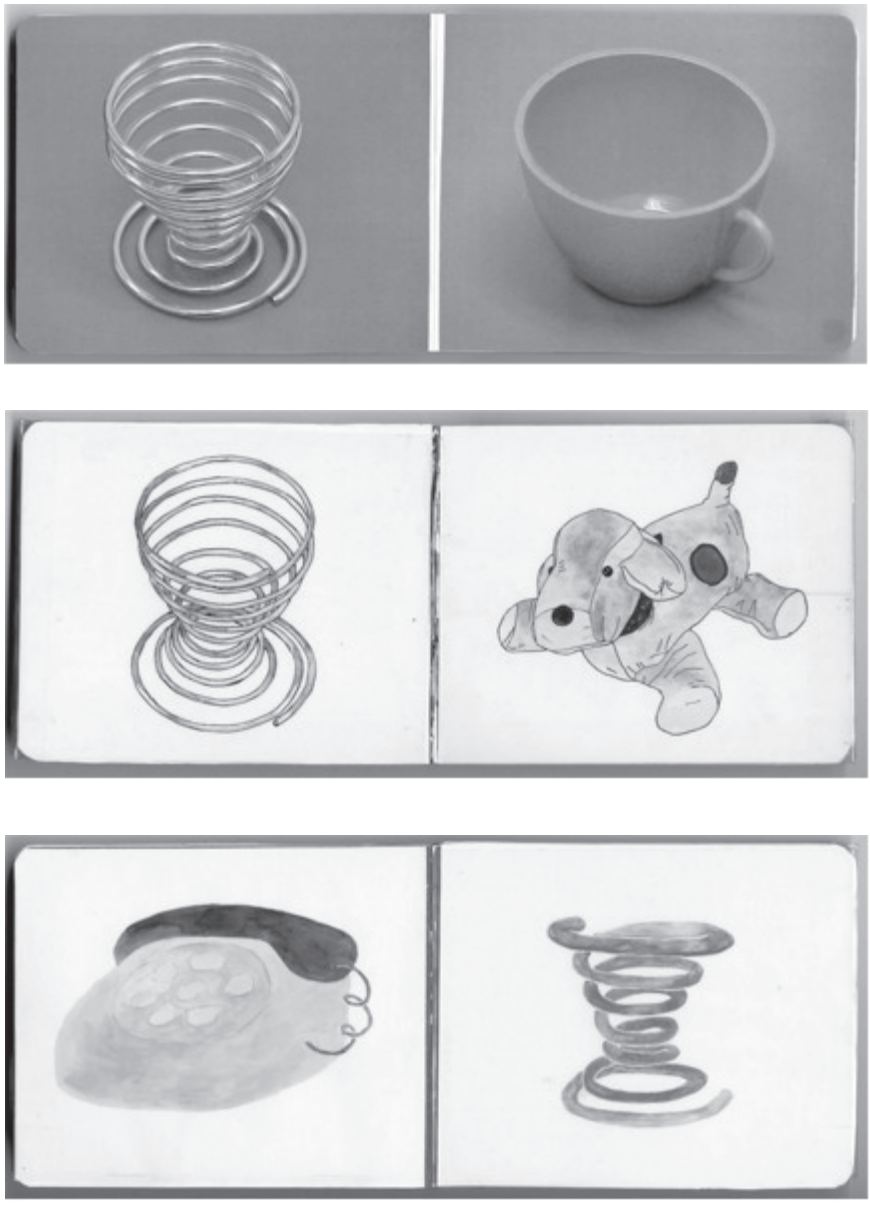

FIGURE 1 Sample pictures from the books of one of the novel objects and three of the familiar objects used in Study 1.

Test phase. Immediately after the experimenter finished reading the book, she invited the child to sit across from her at a small table. To familiarize the child with the testing procedure, the experimenter first presented a pair of familiar pictures and asked the child for one of them and then did the same with a pair of familiar objects.

Each child was given three tests, in which the side of the target item alternated across tests, with the first target item on the right for half of the children and on the left for the other half: (1) *Recognition*—pictures of novel target versus novel non-target (the pictures were the same as in the book); (2) *Extension*—target versus non-target objects; and (3) *Generalization*—new exemplars of target and non-target objects.

For each of the three tests, the experimenter first drew the child's attention to the two test items while holding them out of the child's reach. After the child had attended to both items, the experimenter asked for the target item (e.g., "There's a *blicket* here. Show me the *blicket*."). Then she placed the items on the table within the child's reach. If the child picked up both items, the experimenter took them back and repeated the question.

Following standard procedures in word learning studies (Baldwin, Markman, Bill, Desjardins, Irwin, & Tidball, 1996; Behrend, Scofield, & Kleinknecht, 2001; Childers & Tomasello, 2003; Henderson & Graham, 2005; Namy, 2001; Namy & Waxman, 1998), the three tests were always given in the same order. The *recognition* test was administered first to determine whether the children had established the link between the picture and the novel label heard during the book reading. Evidence that the children had learned the label is crucial in interpreting their behavior on the subsequent tests. The *extension* test, which was of primary interest, provided a measure of transfer of the label from the picture to its real referent. The *generalization* test provided a measure of children's application of information beyond the instance that they had seen depicted in the book.

Children's responses to the test questions were recorded by the experimenter during the experimental session. On the rare occasions in which a child's response was not clear during the test, the experimenter watched the videotaped session to determine the child's choice.

Results and Discussion

Both age groups of children learned the novel name for the depicted object from the brief picture book interaction. Furthermore, they usually extended the name to the real object they had seen depicted in the book, and the older children also generalized the label to a novel exemplar. However, the realism of the pictures in the books affected performance, especially for the younger children. Figure 2 depicts the proportion of correct responses on the three tests by the children in each group.

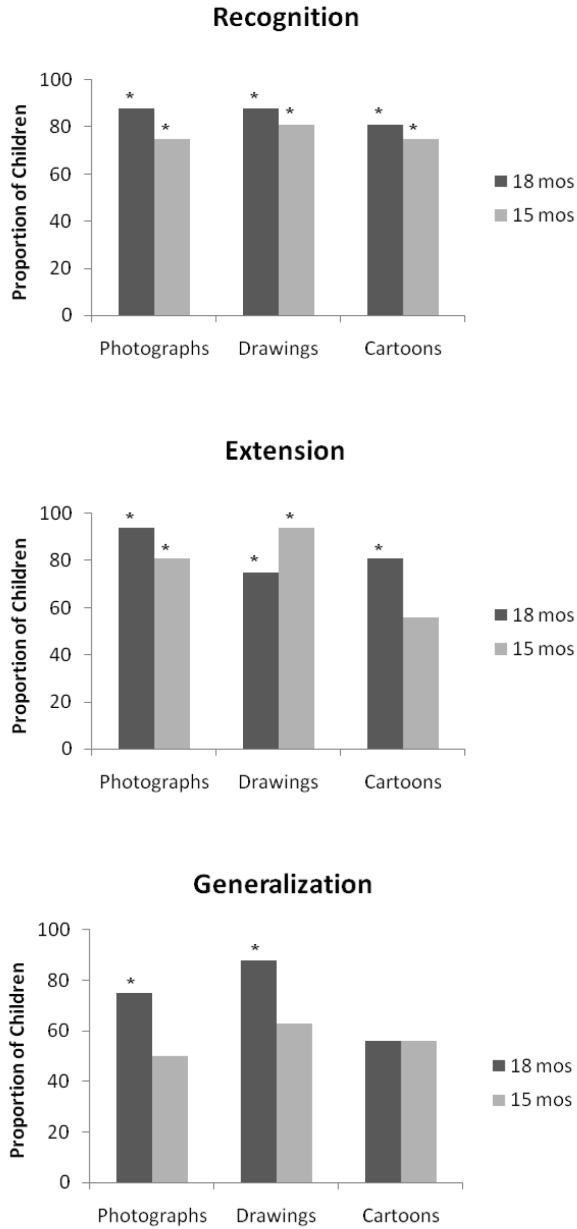

FIGURE 2 Proportion of 15- and 18-month-old children in each of the three book conditions in Study 1 who gave correct responses on the three tests. Above chance (50%) performance is designated by asterisks.

To examine differences in performance on the three tests as a function of age and condition, a logistic regression analysis was conducted with test as a repeated measure. (Preliminary analyses showed no effects of gender or type of target object.) There were three significant main effects: age, χ^2 (1, 96) = 11.69, $p < .01$; condition, χ^2 (2, 96) = 12.25, $p < .01$; and test, χ^2 (2, 96) = 12.64, $p < .01$. Overall, the 18-month-olds performed better (80%) than the 15-month-olds did (70%). Also, overall, the children's performance was better with drawings (81%) than with the less realistic cartoons (68%) ($\chi^2 = 4.63$, $p < .05$). Their performance with photographs (77%) was not significantly different from their performance with drawings or cartoons. With respect to tests, performance on the *recognition* test (81%) and the *extension* test (80%) was better than performance on the *generalization* test (65%) ($\chi^2 = 6.75$ and $\chi^2 = 5.86$, respectively, $p < .05$)

As a more stringent measure of the extent to which the children understood the relation between picture and referent, we examined the performance of individual children across the three tests. Just over half of the 18-month-olds provided correct answers on all three tests: 54% (26 out of 48) selected the correct picture, extended the label to the correct object, and generalized to the new exemplar. This rate of success is significantly above chance, χ^2 (1, 48) = 76.1, $p < .01$ (chance = 12.5%). In contrast, only 29% (14 out of 48) of the 15-month-olds responded correctly on all three tests. Thus, there was a large difference between the two age groups in the extent to which they applied information from the picture book to the real objects. Nevertheless, the number of 15-month-olds who were correct on all three tests was significantly above chance, χ^2 (1, 48) = 12.12, $p < .01$, showing that a substantial minority of the younger children did extend the label from the picture to the object and generalize to the novel exemplar.

These results provide clear evidence that very young children extrapolate information that they learn from a picture book to the real world. Both 18- and 15-month-olds who learned a novel name for a novel object from a brief picture book interaction with an adult extended the name to the real object they had seen depicted in the book. This finding is consistent with Preissler and Carey's (2004) research indicating that when 18-month-old children heard something new in relation to a picture, they appreciated that the information applied to the real object, not just to the depicted object.

Our results also reveal that very young children's ability to apply what they learn in picture book interactions is affected by iconicity, which interacts with age. When the task was relatively simple—extending the novel label from the depicted to the real object—the level of iconicity made no difference for the 18-month-olds, who were successful in all three conditions. However, iconicity was important for the 15-month-olds, who extended the name appropriately in the photograph and drawing conditions, but not in the cartoon condition.

When the task was more demanding—generalizing the newly learned name to a novel exemplar of the depicted object—the older children generalized only from

the more realistic pictures, failing to do so with the least realistic stimuli (the cartoons). This result is consistent with extensive evidence that very young children are highly reliant on physical similarity to exploit higher-level relations (e.g., Gentner, 1989; Smith, 1981). Regardless of the level of similarity between the picture and the real object, the 15-month-olds failed to generalize to the new exemplar in any of the three book conditions. This finding is addressed further in the General Discussion.

STUDY 2

The results of Study 1 established that by 15 months of age, young children can learn a label for a picture of an object and extend that label to the real object. However, flexible symbol use requires the free transfer of information not only from symbol to referent, but also from referent to symbol. In addition to applying new information acquired from books to the real world, children must use what they know about the world to interpret depictions. A typical part of everyday picture book interactions involves parents asking their children to name familiar objects depicted in the book.

Accordingly, in Study 2, we examined 15- and 18-month-olds' transfer of a label that they learned for a real object to a picture of the object. The children were first taught a novel name for a novel object, and they were then asked to extend the label to either a photograph or a cartoon of the object in a naturalistic picture book interaction.

The procedure differed slightly from that of Study 1. First, because no differences were found between the photograph and realistic drawing conditions in Study 1, we did not include a realistic drawing condition in Study 2. In addition, in order to have a richer data set, we gave two trials for each of the three tests.

Method

Participants

The participants included 69 children (34 boys and 35 girls) in two age groups: 15-month-olds (N = 37, range: 14.5 to 16.9, M = 15.5) and 18-month-olds (N = 32, range: 17.8 to 19.5, M = 18.4). All children participated in two book conditions: photographs (N = 36) and cartoons (N = 33). An additional 14 children (five from the younger group and nine from the older group) were excluded due to fussiness or inattentiveness, most during the *extension* test (8) and the *generalization* test (2) with the picture books. Three children were excluded due to experimenter error. None of the children participated in Study 1. The children were randomly assigned to two book groups—photograph or cartoon—with age and gender counterbalanced.

Materials

Four objects were used during the training phase of the study: two familiar objects (a small, brown stuffed bear and a yellow rubber ducky) and two novel objects (a purple and green wallpaper roller and a black-and-white rubber object). (According to their parents, none of the children had ever seen the novel objects before.) Each novel object served as the target object for half of the children in each book condition.

Four laminated books (13.5 cm × 20 cm) were constructed and used in the test phase of the study, two with color photographs and two with colored cartoons. The depicted objects were approximately 10 cm × 10 cm. The cartoons, which were made from the original photographs with Adobe Photoshop, had considerably less detail than the photographs, and the overall shape and details of the objects were somewhat distorted.

Each 16-page book included one picture each of eight familiar objects (stuffed bear, rubber duck, ball, toy truck, toy keys, toy phone, stuffed dog, balloons), as well as two pictures each of the two novel objects described above and two new-exemplar objects, identical to the novel objects except in color. The novel and new-exemplar objects appeared on opposite sides between books, and they appeared equally often on the left and right. Each two-page spread contained either two familiar objects, the two novel objects, or the two new-exemplar objects, with familiar and novel pairs appearing on alternating spreads. The order of the pairs was: (1) familiar, (2) novel, (3) familiar, (4) novel, (5) familiar, (6) new-exemplar, (7) familiar, and (8) new-exemplar.

Procedure

The procedure for this study was very similar to that in Study 1 with two exceptions. First, the children were taught a label for an actual object rather than a picture of an object. Second, each test consisted of two trials, rather than just one. Other minor differences are noted below. The children sat at a table in a Sassy seat opposite the experimenter.

Training phase. During this phase, the children were taught a novel name for one of the two novel objects. On each of the five training trials, the experimenter presented a pair of real objects and labeled (or talked about) each object three times, making sure the children attended to the objects. The familiar objects were labeled with their familiar names, and the target object was labeled with a novel name ("Look, it's a *toma*. Yeah, that's a *toma*. See the *toma*."). The non-target object was never labeled but was talked about to an equal extent ("Look at this! Wow, look at this. Yeah, see this.").

The order of training trials was (1) familiar object/target novel object, (2) non-target novel object/familiar object, (3) target novel object/non-target novel ob-

ject, (4) non-target novel object/familiar object, and (5) familiar object/target novel object. Thus, over trials, the child heard the target object labeled a total of nine times. The target object was presented on the left on the first trial for half of the children and on the right for the other half. The novel objects were presented on alternating sides across trials, and they appeared equally often on the left and right side.

Test phase. Immediately after training, each child was given three tests: (1) *Recognition*—target versus non-target objects; (2) *Extension*—picture of target versus picture of non-target objects; and (3) *Generalization*—pictures of new exemplars of target versus non-target objects. As in Study 1, the three types of tests were always given in the same order because of our primary focus on *extension* from object to picture. There were two test trials for each test type, with the side of the target item alternated across the tests, beginning with the target on the right for half of the children and on the left for the others.

For the *recognition* test, the experimenter first drew the child's attention to the two test objects while holding them out of reach. After the child had attended to both, the experimenter asked for the target object (e.g., "I see a *toma* here. Where is the *toma*?") and placed both objects on the table within the child's reach. If a child was hesitant to respond or picked up both objects, the experimenter repeated the question. Once the child had made an explicit choice, the experimenter removed the objects. After regaining the child's attention, she presented the objects again on the opposite sides, and the question was repeated.

For both the *extension* and *generalization* tests, a book was employed. In an effort to keep the child's attention on the book, the experimenter labeled and pointed to the familiar objects in between the test pairs.

On the pages with paired pictures of the novel objects, the experimenter said (without pointing), "There's a *toma* here! I see a *toma*." Then she asked the child to indicate the target item (e.g., "Where is the *toma*?").[2] The child's responses were recorded immediately by the experimenter.

Results and Discussion

The pattern of results from Study 2 substantially parallels those in Study 1. Children in both age groups learned the object name from the brief training session, and most of them extended the name to depictions of the object in a book. The older children also generalized to a picture of a new exemplar. The degree of realism of the pictures in the books affected performance, especially for the younger

[2]One 18-month-old and 14 of the 15-month-olds refused to point on at least one trial during the picture test. In these cases, the experimenter presented the child with unbound pictures of the objects and asked for the target item (similar to the picture tests in Study 1). This method enabled children to select the picture rather than simply point.

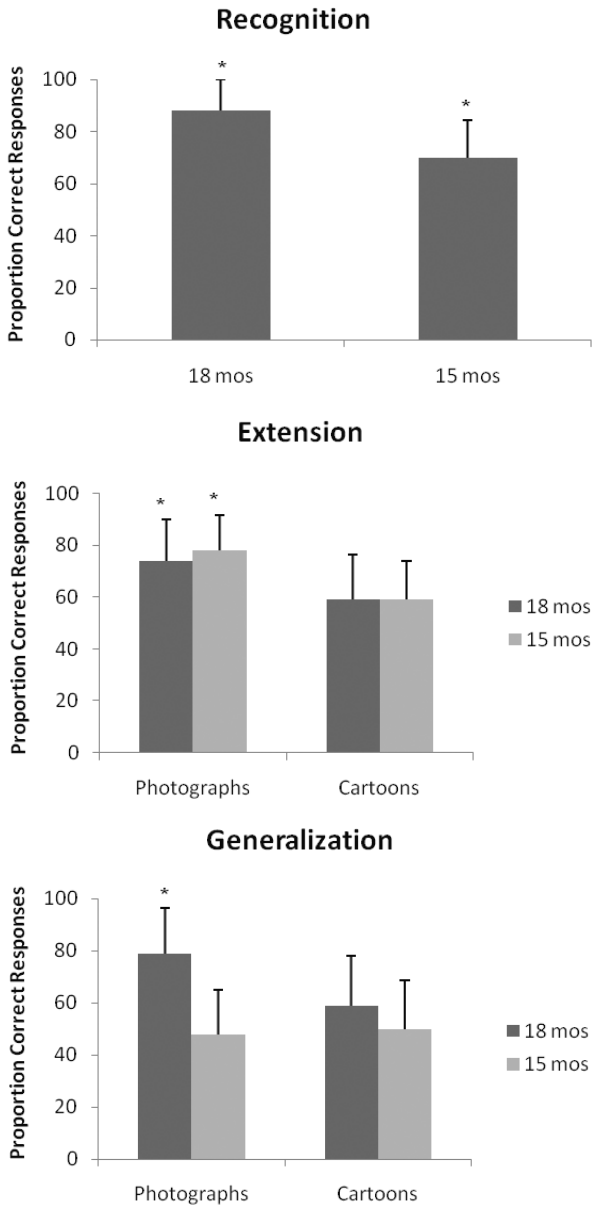

FIGURE 3 Proportion of correct responses on the three tests by 15- and 18-month-old children in the two book conditions in Study 2. The results for the *recognition* test are not broken down by book condition type because the children had not yet encountered the books. Above chance (50%) performance is designated by asterisks.

children. Figure 3 depicts the proportion of correct responses on each of the three tests by children in each group.

Each child received a score (0, 1, or 2) for performance across the two trials for each test type. Preliminary analyses showed no effects of gender, order, or target object on performance.

To examine performance on the test questions, we conducted two analyses. Because the *recognition* test was not affected by book condition, these data were analyzed separately from *extension* and *generalization* data. A one-way (recognition by age) analysis of variance revealed a main effect of age, $F(1,67) = 5.9$, $p < .05$, with the 18-month-olds performing significantly better on the *recognition* test than 15-month-olds.

To examine differences in *extension* and *generalization* as a function of age *and* condition, we conducted a 2 (*age*: 15 vs. 18 months) × 2 (*condition*: photograph vs. cartoon) × 2 (*test*: extension vs. generalization) mixed analysis of variance with test as a repeated measure.

As in Study 1, there were three significant main effects: age, $F(1,65) = 3.60$, $p < .01$; condition, $F(1,65) = 5.47$, $p < .05$; and test, $F(1,65) = 3.02$, $p < .01$. Overall, the 18-month-olds performed significantly better (72%) than the 15-month-olds (59%). Also, the children's performance was better with photographs (74%) than with cartoons (57%). Finally, performance was significantly higher on *extension* (69%) than *generalization* (61%). In addition, there was a test by age interaction, $F(1,65) = 5.79$, $p < .05$. Post hoc tests revealed that 15-month-olds' performance was significantly lower on *generalization* than *extension* ($t(36) = 2.85$, $p < .01$) and also lower than the 18-month-olds' performance on *extension* ($t(31) = –2.95$, $p < .01$) and *generalization* ($t(31) = 3.09$, $p < .01$).

For the final analysis, we examined the performance of individual children across trials to assess the level of their understanding of the relation between the object and its depictions. Forty-one percent (13 out of 32) of the 18-month-olds provided correct answers on both trials in all three tests: they learned the name of the object, extended the label to the correct picture, and generalized to the new-exemplar picture. This rate of success is significantly above chance, $\chi^2 (1, 32) = 317.87$, $p < .001$ (chance = 1.6%). Fewer than 14% (5 out of 37) of the 15-month-olds responded correctly across the three tests. Nevertheless, the number of 15-month-olds who were correct on all three tests was significantly above chance, $\chi^2 (1, 37) = 34.4$, $p < .001$ (chance = 1.6%).

These results closely mimic those of Study 1. Young children readily transfer information from objects to pictures; however, transfer of information is affected by the iconicity of the picture. Similar to the pattern of *extension* and *generalization* obtained in Study 1, both 15- and 18-month-olds readily extended a label learned for a real object to photographs of the object, but not to cartoons. The older children readily generalized the label to a photograph of a new exemplar, but the younger children did not. Neither group generalized to a new-exemplar cartoon.

The one point where Studies 1 and 2 diverge concerns 18-month-olds' *extension* from object to cartoon. The 18-month-olds in Study 1 extended the label learned for the cartoon to the real object, but those in Study 2 failed to extend the label learned for the object to a cartoon of it.

GENERAL DISCUSSION

Picture book interactions with very young children involve two common activities: parents label depicted objects and provide their children with new information about them, and they encourage their children to identify depictions based on their knowledge of real objects. As shown here, in their second year, children are proficient at transferring simple information, in this case a novel name, between pictures and objects. In particular, when the children in this research learned a novel label for an object depicted in a picture book, both the 15- and 18-month-olds were later able to extend the name to the real object. Similarly, when they learned a novel label for a real object, both age groups extended the name to a realistic depiction of it in a book.

Another finding of this research is the importance of iconicity—the degree of similarity between pictures and objects—in very young children's *extension* and *generalization* of information. The 15-month-olds did not extend the label learned from a cartoon to the real object, and neither 15- nor 18-month-olds extended a label learned for a real object to a cartoon depiction of the object. Neither age group generalized when cartoons were involved, neither to objects nor from real objects to cartoons.

Physical similarity thus plays a role in children's transfer of information between pictures and objects. Higher levels of iconicity involve more perceptual detail and hence more information in common between objects and depictions. The information about the referent object provided in the photographs used here included color, shape, texture, reflections, shadows, relations among component shapes, and so on. In contrast, the cartoons had less information, and some of it was distorted. As with other types of symbolic artifacts, higher levels of perceptual similarity between symbol and referent make the referential relation more transparent, thereby helping children transfer information between symbol and referent (Callaghan, 2000; DeLoache, Kolstad, & Anderson, 1991).

The findings regarding the role of perceptual similarity in the transfer of information from the page to the world and vice versa have important practical implications. They tell us that if a book is intended to serve an educational function, such as teaching children something new about the real world or having children use their real world knowledge to identify a picture in a book, then the nature of the pictures in the book should receive careful consideration. This is especially important, given the prevalence of cartoon books for very young children, even for books

apparently designed to promote learning about the real world. Thus, it could be useful for publishers of children's books to take iconicity into account when producing informational books, and for parents and teachers to be aware of the greater efficacy of more realistic illustrations for learning purposes.

Some patterns in the children's *generalization* performance are worth considering. When the children were asked to generalize the name learned for a target to a new exemplar of the target, different patterns of results emerged for the two age groups. The 18-month-olds generalized the new name to a new exemplar, whether from picture to real object or from object to picture. This result suggests that these children interpreted the pictures categorically, as representing a class of objects, not just an individual object.

In contrast, few of the 15-month-olds generalized the label either from a depicted object to a new-exemplar object or from a real object to a picture of a new exemplar. This failure cannot be due to a general difficulty with word generalization, because even 13-month-olds generalize a name learned for one real object to another new exemplar of that object (Woodward, Markman, & Fitzsimmons, 1994). Instead, it may reflect limited understanding of the categorical nature of pictures. These younger children may be prone to interpret pictures of individual objects as representations of a specific object, rather than of a general class of objects. However, because the *generalization* test in this study followed the *extension* test, we have to be cautious in interpreting these results. To be fully confident in our interpretation, in future studies we would need to test children's transfer from the picture to the new exemplar without having them tested on the *extension* test first.

Nevertheless, if our interpretation is correct, it might be possible to induce a more mature categorical interpretation of pictures in 15-month-olds by teaching them a label for multiple exemplars from a given category. This suggestion is based on evidence that preschool children who learn a novel label in relation to several objects from a category are more likely to generalize the label to a novel exemplar (Gentner & Namy, 1999; Namy & Gentner, 2002). Thus, exposing 15-month-olds to photographs of multiple objects from a given category might facilitate generalization to new-exemplar objects, and vice versa.

The present research raises additional questions for future research. One concerns the extent to which very young children can learn and generalize different types of information from picture books. Recent research shows that 18- to 30-month-olds can learn to imitate a novel sequence of actions with novel objects from a picture book interaction (Simcock & DeLoache, 2006). At what age could young children learn *factual information* from picture book interactions, and what factors would affect their generalization of facts beyond the book? Research is currently underway in which we examine preschool children's learning about the concept of camouflage as a biological defense mechanism. We are interested in children's transfer of that knowledge to realistic displays containing live animals (Ganea, Ma, & DeLoache, 2007).

Of particular interest for future research, *how far* might young children generalize or transfer information learned from a picture book interaction to real situations? A goal shared by parents, educators, and presumably publishers is that young children will apply what they learn from picture book interactions to the real world. However, according to Barnett and Ceci's (2002) analysis of transfer, remarkably little research has examined transfer of information from one real-world context to another. In future studies, young children will learn some new information (e.g., about aardvarks) from a picture book interaction with their parents at home. Some time later, they will be tested to see what they apply from that interaction to the real referent in a very different setting (e.g., the local zoo). Learning more about how to facilitate far transfer by very young children should make important practical and theoretical contributions.

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REFERENCES

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.

Baldwin, D. A., Markman, E. M., Bill, B., Desjardins, R. N., Irwin, J. M, & Tidball, G. (1996). Infants' reliance on a social criterion for establishing word-object relations. *Child Development, 67,* 3135–3153.

Barnett, S., & Ceci, S. (2002). When and where do we apply what we learn? A taxonomy for far transfer. *Psychological Bulletin, 128,* 612–637.

Behrend, D. A., Scofield, J., & Kleinknecht, E. E. (2001). Beyond fast mapping: Young children's extensions of novel words and novel facts. *Developmental Psychology, 37*(5), 698–705.

Beilin, H., & Pearlman, E. G. (1991). Children's iconic realism: Object versus property realism. In H. W. Reese (Ed.), *Advances in child development and behavior* (pp. 73–111). New York: Academic Press.

Bialystok, E. (1995). Making concepts of print symbolic: Understanding how writing represents language. *First Language, 15,* 317–338.

Bus, A. G., van IJzendoorn, M. H., & Pellegrini, A. D. (1995). Joint book reading makes for success in learning to read: A meta-analysis of intergenerational transmission of literacy. *Review of Educational Research, 65,* 1–21.

Callaghan, T. C. (2000). Factors affecting children's graphic symbol use in the third year. Language, similarity, and iconicity. *Cognitive Development, 15,* 185–214.

Childers, J. B., & Tomasello, M. (2003). Children extend both words and non-verbal actions to novel exemplars. *Developmental Science, 6,* 185–190.

DeBaryshe, B. D. (1993). Joint picture-book reading correlates of early oral language skills. *Journal of Child Language, 20,* 455–461.

DeLoache, J. S., & Burns, N. M. (1994). Early understanding of the representational function of pictures. *Cognition, 52,* 83–110.

DeLoache, J. S., & DeMendoza, A. P. (1987). Joint picturebook interactions of mothers and 1-year-old children. *British Journal of Developmental Psychology, 5,* 111–123.

DeLoache, J. S., Kolstad, V., & Anderson, K. N. (1991). Physical similarity and young children's understanding of scale models. *Child Development, 61,* 111–126.

DeLoache, J. S., Pierroutsakos, S. L., & Troseth, G. L. (1996). The three R's of pictorial competence. In R. Vasta (Ed.), *Annals of child development* (Vol. 12, pp. 1–48). London: Jessica Kingsley Publishers Ltd.

DeLoache, J. S., Pierroutsakos, S. L., Uttal, D. H., Rosengren, K. S., & Gottlieb, A. (1998). Grasping the nature of pictures. *Psychological Science, 9,* 205–210.

DeLoache, J. S., Strauss, M., & Maynard, J. (1979). Picture perception in infancy. *Infant Behavior and Development, 2,* 77–89.

Dirks, J. R., & Gibson, E. (1977). Infants' perception of similarity between live people and their photographs. *Child Development, 48,* 124–130.

Flavell, J. H., Flavell, E. R., Green, F. L., & Korfmacher, J. E. (1990). Do young children think of television images as pictures or real objects? *Journal of Broadcasting & Electronic Media, 34,* 399–419.

Ganea, P. A., Ma, L., & DeLoache, J. S. (2007). Young children's learning and extension of scientific information from picture books. Paper presented at the Biennial Meeting of the Society for Research in Child Development, Boston, MA.

Gelman, S. A., Coley, J. D., Rosengren, K. S., Hartman, E., & Pappas, A. (1998). *Beyond labeling: The role of maternal input in the acquisition of richly structured categories. Monographs of the Society for Research in Child Development,* Serial No. 253, 63(1).

Gentner, D. (1989). The mechanisms of analogical learning. In S. Vosniadou & A. Ortony (Eds.), *Similarity and analogical reasoning* (pp. 199–241). New York: Cambridge University Press.

Gentner, D., & Namy, L. L. (1999). Comparison in the development of categories. *Cognitive Development, 14,* 487–513.

Harris, P. L., Kavanaugh, R. D., & Dowson, L. (1997). The depiction of imaginary transformation: Early comprehension of a symbolic function. *Cognitive Development, 12,* 1–19.

Henderson, A. M. E., & Graham, S. A. (2005). Two-year-olds' appreciation of the shared nature of novel object labels. *Journal of Cognition and Development, 6,* 381–402.

Justice, L. M., & Ezell, H. K. (2000). Enhancing children's print and word awareness through home-based parent intervention. *American Journal of Speech and Language Pathology, 9*, 257–269.

Justice, L. M., & Ezell, H. K. (2002). Use of storybook reading to increase print awareness in at-risk children. *American Journal of Speech-Language Pathology, 11,* 17–29.

Mason, J. (1980). When do children begin to read? An exploration of four-year-old children's letter and word reading competencies. *Reading Research Quarterly, 15,* 203–227.

Murphy, C. M. (1978). Pointing in the context of a shared activity. *Child Development, 49,* 371–380.

Namy, L. L. (2001). What's in a name when it isn't a word? 17-Month-olds' mapping of nonverbal symbols to object categories. *Infancy, 2*(1), pp. 73–86.

Namy, L. L., & Gentner, D. (2002). Making a silk purse out of two sows ears: Young children's use of comparison in category learning. *Journal of Experimental Psychology, 131,* 5–15.

Namy, L. L., & Waxman, S. R. (1998). Words and gestures: Infants' interpretations of different forms of symbolic reference. *Child Development, 69*(2), 295–308.

Ninio, A. (1983). Joint book reading as a multiple vocabulary acquisition device. *Developmental Psychology, 19,* 445–451.

Ninio, A., & Bruner, J. (1978). The achievement and antecedents of labeling. *Journal of Child Language, 5,* 1–15.

Pierroutsakos, S. L., & DeLoache, J. S. (2003). Infants' manual exploration of pictorial objects varying in realism. *Infancy, 4,* 141–156.

Preissler, M. A., & Carey, S. (2004). Do both pictures and words function as symbols for 18- and 24-month-old children? *Journal of Cognition and Development, 5,* 185–212.

Rideout, V. J., Vandewater, E. A., & Wartella, E. A. (2003). Zero to six: Electronic media in the lives of infants, toddlers, and preschoolers. Retrieved May 25, 2004, from The Henry J. Kaiser Family Foundation Web site: http://www.kff.org/entmedia/3378.cfm.

Robinson, E. J., Nye, R., & Thomas, G. V. (1994). Children's conceptions of the relationship between pictures and their referents. *Cognitive Development, 9,* 165–191.

Sénéchal, M., & Cornell, E. H. (1993). Vocabulary acquisition through shared reading experiences. *Reading Research Quarterly, 28,* 360–375.

Sénéchal, M., Cornell, E. H., & Broda, L. S. (1995). Age-related differences in the organization of parent-infant interactions during picture-book reading. *Early Childhood Research Quarterly, 10,* 317–337.

Sénéchal, M., & LeFevre, J. (2001). Storybook reading and parent teaching: Links to language and literacy development. In P. R. Britto & J. Brooks-Gunn (Eds.), *The role of family literacy environments in promoting young children's emerging literacy skills. New directions for child and adolescent development* (pp. 39–52). San Francisco, CA: Jossey-Bass.

Simcock, G., & DeLoache, J. S. (2006). The effects of iconicity on re-enactment from picture books by 18- to 30-month-old children. *Developmental Psychology, 42*(6), 1352–1357.

Slater, A., Rose, D., & Morison, V. (1984). New-born infants' perception of similarities and differences between two- and three-dimensional stimuli. British *Journal of Developmental Psychology, 2,* 287–294.

Smith, L. B. (1981). The importance of the overall similarity of objects for adults' and children's classifications. *Journal of Experimental Psychology: Human Perception and Performance, 1,* 811–824.

Snow, C. E., & Ninio, A. (1986). The contracts of literacy: What children learn from learning to read books. In W. Teale & E. Sulzby (Eds.), *Emergent literacy: Writing and reading* (pp. 116–137). Norwood, NJ: Ablex.

Sulzby, E. (1985). Children's emergent reading of favorite storybooks: A developmental study. *Reading Research Quarterly, 20,* 458–481.

Szechter, L. E., & Liben, L. S. (2004). Parental guidance in preschoolers' understanding of spatial-graphic representations. *Child Development, 75,* 869–885.

Teale, W. H., & Sulzby, E. (1986). *Emergent literacy: Writing and reading*. Norwood, NJ: Ablex.

Troseth, G., Pierroutsakos, S. L., & DeLoache, J. S. (2004). From the innocent to the intelligent eye: The early development of pictorial competence (pp. 1–35). In R. V. Kail (Ed.), *Advances in child development and behavior* (Vol. 32). New York: Elsevier/Academic Press.

van Kleeck, A. (2003). Research on book sharing: Another critical look. In A. van. Kleeck, S. A. Stahl, & E. Bauer (Eds.), *On reading books to children: Parents and teachers* (pp. 271–319). Mahwah, NJ: Lawrence Erlbaum Associates.

Whitehurst, G. J., Falco, F., Lonigan, C. J., Fischel, J. E., DeBaryshe, B. C., Valdez-Menchaca, M. C., & Caulfield, M. (1994). A picture book reading intervention in daycare and home for children from low-income families. *Developmental Psychology, 24*, 552–558.

Whitehurst, G. J., & Lonigan, C. J. (1998). Child development and emergent literacy. *Child Development, 69,* 848–872.

Woodward, A. L., Markman, E. M., & Fitzsimmons, C. M. (1994). Rapid word learning in 13- and 18-month-olds. *Developmental Psychology, 30,* 553–566.

Yonas, A., Chov, M., Alexander, A., & Jacques, J. (2003). Actions of 9-month-old infants directed at a real toy, a photographed toy, and surfaces. Poster presented at the meeting of the Society for Research in Child Development, Tampa, FL.

Zaitchik, D. (1990). When representations conflict with reality: The preschooler's problem with false beliefs and "false" photographs. *Cognition, 35,* 41–68.