

REGULAR ARTICLES

What's Up? The Development of an Orientation Preference for Picture Books

Judy S. DeLoache

*Psychology Department
University of Illinois*

David H. Uttal

*Department of Psychology
Northwestern University*

Sophia L. Pierroutsakos

*Department of Psychology
Furman University*

The very strong, natural-seeming preference that adults and older children have for looking at pictures in their canonical orientation is not shared by very young children. In 3 studies with 18- to 30-month-old children, several different assessments were made of the degree to which the children behaved differentially to upright versus inverted picture books. The 18-month-olds in these studies did not exhibit a strong orientation preference: They usually (a) looked at a picture book that was handed to them upside down without reorienting it, (b) did not acknowledge or protest when an adult read to them while holding a book upside down, and (c) selected randomly between upright and inverted picture books. In addition, they were equally accurate at identify-

ing depicted objects in upside-down and right-side-up pictures. In contrast, a group of 30-month-olds consistently preferred to interact with canonically oriented picture books. The 24-month-old participants generally behaved like the 18-month-olds, but gave more evidence of a preference. We suggest that these age differences in orientation preference may have to do with both conceptual and perceptual factors. The results, thus, contribute to the growing evidence that the development of pictorial competence is complex and multifaceted.

The development of symbolic competence is one of the major achievements of the first years of life. Young children in Western societies have experience with a wide array of symbolic representations, including various pictorial media. Television sets are nearly ubiquitous in middle-class homes, and the environment of most children is rich with pictures—artwork and family photographs on the walls, magazines on the tables, and labels on everything from canned goods to compact disc cases to patterns on sheets, clothing, and toys. In addition, most middle-class infants and toddlers have substantial experience with pictures in picture book reading interactions with their parents (Gelman, Coley, Rosengren, Hartman, & Pappas, 1998).

What do infants and very young children make of the pictures to which they have so much exposure? There is no doubt that even young infants can perceive and recognize pictures. For example, 5-month-old infants can recognize pictures of people and toys to which they have been familiarized (DeLoache, Strauss, & Maynard, 1979; Dirks & Gibson, 1977; Rose, 1977), and they can also discriminate between pictures and real objects (DeLoache et al., 1979). Even newborns recognize a two-dimensional representation of a simple shape (Slater, Rose, & Morison, 1984). These abilities do not require pictorial experience; a 19-month-old child with no prior exposure to pictures immediately recognized line drawings and photographs of familiar objects when first presented with them (Hochberg & Brooks, 1962).

Perception is not, however, equivalent to comprehension, as many theorists have pointed out (e.g., Beilin & Pearlman, 1991; DeLoache, Pierroutsakos, & Troseth, 1996; Ittelson, 1996; Sigel, 1978). There is increasing evidence that infants' and toddlers' comprehension of the nature of pictures does not match their precocious perceptual abilities. For example, 9-month-old infants sometimes attempt to treat depicted objects as if they were real objects (DeLoache, Pierroutsakos, Uttal, Rosengren, & Gottlieb, 1998). When presented with books with highly realistic color photographs of single objects, infants of this age manually explore them; they feel, rub, or pat the images, often trying to grasp the depicted objects. These infants appear not to understand the nature of pictures, specifically the ways that depicted objects differ from real objects.

Toddlers show different limitations with respect to pictures, often failing to understand the relation between pictures and the reality they depict. For example,

children around 24 months of age have surprising difficulty matching real object displays and photographs of those displays (DeLoache, Pierroutsakos, & Anderson, 1998; Harris, Kavanaugh, & Dowson, 1997). Two-year-olds who can sensibly interpret a picture of a scene nevertheless fail to exploit the information depicted in it to solve a problem such as locating a hidden object (DeLoache & Burns, 1994).

There are, thus, various discontinuities in infants' and toddlers' understanding of pictures. In this article, we report a new form of discontinuity—a phenomenon that has never, to our knowledge, been systematically investigated. We document dramatic age differences between 18 and 30 months of age in young children's orientation preference for picture books.

There is a canonical orientation for pictures, and orientation has been shown to affect adults' recognition memory for pictures. Adults show better recognition for upright than for inverted pictures, especially faces (e.g., Diamond & Carey, 1986; Rock, 1974; Yin, 1969). Furthermore, adults have a strong orientation preference with respect to pictures: If we pick up a picture book that is inverted, we turn it around; if for some reason we have to look at a picture upside down, we are likely to rotate our heads to try to align ourselves with the image.

Like adults, infants and even newborns can discriminate orientation: Infants who are habituated to a simple visual stimulus in one orientation dishabituate to the same figure presented in a different orientation (e.g., Atkinson, Hood, Wattam-Bell, Anker, & Tricklebank, 1988; Bornstein, Gross, & Wolf, 1978; McGurk, 1970, 1972). Some orientation preferences are also present in infancy. For example, infants as young as 1½ months generally look longer at abstract shapes in a vertical, as opposed to horizontal or oblique, orientation (e.g., Bornstein, 1979; Held, 1989); and 2- to 4-month-old infants smile more and look longer at face photographs presented in an upright orientation than at faces in noncanonical orientations (Hayes & Watson, 1981). Discrimination problems are learned by very young children more easily with right-side-up than upside-down stimuli (Braine, 1978), and preschool and older children perform better when identifying upright pictures (Brooks & Goldstein, 1963; Ghent, 1960). By 10 years of age, children show a particularly large disparity in recognition memory for upright and inverted faces (Carey, Diamond, & Woods, 1980).

Extensive evidence, thus, exists of effects of picture orientation on discrimination, recognition, and preferences in infants. However, we report here that slightly older children do not exhibit a strong preference for upright picture books. The initial inspiration for this research came from informal observations and anecdotal reports of toddlers contentedly looking at their picture books upside down. Our goal in the research presented here was to investigate systematically the validity of these informal observations, to ask to what extent and under what conditions toddlers care whether they are looking at a book upside down or right side up.

STUDY 1

In the first study, three different assessments of orientation preference were made: (a) reorienting a picture book presented to the child upside down, (b) acknowledging or protesting an improperly oriented book in a joint picture book reading session with an adult, and (c) choice of a properly oriented versus inverted book.

Method

Participants. The participants were 72 children, with 24 (12 girls, 12 boys) in each of three age groups: 18-month-olds (18–19 months old, $M = 18.2$), 24-month-olds (23–25 months old, $M = 24.1$), and 30-month-olds (29–31 months old, $M = 30.0$). Half the children of each age and gender were assigned to one stimulus order and half to the other. As in all the research reported here, the children's names came from files of newspaper birth announcements, their parents were contacted by telephone, and the sample was predominantly White and middle class.

In all parts of all three studies reported, at least two stimulus orders were used, and order was always counterbalanced with gender, age, and other relevant variables. Because there were no differences for order or gender, we do not mention these factors further.

Materials. Seven standard children's books served as stimuli.¹ All the pictures in the books were objects or scenes that had a clear upright dimension.

Procedure. The three-part sessions were conducted in the participants' homes, with at least one parent present. The first part involved four trials in which the child was handed an open book and invited to look at it. On two trials the book was presented upside down, and on the other two trials it was handed to the child right side up, with order counterbalanced. Neither the experimenter nor the parent ever commented on the orientation of the books. The question of interest was

¹The books used for Study 1 were *The Little Kitten*, *The Little Lamb*, *The Little Goat* (all Random House), *Baby's First Book*, *My ABC Book* (Platt & Munk), and *Baby's First ABC* (Preschool Puppet Book) plus one of the child's own books. The first three of the books provided by the experimenter were made up of color photographs and had a narrative structure. The next three were standard baby books with from one to four simple objects depicted per page and no story line. The stimuli in Study 3 were *Richard Scarry's Best Word Book Ever* (Golden Press, New York), and *Spot's Big Book of Words* (Ventura, London). There were no apparent differences in the children's behavior as a function of the different books.

whether the children would refuse or spontaneously reorient any of the books (especially those presented upside down).

The second part of the session was a joint book “reading” interaction in which the child and the experimenter looked at four books together. The experimenter initially held each book either upside down or right side up, but then reoriented it halfway through. Again, neither adult ever commented on the book’s orientation, either initially or when it was turned. If a child verbally or nonverbally acknowledged or protested the book’s orientation, the experimenter turned it right side up. If a child turned the book himself or herself, it was left that way.

The third part of the session was a choice trial in which the experimenter held out two copies of the same book turned to the same page. One book was right side up and the other upside down, with left–right position varied across children. The experimenter encouraged the child to choose one of the books, asking “Which one would you like? Take one.” We were interested in whether the children would prefer the properly oriented book over the upside-down one.

Results and Discussion

The pattern of results in this study revealed age differences in the degree of young children’s orientation preference. The 30-month-olds generally gave evidence of caring whether a book was upside down or right side up, whereas the two younger groups’ response to picture orientation was quite weak.

Figure 1 shows the proportion of responses to the upside-down picture books in the three parts of the study. The results are shown in proportions to facilitate comparison across the different parts of the study, but all the analyses were performed on the number of responses.

The overall proportion of times the children reoriented the upside-down books handed to them is shown in Figure 1a. A one-way analysis of variance (ANOVA) of the number of reorientations revealed a significant age difference, $F(2, 60) = 3.38, p < .05$. Post hoc tests revealed that the 30-month-olds turned the two books around significantly ($p < .05$) more often ($M = 1.42, SD = .84$) than did either the 18-month-olds ($M = 0.62, SD = .86$) or the 24-month-olds ($M = 0.78, SD = .97$). The two younger groups did not differ from each other in their tendency to reorient the upside-down books. The number of children in the 18-, 24-, and 30-month-old groups who never reoriented the books was 9, 10, and 5, respectively.

In the joint book reading part of the session, the children typically did not respond to the four books when held upside down by the experimenter; most of the time they neither commented on nor protested an inverted book, and they never turned it themselves. Figure 1b shows the proportion of upside-down books responded to. In an ANOVA of the number of responses to the upside-down books, there was a significant age difference, $F(2, 65) = 3.29, p < .05$. Post hoc tests indi-

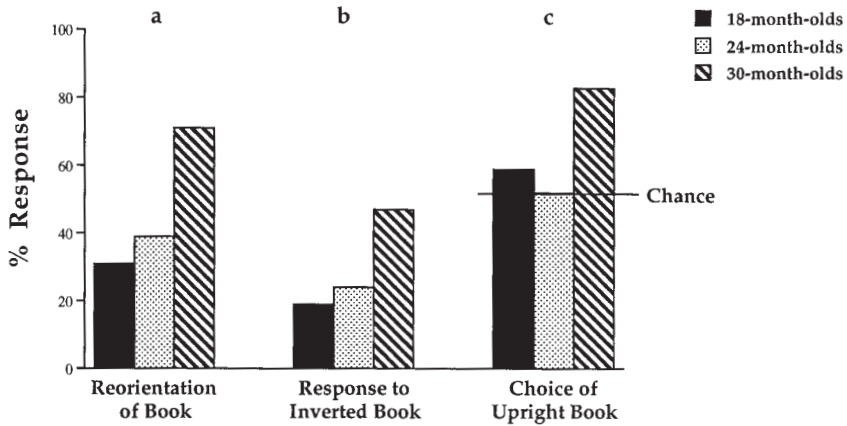


FIGURE 1 Age differences in orientation preference for picture books shown by the three age groups in Study 1. Panel a shows the proportion of times children reoriented a book handed to them upside down. Panel b shows the proportion of children who ever responded to the orientation of a book held upside down by the experimenter in a joint picture book reading session. Panel c shows the proportion of times children chose the upright member of a pair of books, compared to the chance level of 50%.

cated that the 30-month-olds were significantly more likely to acknowledge or protest being read to from an upside-down book ($M = 2.08$, $SD = .93$) than were the 18-month-olds ($M = 0.76$, $SD = .75$) or 24-month-olds ($M = 0.96$, $SD = .71$). The number of individual children in the three age groups who never responded to the orientation of the book held by the experimenter were 18, 16, and 11, respectively.

In the third part of the session, the children were offered a choice between a properly oriented book and the same book upside down. The proportion of choices of the upright book are shown in Figure 1c. The selections of the 18-month-olds (59%) and 24-month-olds (52%) did not differ from chance (50%), but the 30-month-olds chose the upright book (83%) significantly more often than chance, $t(23) = 3.81$, $p < .05$ (one-tailed).

The results from the three parts of this study were generally consistent. The 18- and 24-month-old children gave only weak evidence of caring whether they interacted with a picture book in its canonical, upright orientation or in an inverted position. When handed an upside-down book, they usually looked at it in whatever orientation it was given to them. When engaged in a picture book interaction with an adult who was holding the book upside down, they rarely indicated any displeasure or desire to have the book turned right side up. When offered a choice between identical upside-down and right-side-up books, they responded at chance.

The 30-month-olds, however, showed a stronger orientation preference. They typically turned around an upside-down book to look at it, and they chose a prop-

erly oriented book over an inverted one. When reading with an adult, they responded to the orientation of upside-down books significantly more often than the younger children did, although they still reacted only half the time to noncanonically oriented books.

These results suggest two conclusions: (a) Very young children do not initially have a strong preference for the canonical orientation of a picture book, and (b) their orientation preference grows substantially between 24 and 30 months of age (at least in this sample of middle-class U.S. children). Thus, young children do not share the very strong orientation preference of their parents and older siblings. This result is not due to an absence of experience; all of the children's parents reported frequently engaging in picture book interactions with them (during which, needless to say, the book was always properly oriented).

Because the results of the first study were relatively surprising, we wanted to look further for evidence of a picture book orientation preference in 18- and 24-month-olds. In particular, we thought that the weak response by these children in Study 1 to the upside-down books in the joint reading session with the experimenter might be, at least in part, due to interaction with an unfamiliar adult. Perhaps children would behave differently in a picture book interaction in which their own mother held the book in an unfamiliar orientation.

STUDY 2

Study 2 had three parts. In the first, mothers and their children engaged in their ordinary joint picture book reading interactions, except that the mother occasionally held the book upside down and recorded her child's response. In the second part, the experimenter showed the children upright and inverted pictures from the same category (e.g., men) and asked them to point (e.g., "show me the man"). In the third part, the children were asked to point to objects that were named by the experimenter while she held a book either right side up or upside down. We were interested in whether the children's identification accuracy would be affected by orientation.

Method

Participants. The participants were a new group of 24 children, including 12 (6 girls and 6 boys) in each of two age groups: 18-month-olds (18–22 months old, $M = 18.8$) and 24-month-olds (23–24 months old, $M = 23.4$).

Materials. Standard commercial children's books were used for the joint mother-child picture book interactions. A special book was constructed for the

choice trials. It was a binder with transparent envelopes into which 10 pictures were inserted. The pictures included two similar but clearly different versions of five categories: men, babies, kittens, lambs, and ducks. These categories were selected to be highly familiar to 18-month-olds and to have names that even these young children would be likely to know. The pictures were arranged so that when the book was opened, two different versions of the same category would appear on opposite sides. One picture of each pair (e.g., a man, shown digging in the ground with a shovel) was right side up, and the other (e.g., another man, portrayed watering a plant with a hose) was upside down. Orientation and right–left position were varied across participants. For the picture identification trials, four pictures from a standard, popular children’s book were used. Each picture was a complex scene with familiar content in which many objects were depicted (farm animals, zoo animals, a house, clothing).

Procedure. The first part of the study was conducted by the mothers of the children, following our detailed instructions. During a 2-week period, each mother started six book reading interactions with a book held upside down. She recorded on a data sheet provided for the purpose any comments or other actions the child made with respect to the orientation of the book. Otherwise, the mother–child pairs followed their normal book reading routines.

Approximately 3 days after the conclusion of the mothers’ observations, the experimenter conducted two tests in the children’s homes. First, the experimenter showed the child the five pairs of pictures in the specially constructed book. For each pair, which included different versions of the same category, the child was asked to “point to the [category name—man, baby, kitty, lamb, duck].” Thus, pointing to either picture would be a correct response to the command, but one picture was upright and the other one was inverted.

Finally, the child sat with the experimenter to look at the picture books with complex scenes. There were four picture identification trials, each one with a different picture. The child was asked to point to 10 different items in each picture: “Where’s the [horse, tiger, bed, shirt, etc.]?” The named objects were those we thought children of this age would be most likely to know. For each child, two of the pictures were right side up, and two were presented upside down. Orientation and picture were counterbalanced across children.

Results and Discussion

According to the mothers’ records of their book reading interactions with their children, the children commented on the book being upside down or reoriented it themselves about half the time. The 18- and 24-month-olds reacted to the orientation of

the upside-down books on 46% and 57% of the six trials, respectively. Thus, these children were somewhat more likely to protest when it was their own mother holding a book upside down than the children of the same age in Study 1 had been with an unfamiliar person, although the unusual orientation was still accepted almost half the time. However, the mean levels obscure the fact that performance was distinctly bimodal for both age groups. Of the total group of 24 children, 9 children (5 of the younger group and 4 of the older group) never responded to the unusual orientation, whereas 10 children (4 of the younger group and 6 of the older group) always protested the upside-down books. Only 5 children did not fall at these extremes.

On the five choice trials, in which the child was asked to point to the x (one version of which was properly oriented and one inverted), either response was actually correct, and children occasionally pointed to both. The proportion of times the child pointed to the upright picture or to both pictures was 70% ($M = 3.75$) for the 24-month-olds and 53% ($M = 2.72$) for the 18-month-olds. The older children pointed to the upright picture significantly more often than chance, $t(11) = 3.16$, $p < .05$, but the younger children obviously did not.

The picture identification trials, in which the children were asked to point to 10 named items in complex pictures, were apparently quite difficult for some of these young children. Six of the 18-month-olds and 2 of the 24-month-olds either could not identify the named objects or refused to point. The proportions of named objects that were correctly identified (pointed to) by the remaining children were as follows: The younger children identified 32% of the named objects when the picture was right side up and almost the same amount (27%) when the picture was inverted. The older children were more accurate overall, and they also showed a different pattern with respect to orientation. They pointed correctly to 71% of the named objects in the canonically oriented pictures, but they were only 39% correct when identifying objects in upside-down pictures.

It was not possible to perform an ANOVA on these data, however, because 2 of the 10 older children immediately turned the inverted books right side up. Hence, they had no identification score for the initially upside-down pictures. Accordingly, we performed a nonparametric test (Fisher's t), comparing the number of children in each age group who gave evidence of a bias toward right-side-up pictures, either by identifying more objects in the canonically oriented versus the inverted books or by spontaneously reorienting the upside-down pictures. Only 2 of the 6 younger children showed such a bias, but 9 of the 10 older ones did. This difference was significant ($p < .05$). The results for the 24-month-olds are, thus, consistent with earlier reports of an upright advantage in preschool children's identification of photographs of their classmates' faces (Brooks & Goldstein, 1963), matching depicted objects (Ghent, 1960), and learning a discrimination problem based on orientation (Braine, 1978).

The results of Study 2 are consistent with those of Study 1 in indicating that 18- and 24-month-old children do not share the strong orientation preference of older

individuals. However, the data reported in this study differ in that some children gave some evidence of preference on some of the measures. In the joint book reading with their mothers, some (not quite half) of the children in both age groups consistently responded to the unfamiliar orientation. In the two pointing and identification tasks, the 24-month-old group responded differentially as a function of orientation. In addition, there was some cross-task consistency: Children who usually indicated they wanted their mother's book turned around (on four to six of the six trials) chose the right-side-up picture more than half the time in the choice trial (on four to five of the five trials), $\chi^2(1, N = 22) = 10.14, p < .05$.

Across the two studies, we see a growing orientation preference for picture books between 18 and 30 months of age. The 18-month-olds exhibited a remarkable indifference to picture orientation on some measures, whereas the 30-month-olds consistently preferred canonically oriented books.

Study 3 was designed to follow up on the surprising absence in Study 2 of a difference in the 18-month-olds' identification accuracy for upright and inverted pictures. We wanted to see if this result would replicate even in children's interactions with their own mothers rather than an unfamiliar person.

STUDY 3

Method

Participants. The participants were 12 children in an 18-month-old age group (17–21 months old, $M = 18.5$), including 6 girls and 6 boys. The children were randomly assigned to one of four stimulus orders.

Materials. Two large picture books similar to those used in Study 2 (approximately 25×30 cm) were used.

Procedure. As in the previous studies, all observations were conducted in the participants' homes, with at least one parent present. The child was seated with his or her parent. The parent was given a picture book open to a scene in which many familiar objects were depicted. The parent was instructed to hold the picture book either right side up or upside down and was given a list of six items to ask the child to identify in the picture. A second book was then given to the parent in the opposite orientation of the first book, along with a new list of six items to ask the child to identify. Half of the children had the upside-down book first, and half had the opposite. Which of the two books was upside down was counterbalanced across par-

ticipants. Neither the experimenter nor the parent ever commented on the orientation of the book.

Results and Discussion

The results for the identification of depicted objects in the picture books very closely paralleled those in Study 2. The children correctly pointed to 32% of the named objects in the upside-down books and to 33% in the right-side-up books (compared to 32% and 27% in Study 2). Thus, we again see no difference in the identification accuracy of 18-month-olds as a function of the orientation of a picture book.

GENERAL DISCUSSION

The three studies reported here establish a hitherto unreported phenomenon—the emergence of a strong orientation preference for picture books between 18 and 30 months of age. The 18-month-olds in these studies usually (a) looked at a picture book that was handed to them upside down without reorienting it, (b) did not acknowledge or protest when someone else read to them while holding a book upside down, and (c) chose randomly between upright and inverted picture books. In addition, they were equally accurate at identifying depicted objects in upside-down and right-side-up books. In contrast, 30-month-old children typically preferred canonically oriented books in all the situations we tested. Our 24-month-old participants generally behaved more like the 18-month-olds, but provided a bit more evidence of an orientation preference. Along with these general age trends, there were individual differences at all three ages; even in the 18-month-old group, some children favored upright over inverted books and pictures in some situations.

Why do very young children not share the strong picture orientation preference of their parents? There are two realms of experience that may be important in the development of an orientation preference. One is specific experience with picture books. Although all these children had enjoyed many hours in picture book interactions with their parents and others, it might take a substantial amount of experience to learn the cultural convention of interacting with picture books in one particular way—with the book held in the conventional, upright orientation. Looking at pictures this way is so natural to adults that it is hard to imagine an alternative; it is difficult to think of picture orientation as a convention. However, pictures are distinctly different from real-world settings and objects in that they have no qualities other than visual; they offer no affordances or consequences. Unlike the real thing, a picture of a glass of milk will not spill if turned upside down,

and one cannot sit in a depicted chair, regardless of whether its legs point down toward the floor or up toward the ceiling.

Very general world experience may also play a role in the development of an orientation preference for pictures. Perhaps the relative indifference to picture orientation that we observed in the youngest participants in this research reflects a relative lack of general perceptual experience. The importance of specific experience—or expertise—is well established with respect to the effect of orientation on picture recognition by older children and adults. Diamond and Carey (1986) argued persuasively that the large advantage of the upright orientation for faces is in part attributable to the enormous amount of experience that everyone has with faces. This claim is supported by the fact that dog experts (dog show judges, dog breeders, and dog aficionados) show a similarly large difference in recognition memory for upright versus inverted pictures of dogs (Diamond & Carey, 1986). Thus, greater experience with certain kinds of stimuli leads to greater effects of orientation. Diamond and Carey related the expertise results to the fact that the magnitude of the upright face advantage increases with age (Carey et al., 1980). They suggested that the expertise and the developmental effects may be due to a shift with experience from piecemeal encoding of isolated features to relational encoding of the configuration of features.

We can speculate then that very young children—the “universal novices” of the world (Brown & DeLoache, 1978)—may simply not have accumulated enough perceptual experience to have shifted from piecemeal to more comprehensive encoding of visual stimuli, with the result that they are not strongly affected by picture orientation. We, thus, propose that the development of a preference for upright orientation of picture books may have to do with both general *perceptual* experience and specific *conceptual* progress—increased understanding of the conventions of picture book reading. This developmental progression is proposed for pictures only; that is, it is specific to a class of entities without the affordances of real objects. In future research, we plan to compare directly young children’s orientation preference for orientation-specific real objects versus pictures of those objects, with the expectation that a reliable preference will be apparent at an earlier age for the objects than for the pictures.

Furthermore, we see the development of an orientation preference as part of the more general development of *pictorial competence* (DeLoache & Burns, 1994; DeLoache et al., 1996)—recognizing, interpreting, using, and understanding pictures; and full pictorial competence includes the simplest perception of depicted information and the most sophisticated understanding of the conventions, techniques, and uses of pictorial media. There are many steps in the development of mature pictorial competence, and its achievement takes several years.

The earliest step is developing the *picture concept*, coming to understand the basic differences between pictures and real objects. As we described earlier, when 9-month-old infants are presented with realistic photographs of objects, they re-

spond to the depicted objects as if they were real, feeling, rubbing, and even trying to grasp the images (DeLoache, Pierroutsakos, Uttal, et al., 1998). In spite of being able to perceive depicted information and to discriminate between real objects and their depictions, these infants do not yet understand how pictures and objects differ. By 19 months, infants have acquired this important distinction; they point to and label depicted objects, rather than manually investigating them. Thus, by the middle of the second year of life, infants have an initial concept about pictures, which includes features such as two-dimensional, nontangible, nonreal, as well as some representation of the contexts in which pictures occur and how they are used.

Encounters with pictures now result in a two-part, or dual, mental representation: A picture of x is mentally represented as x and *picture of x* . The child perceives the content of the picture— x —and that calls to mind other knowledge about x s in general or about the particular x that is depicted. At the same time, the *picture of* representation, a kind of mental tag, specifies that this particular x is not a real x . It further indicates that part of the child's mental representation of x does not apply; x cannot be picked up, it will not move, it would not be cold to the touch, its teeth are not to be feared, and so on. Thus, representing a stimulus as *picture of x* temporarily cancels part of the normal mental representation of x . The idea of a *picture of* tag is similar to mental markers proposed by Leslie (1987) and Harris and Kavanaugh (1993) that keep nonliteral representations involved in pretend play from intruding on serious ones.

The very young children who participated in the research reported here clearly had an initial picture concept. It is possible that this concept contributed to the relatively weak orientation preference shown by the youngest ones. The mental tag *picture of* that temporarily cancels the child's representation of many of the physical features of the depicted object may also remove the constraints of orientation applicable to real objects. Although turning over a real glass of milk would have a definite, undesired outcome, there is no functional consequence to an upside-down picture of a glass. Thus, what they do know about pictures may combine with what they do not yet know—the picture orientation convention—to result in a relatively weak preference for picture orientation. DeLoache et al. (1996) described other examples of development-induced errors with respect to pictures—cases in which very young children's developing but still incomplete knowledge about pictures causes them to fail to use pictures appropriately.

In conclusion, the research presented in this article establishes the gradual emergence of an orientation preference for picture books, and it reveals some factors that influence whether young children respond differentially to upright and inverted pictures. However, there are many questions to be addressed in future research to gain a better understanding of this phenomenon. For example, given that some children behaved differently to upside-down and right-side-up pictures in some situations, but not in others, more sensitive measures might reveal additional differences. Thus, young children who do not reorient an upside-down book

might nevertheless look for a longer time at a right-side-up book. Similarly, even though there was no difference in the accuracy with which our 18-month-old participants identified depicted objects as a function of orientation, such difference might appear (a) if simpler pictures were used, or (b) if the latency to identify upright and inverted pictures were examined.

The results reported here, thus, contribute to the growing evidence that the development of pictorial competence (DeLoache & Burns, 1994; DeLoache et al., 1996) is very complex and involves many steps. The emergence of a preference for looking at picture books in their canonical orientation is one of the very early steps in this progression.

ACKNOWLEDGMENTS

The research reported here was supported in part by Grant HD-25271 from the National Institute of Child Health and Human Development to Judy S. DeLoache, by NIH postdoctoral Fellowship HD-07205 to David H. Uttal, and by University of Illinois and NIH predoctoral Fellowships HD-07205 to Sophia L. Pierroutsakos.

REFERENCES

- Atkinson, J., Hood, B., Wattam-Bell, J., Anker, S., & Tricklebank, J. (1988). Development of orientation discrimination in infancy. *Perception, 17*, 587-595.
- 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* (Vol. 23, pp. 73-111). New York: Academic.
- Bornstein, M. H. (1979). Perceptual development: Stability and change in feature perception. In M. H. Bornstein & W. Kessen (Eds.), *Psychological development from infancy: Image to intention* (pp. 37-81). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Bornstein, M. H., Gross, C. G., & Wolf, J. Z. (1978). Perceptual similarity of mirror images in infancy. *Cognition, 6*, 89-116.
- Braine, L. G. (1978). A new slant on orientation perception. *American Psychologist, 33*, 10-22.
- Brooks, R. M., & Goldstein, A. G. (1963). Recognition by children of inverted photographs of faces. *Child Development, 34*, 1033-1040.
- Brown, A., & DeLoache, J. S. (1978). Skills, plans and self-regulation. In R. Siegler (Ed.), *Children's thinking: What develops?* (pp. 3-35). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Carey, S., Diamond, R., & Woods, B. (1980). Development of face recognition—A maturational component? *Developmental Psychology, 16*, 257-269.
- DeLoache, J. S., & Burns, N. M. (1994). Early understanding of the representational function of pictures. *Cognition, 52*, 83-110.
- DeLoache, J. S., Pierroutsakos, S. L., & Anderson, K. (1998). [Very young children's ability to match pictures and object displays]. Unpublished raw data.
- DeLoache, J. S., Pierroutsakos, S. L., & Troseth, G. (1996). The three R's of pictorial competence. In R. Vasta (Ed.), *Annals of child development* (pp. 1-48). Bristol, PA: Jessica Kingsley.

- 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. S., & Maynard, J. (1979). Picture perception in infancy. *Infant Behavior and Development, 2*, 77–89.
- Diamond, R., & Carey, S. (1986). Why faces are and are not special: An effect of expertise. *Journal of Experimental Psychology, 2*, 107–117.
- Dirks, J. R., & Gibson, E. (1977). Infants' perception of similarity between live people and their photographs. *Child Development, 48*, 124–130.
- Gelman, S. A., Coley, J. D., Rosengren, K. S., Hartman, E. E., & Pappas, A. S. (1998). Beyond labeling: The role of parental input in the acquisition of richly structured categories. *Monographs of the Society for Research in Child Development, 63*(1, Serial No. 253).
- Ghent, L. (1960). Recognition by children of realistic figures presented in various orientations. *Canadian Journal of Psychology, 14*, 249–256.
- Harris, P. L., & Kavanaugh, R. D. (1993). Young children's understanding of pretense. *Monographs of the Society for Research in Child Development, 58*(1, Serial No. 231).
- Harris, P. L., Kavanaugh, R. D., & Dowson, L. (1997). The depiction of imaginary transformations: Early comprehension of a symbolic function. *Cognitive Development, 12*, 1–19.
- Hayes, L. A., & Watson, J. S. (1981). Facial orientation of parents and elicited smiling by infants. *Infant Behavior and Development, 4*, 333–340.
- Held, R. (1989). Perception and its neuronal mechanisms. *Cognition, 33*, 139–154.
- Hochberg, J., & Brooks, V. (1962). Pictorial recognition as an unlearned ability: A study of one child's performance. *American Journal of Psychology, 75*, 624–628.
- Ittelson, W. H. (1996). Visual perception of markings. *Psychonomic Bulletin & Review, 3*, 171–187.
- Leslie, A. M. (1987). Pretense and representations: The origins of "theory of mind." *Psychological Review, 94*, 412–426.
- McGurk, H. (1970). The role of object orientation in infant perception. *Journal of Experimental Child Psychology, 9*, 363–373.
- McGurk, H. (1972). Infant discrimination of orientation. *Journal of Experimental Child Psychology, 14*, 151–164.
- Rock, I. (1974). The perception of disoriented figures. *Scientific American, 230*, 78–85.
- Rose, S. A. (1977). Infants' transfer of response between two-dimensional and three-dimensional stimuli. *Child Development, 48*, 1086–1091.
- Sigel, I. E. (1978). The development of pictorial comprehension. In S. Bikkar, B. S. Randhawa, & W. E. Coffman (Eds.), *Visual learning, thinking and communication* (pp. 93–111). New York: Academic.
- Slater, A., Rose, D., & Morison, V. (1984). Newborn infants' perception of similarities and differences between two- and three-dimensional stimuli. *British Journal of Developmental Psychology, 2*, 287–294.
- Yin, R. K. (1969). Looking at upside-down faces. *Journal of Experimental Psychology, 81*, 141–145.