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The Origins of Pictorial Competence

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Abstract

Pictorial competence, which refers to the many factors involved in perceiving, interpreting, understanding, and using pictures, develops gradually over the first few years of life. Although experience is not required for accurate perception of pictures, it is necessary for understanding the nature of pictures. Infants initially respond to depicted objects as if they were real objects, and toddlers are remarkably insensitive to picture orientation. Only gradually do young children figure out the nature of pictures and how they are used.

Keywords

symbolic development; picture perception

As philosophers, new and old, have emphasized, humans are “the

symbolic species” (Deacon, 1997), and symbolization is the “most characteristic mental trait of [humans]” (Langer, 1942, p. 72). Just as the emergence of the symbolic capacity in the course of evolution irrevocably transformed the human species, so too does the development of symbolic functioning transform young children. The capacity for symbolization vastly expands their intellectual horizons, liberating them from the constraints of time and space and enabling them to acquire information about reality without directly experiencing it.

All children growing up anywhere in the world must master a wide variety of symbol systems and symbolic artifacts for full participation in their society. Our research has focused on how young children begin to understand and exploit the informational potential of various symbolic objects, including models, maps, and pictures.

We define a symbolic artifact as something that someone intends to stand for something other than itself (DeLoache, 1995). Thus, virtually anything can serve as a symbol, and virtually any concept that one has can be symbolized, but the symbol is always different in some way from that which it represents. What makes something symbolic is human intention; an entity becomes a symbol only as the result of a person using it to denote or refer to something.

THE CHALLENGE OF DUAL REPRESENTATION

Although mastering symbols is a universal task, it is not an easy one. A formidable challenge to young children in developing competence with symbols stems from the inherently dual nature of symbols; every symbolic artifact is an object in and of itself, and at the same time it also stands for something other than itself. To understand and use a symbol, *dual representation* is necessary—one must mentally represent both facets of the symbol’s dual reality, both its concrete characteristics and its abstract relation to what it stands for

(DeLoache, Pierroutsakos, & Troseth, 1996).

It is quite difficult for young children to simultaneously hold in mind the two aspects of symbolic objects. The younger the child, the more he or she tends to focus on the concrete object itself, consequently failing to appreciate its abstract relation to what it stands for. To achieve dual representation with respect to a given symbolic object, children must avoid becoming "captured" by the object itself and keep in mind both the object and its referent. Research on the development of children's understanding of pictures reveals that these apparently simple symbols present challenges to the newest members of the symbolic species.

PICTURES AND THE INNOCENT OR INTELLIGENT EYE

A long-standing debate in psychology and other fields has centered on the degree to which experience is necessary to perceive and understand pictures: Do infants and young children look at pictures with an innocent eye (Gombrich, 1969) or with an intelligent eye (Gregory, 1970)? In other words, do children have to learn how to read pictures, how to interpret the code that relates pictures to the world they represent, as art historian Gombrich (1969) and philosopher Goodman (1976) argued? Are pictures cultural artifacts that members of a society must learn to interpret in context, as argued by anthropologists such as Derogowski (1989)? Or was Gibson (1979) correct that special skills are not needed for dealing with pictures because they provide much of the same information that is available from the real world?

As with many long-standing debates, neither the answer nor the

appropriate question is so simple. For one thing, the complex nature of even the simplest pictures is often overlooked. Ittelson (1996) pointed out that specifying what the term "picture" properly refers to is surprisingly difficult. Given that pictures themselves are complex, it follows that achieving a full understanding of them is quite complex. To foreshadow our conclusion, we maintain that the young eye is never wholly innocent, but it is only as intelligent as the head in which it resides.

PICTORIAL COMPETENCE

We use the term *pictorial competence* to encompass the many factors that are involved in perceiving, interpreting, understanding, and using pictures, ranging from the straightforward perception and recognition of simple pictures to the most sophisticated understanding of the conventions and techniques of highly complex ones (DeLoache et al., 1996). Full pictorial competence involves both perceptual abilities and conceptual knowledge. In perceiving and interpreting a picture, a viewer not only sees the representation—the picture surface—but also "sees through" it to its referent. At the same time, the viewer must understand and keep in mind the nature of the relation between representation and referent. Finally, pictorial competence also includes pragmatic knowledge about how pictures are produced and used.

There is ample evidence that young infants, even newborns, possess some elements of pictorial competence. (See DeLoache et al., 1996, for a summary.) For one thing, they can discriminate between actual objects and depictions of objects. For another, infants can recognize familiar objects and people in photographs or drawings.

Clearly, pictorial experience is not necessary for accurate picture perception. But this precocity in picture perception is only the beginning of the story.

GRASPING THE NATURE OF PICTURES

Despite their ability to perceive pictures and discriminate depicted from real objects, young infants do not understand the nature of pictures nor the differences between pictures and their referents. This conclusion comes from an ongoing series of studies in which we are observing infants as they are allowed to explore pictures of familiar types of objects (DeLoache, Pierroutsakos, Uttal, Rosengren, & Gottlieb, 1998; Pierroutsakos & DeLoache, 2003). Each infant sits in a high chair, and a book is placed on the tray directly in front of him or her. The specially constructed books we use contain highly realistic color photographs of single objects.

A person who can perceive pictures and also understands their nature would simply look at the depicted objects. That is not, however, what the 9-month-old infants in our research do. Instead, almost every infant we have tested in several studies has at least once manually explored the depicted objects. As illustrated in Figure 1, babies touch, rub, and strike at the surface of the pictures, and they frequently make grasping motions as if trying to pick up the depicted objects.

Some babies are notably persistent, making repeated attempts to pluck the objects from the page; others react to some but not all of the pictures; and a few are satisfied with a lone attempt. The impression we have watching the infants in our research is that some of them really think they should be able to grasp and pick up the depicted objects. Others do not seem



Fig. 1. Infants' manual investigation of pictures. The babies on the left and in the middle are manually investigating a color photograph of an object. In an excess of zeal, the third child has bent over to put his mouth on the nipple of a depicted baby bottle. All three of these children are to some extent treating the depicted objects as if they were real objects.

to be so sure, but nevertheless give it a try.

It is important to note that this behavior does not reflect a failure to discriminate between pictures and objects. When a real object is presented side by side with a photograph of that object, infants almost always reach for the object first, indicating clear discrimination between two- and three-dimensional stimuli. At the same time, the more a picture resembles an actual object, the more infants try to interact with it. As shown in Figure 2, infants' manual investigation of depicted objects varies as a function of the degree of pictorial realism (Pierroustakos & DeLoache, 2003). Color photographs elicit substantially more manual investigation than do less realistic pictures.

Infants' manual exploration of two-dimensional images is not limited to still pictures. In one study (Pierroustakos & Troseth, 2003), 9-month-olds seated close to a monitor viewed a video presentation in which a hand deposited an object on a tabletop. The infants grasped at and tried to pluck the object off the video screen, just as children in the earlier studies did with pictures in books. When shown a moving object, such as a windup snail slowly lumbering across the screen, the children were particularly persistent at reaching for it.

The manual exploration of pictures that is so common and easily elicited in 9-month-olds becomes increasingly less common as they grow older. In one of our studies (DeLoache et al., 1998), we compared how young children of different ages interacted with pictures (see Fig. 3). The level of manual exploration was highest among

9-month-olds and substantially lower among 15-month-olds; virtually none of the 19-month-olds investigated the pictures manually. The decline in manual exploration among the older children was accompanied by an increase in a different manual behavior—pointing at pictures, often accompanied by verbalizations. Thus, as children

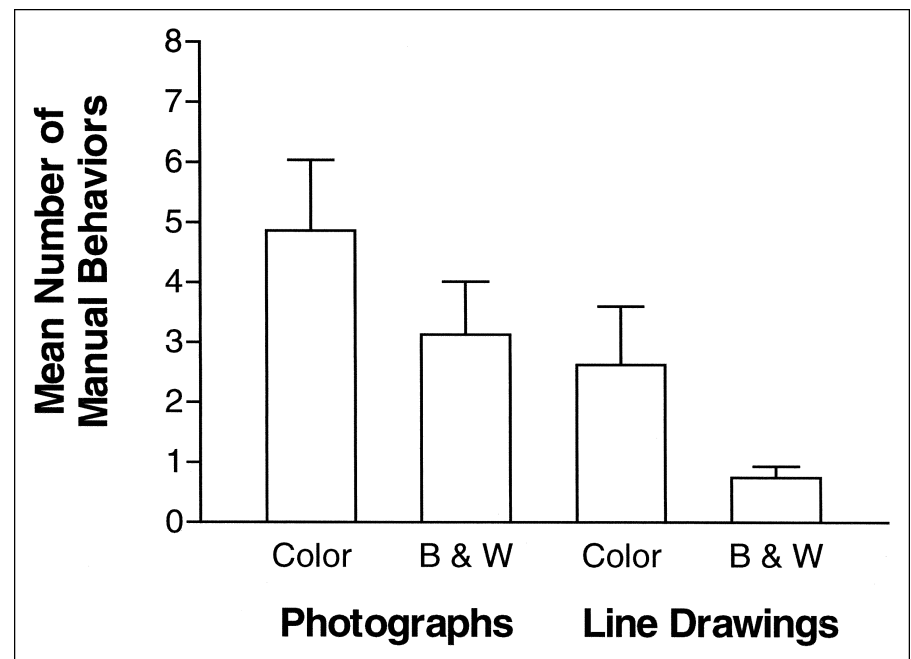


Fig. 2. The relation between infants' manual exploration of pictures and the pictures' degree of realism (Pierroustakos & DeLoache, 2003). Across the range from black-and-white (B & W) line drawings through color photographs, the more a depicted object resembles a real object, the more infants manually explore the image by feeling, patting, and grasping at it.

become older, they increasingly attempt to get another person to share their interest in a depicted object, instead of trying to interact directly with it. By the time children are 19 months of age, depicted objects have become objects of contemplation and communication, not action.

Why do infants grasp at pictures? We think it is because they do not understand the *nature* of pictures. As we have noted, there is no question that they can accurately perceive a difference between pictures and objects. What our research indicates is that infants do not yet understand the significance of that difference; they do not appreciate that pictures share only some of the attributes of their referents.

We thus think the manual exploration of pictures that we have documented reflects a conceptual, not a perceptual, deficit. Infants do not know *what kind of thing* a picture is. Not understanding the significance of two-dimensionality, they respond to realistic pictures as if they were three-dimensional objects. By 19 months of age, the middle-class American children we have studied have come to understand the

crucial nature of the difference between real objects and depicted objects. (This developmental change would presumably occur more slowly in societies in which children receive substantially less exposure to pictures.) Despite their perceptual and cognitive prowess, young children still have a substantial amount of pragmatic knowledge to acquire about how pictures are used.

PICTURE ORIENTATION

Nothing seems more natural to adults than that a picture has a correct orientation, and adults have a strong preference for viewing pictures right side up—with the depicted entity oriented to the viewer as it would typically be in the world. Young children do not share this preference.

Our research on young children's sensitivity to picture orientation started with casual observations and parental anecdotes of toddlers happily looking at their picture books upside down—a rather surprising observation, given that much younger infants

can discriminate orientation and prefer looking at some stimuli (familiar faces) in their normal upright orientation. Studies in our lab have verified that very young children have at best a weak preference for viewing pictures right side up (DeLoache, Uttal, & Pierroutsakos, 2000; Pierroutsakos & DeLoache, 2003). If 18-month-olds are handed an upside-down book to look at, they usually study it in its inverted orientation, not bothering to turn it around. If an adult holds a picture book upside down while reading to them, they typically do not protest or try to reorient it. Their indifference to orientation is specific to pictures: If handed an upside-down object, they almost always reorient it.

Young children's indifference to picture orientation extends beyond a lack of preference: In two studies using different kinds of pictures, 18-month-olds were equally accurate at identifying pictures in their upright and inverted orientations. Furthermore, the time it took them to point to the correct item did not differ for upright and inverted pictures (Pierroutsakos & DeLoache, 2003).

The 18-month-olds in this research had clearly not yet acquired the cultural convention of picture orientation. Although they knew that picture-book interactions involve pointing to and talking about pictures, they had not yet developed a preference for looking at pictures in a particular orientation. An interesting question is to what extent that development may arise from a shift from a piecemeal to a more integrated perception of pictures.

DEVELOPING AN INTELLIGENT EYE

The research summarized here indicates that infants and very

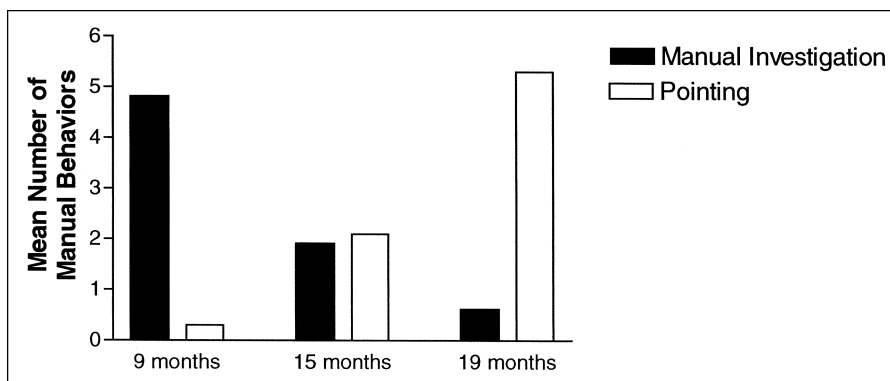


Fig. 3. Mean number of times 9-month-olds, 15-month-olds, and 19-month-olds interacted with pictures by manually exploring them versus pointing at them. Manual exploration of depicted objects decreased with age, presumably because as infants grow older, they figure out how depicted objects differ from real ones. At the same time, they increasingly point to pictures, often while naming the depicted object or requesting that someone else name it. From DeLoache, Pierroutsakos, Uttal, Rosen, and Gottlieb (1998).

young children only gradually develop an intelligent eye for pictures. Very early on, infants possess some aspects of pictorial competence. However, it takes several months of pictorial experience to appreciate the fact that a picture shares only a few of the qualities of its referent. An appreciation for the pragmatics of picture use comes later, with toddlers gradually adopting the convention that pictures are to be looked at in a particular orientation. Full pictorial competence takes several more years to develop, as young children come to understand increasingly more about pictures (see DeLoache et al., 1996).

Our research leads us to both agree and disagree with Lopes (1996) that "no picture is seen with an innocent eye, because we come to pictures primed with beliefs, expectations, and attitudes about systems of representation" (p. 33). We agree that no picture is ever seen with an innocent eye, because even young infants bring to bear whatever knowledge they have about the real-world entity depicted in a picture; they see through the picture to its referent. However, the statement lacks any developmental perspective. Infants do not initially have any conceptual knowledge about pictures, and the development of full pictorial competence—the emergence of the truly intelligent eye in the thinking brain—proceeds for several years.

CONCLUSION

The research summarized here raises more questions that it answers—as should always be the case. For example, how might infants' manual exploration of pictures be influenced by perceptual features of the objects depicted and by children's past experience with

those objects? In the development of sensitivity to picture orientation, what role is played by changes in basic perceptual processing, specifically, a general shift from relatively piecemeal processing to more holistic processing of pictorial stimuli?

The central issue underlying the research described here is the interplay of perceptual experience and conceptual knowledge, a general problem of continuing interest throughout psychology. An important topic in this domain—one applicable to any age group—concerns what kinds of pictorial displays facilitate learning. We are currently examining this general problem by investigating what and how infants and toddlers learn from picture books—an issue that has never been studied. Our initial studies concern whether new words and ideas are learned and generalized better from books containing highly realistic pictures or from pictures less tied to specific referents. Given our prior work, there are reasons to expect either possibility might be correct. We expect the result of this work to be of theoretical and practical interest.

As a final note, we wish to make the methodological point that researchers should never take it for granted that pictorial stimuli can tell them about real-world behavior with real objects. "Generalizations to and from studies using pictures as stimuli must be carefully examined" (Ittelson, 1996, p. 181). Many controversies, including some in developmental psychology, might be at least partly traceable to differences in the effects of using pictures and real objects as stimuli.

Recommended Reading

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Note

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