Research Report

INTENTION AND ANALOGY IN CHILDREN'S NAMING OF PICTORIAL REPRESENTATIONS

Paul Bloom and Lori Markson
University of Arizona

Abstract—*What underlies children's naming of representations, such as when they call a statue of a clothespin "a clothespin"? One possibility is that they focus exclusively on shape, extending the name "clothespin" only to entities that are shaped like typical clothespins. An alternative possibility is that they extend a word that refers to an object to any representation of that object, and that shape is relevant because it is a reliable indicator of representational intent. We explored these possibilities by asking 3- and 4-year-olds to describe pictures that represented objects through intention and analogy. The results suggest that it is children's appreciation of representation that underlies their naming; sameness of shape is neither necessary nor sufficient. We conclude by considering whether this account might apply more generally to artifacts other than pictorial representations.*

People use words to describe both actual entities, such as chairs and dogs, and representations of these entities. For instance, a person might point to a statue of a chair and say, "Look at the chair," or to a drawing of a dog and say, "That's an ugly dog." What underlies children's and adults' naming of representations?

In an influential article advancing the notion of a "shape bias" in word learning, Landau, Smith, and Jones (1988) proposed that many words

> partition the world according to shape. . . . A mechanical monkey and a real monkey are both called monkey. A 60-foot sculpture of a clothespin gracing downtown Philadelphia is universally recognized and labelled as a clothespin, albeit a 60-foot metallic clothespin. In these cases, qualifiers capture the differences, whereas the head noun captures the shape similarity. (p. 317)

Landau et al. were plainly correct that the shape of the toy and statue strongly influences the names they are given, and there is considerable evidence that shape is important for basic-level object names more generally (e.g., Smith, Jones, & Landau, 1996). But why? Returning to the monkey and clothespin examples, we can see two possibilities. The first is that there is a direct connection between names and shape: Anything shaped like a typical monkey can be called "a monkey"; anything shaped like a typical clothespin can be called "a clothespin." The second possibility is that a word that refers to an object can also be used to refer to a representation of that object (Jackendoff, 1992), and that the shape of the toy and sculpture are excellent cues that they are representations of a monkey and a clothespin (Bloom, 1996; Soja, Carey, & Spelke, 1992).

At least for adults, it is clear that the naming of representations is not entirely dependent on shape. An *X* on a pirate's map can be described as buried treasure, an *O* in an organizational chart as the vice provost, and the juxtaposition of geometrical forms in a painting by Picasso as one of his lovers. Similarly, the fact that something is the same shape as an object does not entail that people give it the same name. A football is egg-shaped, but people would not normally call it "an egg"—presumably because they know that it is not a representation of an egg (Gelman & Diesendruck, in press).

How do children cope with representations that do not resemble what they depict? Two- and 3-year-olds spontaneously name their own drawings ("Momma," "doggie," "birdie"), even though these are often scribbles, resembling nothing (e.g., Cox, 1992). Gardner (1980) called this behavior "romancing," noting that it is hard to tell whether a child who names a picture "birdie" is actually viewing the picture as a representation of a bird, or is merely making a random comment to please inquisitive adults. This issue is still unresolved. If children really are naming their drawings based on what they intended to depict, it would favor a representation-based view of their naming of pictures.

Young children do have some grasp of the role of intention in picture naming. Gelman and Ebeling (1997) showed 3-year-olds drawings that were shaped like various objects, such as a bear. Half of the children were told that the drawings had been created intentionally, and the other half were told that they had been created by accident (e.g., by somebody spilling paint). When asked to describe the drawings, only the children in the intentional condition showed a strong tendency to name the entities that the drawings resembled (e.g., "a bear"), suggesting that children have some idea that artist's intent is relevant to how a picture should be named—at least for pictures that resemble what they depict.

The study we report in this article addresses this issue further. We asked children to name pictures that represented objects by virtue of intent and analogy, but not physical resemblance. In one part of the study, children drew pictures and were later asked to name them. Preschool children are notoriously unskilled artists, and we had them draw different pictures of entities similar in appearance (a lollipop and a balloon, and themselves and the experimenter), reasoning that their subsequent naming of these pictures could not be based on appearance, but would have to be determined, at least in part, by their memory of their own representational intent.

In the remainder of the study, we explored children's ability to use analogical relations to correctly name pictures drawn by other people. For instance, we told them that a child with a broken arm attempted to draw three pigs and a chicken, and showed them a picture with three ovals in one orientation (either vertical or horizontal) and one oval in another orientation. The adult response to this picture is to view the three similar ovals as corresponding to the pigs and the one dissimilar oval as corresponding to the chicken. This sort of reasoning might be based on assumptions about the artist's representational intent (i.e., a person who lacked precise motor control but was trying to depict the pigs as distinct from the chicken would reasonably use the same symbol for all of the pigs and a different one for the chicken). Or it could be based on simpler nonintentional analogical reasoning, by noting the formal parallel between the numbers of ovals of different orientations and the number of pigs and chickens (Gentner, 1983). In a related task, we manipulated the relative size of arbitrary shapes to see if children would use this information to infer the objects that they depicted.

Address correspondence to Paul Bloom, Department of Psychology, University of Arizona, Tucson, AZ 85721; e-mail: bloom@u.arizona.edu.

METHOD

Subjects

Twenty-four 3-year-olds (mean = 3.5 years, range: 2.10–3.11) and twenty-four 4-year-olds (mean = 4.6 years, range: 4.0–5.0) were tested in a quiet room at their preschool. Parental consent was obtained in advance for all children.

Procedure

Each child participated in a series of three tasks. The order of tasks for 4-year-olds was as follows: drawing trials (Part I), size trials, oddity trials, drawing trials (Part II). The order for the 3-year-olds was drawing trials (Part I), size trials, drawing trials (Part II), drawing trials (Part I), oddity trials, drawing trials (Part II). The procedure for each task is described next.

Drawing task

In Part I, children were requested to draw pictures on separate sheets of paper, using a different-color crayon for each picture. Each child was asked to draw a balloon, a lollipop, himself or herself, and the experimenter. The 4-year-olds were asked to draw all of the pictures at the start of the experiment (Part I). After a child completed the other tasks (after about 15 min), the experimenter "rediscovered" the child's drawings, admired them, and then asked the child to describe them (Part II). The 3-year-olds were asked to draw only two pictures at a time (Part I), and had to complete only a single task (an interval of about 7 min) before being asked to name these two pictures (Part II). Half of the children were asked to draw the lollipop and balloon first; the other half were asked to draw themselves and the experimenter first.

It is important to note that the drawings often did not look anything like balloons, lollipops, or people, and even when they did—mostly for the 4-year-olds—one could not tell from a drawing's appearance whether it represented a lollipop versus a balloon, or the experimenter versus the child. One 4-year-old's drawings are shown in Figure 1.

Size task

The children were told that they were going to be shown some pictures that had been drawn by a boy or girl (same sex as the child) their own age who had a broken arm. They were informed that the boy or girl had tried really hard to draw good pictures, but because of the broken arm, the pictures did not always come out looking like what the boy or girl had wanted. The children were then shown, in succession, four sheets of paper, each of which depicted two shapes of unequal size (see Fig. 2, top panel). They were told that each picture was of one of the following four item pairs: mouse-elephant, dog-house, tree-spider, or flower-bicycle. The names of the two items in the drawing were announced twice, once in each order ("He [She] drew a picture of a spider and a tree. Would you like to see his [her] picture of a tree and a spider?"). The initial order of the items was counterbalanced across children and drawings.

The experimenter pointed to each figure in the picture and asked the children to describe it. Children would usually do so, but if a child did not, the experimenter would repeat each name and ask the child to point to the corresponding figure ("Can you point to a spider? Can you point to a tree?").

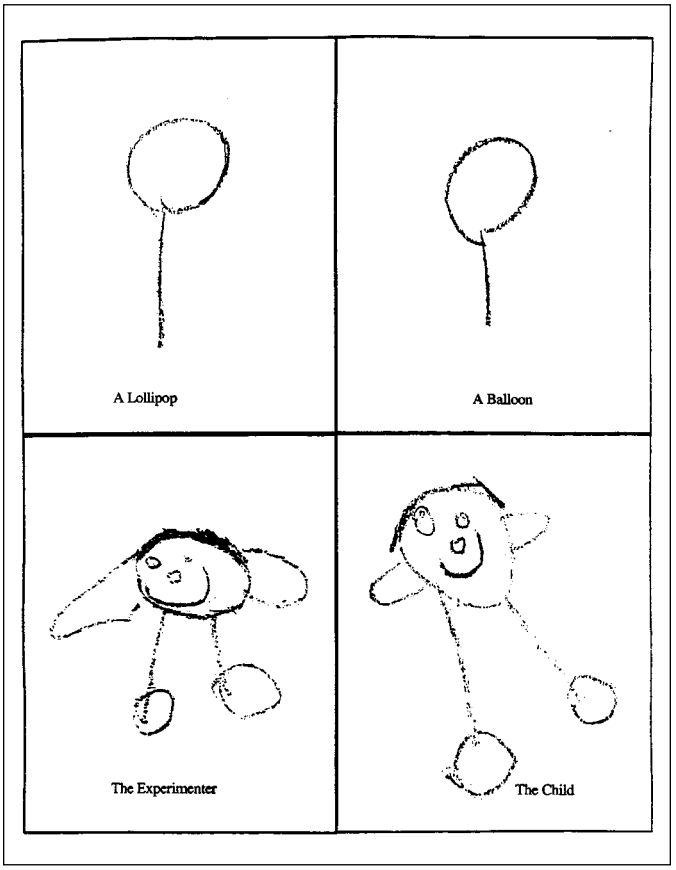

Fig. 1. A child's drawings of a balloon, a lollipop, the experimenter, and herself.

Oddity task

The procedure for this task was identical to the procedure for the size task, except that the children were told that the boy or girl had drawn a picture of "three" (4-year-olds) or "some" (3-year-olds) of one item and "one" of another item (e.g., "He [She] drew three shoes and one sock," or "He [She] drew some shoes and one sock."). The children were shown drawings of four ovals, one of which had a different orientation than the rest (see Fig. 2, bottom panel). In each of the four drawings, the dissimilar oval was in either the second position or the third position in the series of four.

For each picture, the children were told that the boy or girl had drawn one of the following sets of items: cows and horses, shoes and socks, pigs and chickens, or cookies and apples. The names of the items in the drawing were announced twice, always in the same order ("He drew a picture of three cookies and one apple. Would you like to see his picture of three cookies and one apple?"), and the order of the items was counterbalanced across children and drawings. Children were asked to describe the drawings using the same procedure as in the size task.

RESULTS

The dependent measure in each task was the number of trials (out of four) in which the child described the entire drawing correctly (the single figure in the drawing task, the two figures in the size task, and

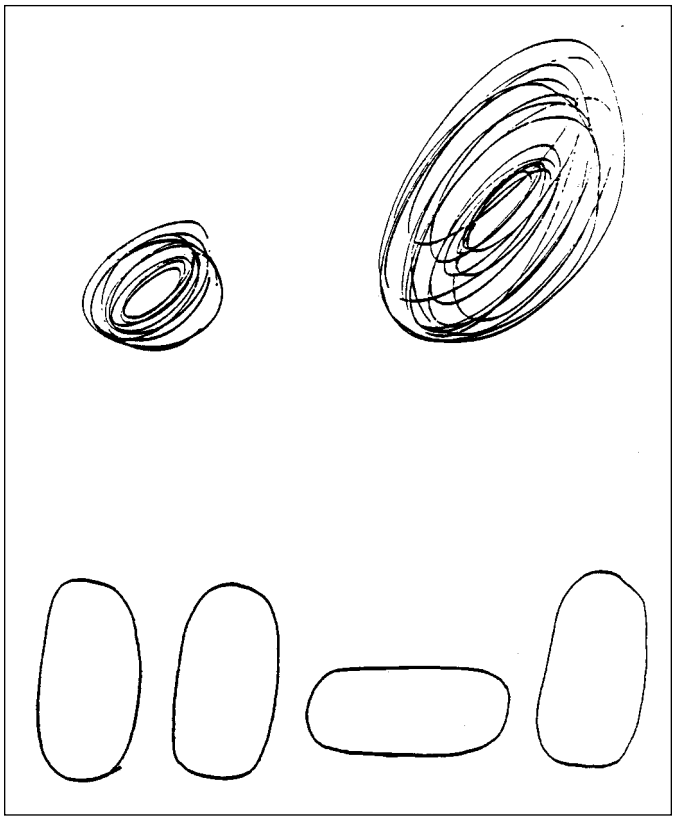

Fig. 2. Sample stimuli for the size task (top panel) and the oddity task (bottom panel).

the four figures in the oddity task) in a way consistent with an understanding of the creator's intent or an appreciation of analogy. The results are shown in Figure 3. A 2 × 3 mixed analysis of variance revealed a main effect of both age (3-year-olds: 66%; 4-year-olds: 79%), $F(1, 46) = 8.36$, $p < .01$, and task (oddity: 61%; size: 76%; drawing: 82%), $F(2, 46) = 5.98$, $p < .005$. There was no significant interaction.

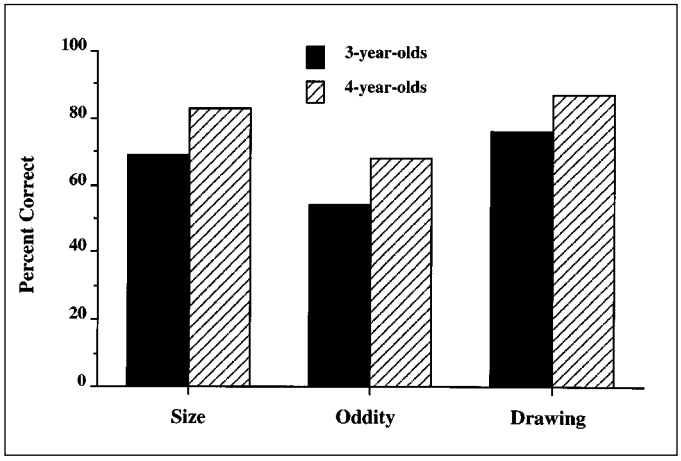

Fig. 3. Percentage correct in the size, oddity, and drawing tasks.

Further analyses explored the children's responses in each task. In the drawing task, a response based on the creator's intent would result in the child naming the pictures on the basis of what he or she had intended for them to depict. Under the conservative estimate that there were only two plausible candidates (i.e., the lollipop vs. the balloon, the child vs. the experimenter) for each picture, both age groups did significantly better than chance: The 3-year-olds were correct for 76% of the pictures, $t(23) = 3.60$, $p < .005$; the 4-year-olds were correct for 87% of the pictures, $t(23) = 8.58$, $p < .0001$ (all t tests are two-tailed).

In the size task, a response based on analogical reasoning would result in the child describing the larger representation as the larger real-world item, and the smaller representation as the smaller real-world item. The results suggest that preschoolers understand this correspondence, as they did significantly better than chance. The 3-year-olds were correct 69% of the time, $t(23) = 3.19$, $p < .005$; the 4-year-olds were correct 83% of the time, $t(23) = 6.49$, $p < .0001$.

In the oddity task, an appreciation of analogy would result in the child naming the three similar representations as the thing the creator intended to make "three" or "some" of, and the single oval with a different orientation as the thing the creator intended to make "one" of. Under the assumption that chance is 50% correct (because the "odd" orientation could correspond to either the single item or one of the three items), the 4-year-olds did significantly better than chance, getting 68% of the pictures right, $t(23) = 2.43$, $p < .05$. The 3-year-olds, however, named only 54% of the pictures correctly and did not perform better than chance, $t(23) = 0.78$, n.s.

We had expected that children's performance on the size task would be correlated with their performance on the oddity task, given that both tasks involve an appreciation of analogy. The 3-year-olds showed such a correlation ($r = .432$, $p < .05$), but the 4-year-olds did not ($r = –.05$, n.s.). Children's performance on the drawing task was not correlated with their performance on the other two tasks.

DISCUSSION

The results suggest that children's naming of representations can be based on factors other than shape. The findings are strongest in the drawing task, and it is worth noting that children's responses in this task were often not subtle, both during the experiment itself and in informal discussion after the experiment. A child might insist, for instance, that one of his pictures was "a balloon" and rigorously correct the experimenter if she described it as a lollipop, even though it looked equally like either object. This shows that sameness of shape is not sufficient to determine children's naming preferences: Something can be shaped like a lollipop, but not called "a lollipop." In the two analogy conditions—size and oddity—the 4-year-olds were also able to correctly name items that bore no resemblance to what they depicted. Even the 3-year-olds were above chance in their performance on the size task, though not on the more complicated oddity task. This shows that sameness of shape is also not necessary: Something can be called "a spider" even if it is not shaped like a spider.

These tasks involve several capacities, some that are present very early in development and others that are not. The ability to name pictures on the basis of what they look like appears to be unlearned. In one study, a boy was raised in a situation in which pictures were kept from his general vicinity and never named for him. Nevertheless, when at the age of 19 months he was exposed to several photographs and line drawings, he was highly successful at naming them (Hochberg &

Brooks, 1962). The appreciation that pictures are representations, however, might emerge somewhat later. Twenty-four-month-olds who are shown a picture that reveals the location of a hidden toy are unable to retrieve the toy on the basis of this information, suggesting that they do not interpret the picture as a representation of current reality; 30-month-olds, in contrast, find this a relatively easy task (DeLoache & Burns, 1994). One speculation is that children's understanding that pictures need not resemble what they depict arises only once they view pictures as representations. The ability to understand different representations undergoes further development in the years that follow, as shown by the 3-year-olds who failed at our oddity task and by a study in which 4-year-olds had difficulty fully understanding the referential properties of photographs (Zaitchik, 1990). Even adults vary considerably in their understanding of representations such as written words, musical notation, maps, graphs, wiring diagrams, and modern art (Ittelson, 1996).

We can now return to the question of why shape is so important in the naming of representations. Children's ability to use intention and analogy when naming pictures that do not resemble their referents suggests that these same factors might apply when they name pictures that do. Children might call a picture that looks like a bird "a bird" not merely because it looks like a bird, but because its appearance makes it likely that it was created with the intent to represent a bird. In general, appearance—and shape in particular—is seen as an excellent cue to intention.

The importance of shape can be seen best by considering certain extreme cases. It is easy enough to call a picture shaped like a bird "a bird," and if there is enough information about the artist's intent, we might give the same name to a scribble or an *X*. But what about a picture that is shaped like something else? In a separate study (Bloom & Markson, 1997), an experimenter sat with a fork on her right and a spoon on her left, and, as the subject watched, she stared intently at the fork while drawing a picture, giving the impression that the fork was the target of her attention. The picture was then shown to the subject, who was asked to name it. If the picture could be seen as either a fork or a spoon, adults called it a fork (and so did 4- and 5-year-olds). But if it looked just like a spoon, almost everyone called it a spoon. Does this mean that the experiment pitted shape against intention, and shape won? Not at all, because the adult subjects would frequently insist that there was a trick going on and that the experimenter was really intending to draw a spoon. And they were right: We wanted to make a picture that looked like a spoon, and it is impossible to draw such a picture without actually intending to represent a spoon. More generally, although an arbitrary shape can be made with the intent to represent anything, adults (and possibly children) see it as very unlikely that someone would produce a drawing that is shaped uniquely like an object without having intended to represent that object.

These findings may have implications for more general claims about the nature of concepts. Many scholars have argued that the nature of human-made objects (artifacts) is largely determined by intentional and historical factors (e.g., Bloom, 1996, in press; Danto, 1981; Keil, 1989). For instance, a gold watch given by a deceased friend may be irreplaceable in the sense that if it were lost, nothing else would be of the same emotional value, regardless of how similar it was to the original. At an auction, John F. Kennedy's golf clubs are immensely more valuable than golf clubs previously owned by someone else, and if it were discovered that Rembrandt's *The Night Watch* is actually a forgery, it could, according to Dutch law, be promptly destroyed. The very notion of a fake or forgery rests on the intuition that there is more to an artwork than its current material nature (Dutton, 1979), and it is interesting to find some glimmer of the same metaphysical commitment in 3-year-olds. When shown two of their own pictures that are virtually identical in form, children believe that the pictures should be treated differently and should get different names, much the same way as many artists and art connoisseurs distinguish Warhol's *Brillo Box* and Duchamp's *Fountain* from ordinary Brillo boxes and urinals (e.g., Danto, 1981; Levinson, 1993).

Finally, children's naming of pictures on the basis of intent and analogy is inconsistent with the claim that they are focusing exclusively on shape. It might be that pictures are not exceptional in this regard. Consider an artifact name, such as *clock*. Although there are prototypical clocks, there is no shape that all clocks share; some clocks are round and analog, others are square and digital, some are shaped like bears and say the time aloud at the touch of a button. Consider also words such as *game*, *furniture*, and *toy;* these words refer to sets of objects that are indefinitely dissimilar in shape, and yet are used and understood by preschoolers.

What determines, then, how people use such words? One proposal is that categorization is based on inferred intent: A person views something as a clock if its appearance and function are consistent with its being designed for a certain purpose (Bloom, 1996, in press; Hall, 1995; Keil, 1989). This theory of how people categorize artifacts might explain why shape is so important. As noted earlier, people see sameness of shape as nonrandom (see also Leyton, 1992). And just as it is extremely unlikely that a drawing or sculpture would be shaped like a typical clothespin if it were not made with the intent to represent a clothespin, it would be extremely unlikely that a functional artifact would be shaped like a typical clothespin if it were not made with the intent to be a clothespin. The results reported here suggest that in the domain of pictures, children use shape as a cue to representation, but that shape is not criterial. The extent to which this holds for artifact kinds in general remains an open question.

Acknowledgments—This research was supported by a grant from the Spencer Foundation to the first author. We are grateful to Judy DeLoache, Barbara Landau, and Karen Wynn for helpful comments on an earlier draft.

REFERENCES

Bloom, P. (1996). Intention, history, and artifact concepts. *Cognition, 60,* 1–29.

Bloom, P. (in press). Theories of artifact categorization. *Cognition.*

Bloom, P., & Markson, L. (1997, April). *The role of intentionality in children's naming of pictures.* Poster presented at the biennial meeting of the Society for Research in Child Development, Washington, DC.

Cox, M. (1992). *Children's drawings.* London: Penguin Books.

Danto, A. (1981). *The transfiguration of the commonplace.* Cambridge, MA: Harvard University Press.

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

Dutton, D. (1979). Artistic crimes: The problem of forgery in the arts. *British Journal of Aesthetics, 19,* 304–314.

Gardner, H. (1980). *Artful scribbles: The significance of children's drawings.* London: Jill Norman.

Gelman, S.A., & Diesendruck, G. (in press). What's in a concept? Context, variability, and psychological essentialism. In I.E. Sigel (Ed.), *Theoretical perspectives in the development of representational thought.* Hillsdale, NJ: Erlbaum.

Gelman, S.A., & Ebeling, K.S. (1997, April). *The influence of shape and representational status on children's naming.* Poster presented at the biennial meeting of the Society for Research in Child Development, Washington, DC.

Gentner, D. (1983). Structure-mapping: A theoretical framework for analogy. *Cognitive Science, 7,* 155–170.

Hall, D.G. (1995). *Artifacts and origins.* Unpublished manuscript, University of British Columbia, Vancouver.

Hochberg, J., & Brooks, V. (1962). Pictorial recognition as an unlearned ability: A study of one child's performance. *American Journal of Psychology, 73*, 624–628.

Ittelson, W.H. (1996). Visual perception of markings. *Psychonomic Bulletin & Review, 3*, 171–187.

Jackendoff, R. (1992). Mme Tussaud meets the binding theory. *Natural Language and Linguistic Theory, 10*, 1–31.

Keil, F. (1989). *Concepts, kinds, and conceptual development.* Cambridge, MA: MIT Press.

Landau, B., Smith, L.B., & Jones, S. (1988). The importance of shape in early lexical learning. *Cognitive Development, 3*, 299–321.

Levinson, J. (1993). Extending art historically. *The Journal of Aesthetics and Art Criticism, 51*, 411–423.

Leyton, M. (1992). *Symmetry, causality, mind.* Cambridge, MA: MIT Press.

Smith, L.B., Jones, S.S., & Landau, B. (1996). Naming in young children: A dumb attentional mechanism? *Cognition, 60*, 143–171.

Soja, N.N., Carey, S., & Spelke, E.S. (1992). Perception, ontology, and word meaning. *Cognition, 45*, 101–107.

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

(RECEIVED 12/22/96; REVISION ACCEPTED 11/25/97)