

The Development of Categorization in the Second Year and Its Relation to Other Cognitive and Linguistic Developments

Alison Gopnik

Scarborough College, University of Toronto

Andrew Meltzoff

University of Washington

GOPNIK, ALISON, and MELTZOFF, ANDREW. *The Development of Categorization in the Second Year and Its Relation to Other Cognitive and Linguistic Developments*. CHILD DEVELOPMENT, 1987, 58, 1523–1531. We report changes in children's categorization behavior between 15 and 21 months of age and relate them to developments in language, object permanence, and means-end understanding. 12 children were studied longitudinally from 15 to 20 months. The children received 3 tasks involving the spontaneous categorization of a mixed array of objects and also received object-permanence and means-ends tasks. Their language development was also recorded. There was an invariant developmental sequence of 3 kinds of active categorization behavior. There were strong relations between the development of the highest-level categorization behavior, 2-category grouping, and the onset of the naming explosion. The highest-level categorization behavior was not strongly related to the attainment of the highest-level object-permanence and means-ends behaviors, though all 3 of these behaviors emerged at about the same age, 18 months. The findings support "the specificity hypothesis," according to which there are certain very specific relations between semantic developments and conceptual developments. Children acquire early words that are relevant to the specific cognitive problems that interest them.

Children develop a number of important cognitive abilities when they are about 18 months old. In particular, there are significant changes in object-permanence and means-ends understanding at about this point. Children also develop important new linguistic abilities when they are about 18 months old. However, there is another significant area of cognitive development in this period that has been less extensively studied. Children begin to categorize objects in new ways when they are about 18 months old. In the study reported here, we investigated the development of these categorization behaviors and their relation to other cognitive and linguistic developments in this period.

Recently, there have been a number of studies of the development of categorization in early infancy (Cohen & Strauss, 1979; Ross, 1980; Sherman, 1985; Younger, 1985). These investigators have used the habituation para-

digm, in which infants are exposed to exemplars of a category and their response to new instances and noninstances of the category is measured. According to these studies, infants of about 10 months can form rather complex categories, such as the category of stuffed animals, and may organize categories around prototypes.

Infants may detect perceptual classes, but it is unclear when they begin to actively sort objects into categories. The habituation paradigm measures receptive perceptual abilities rather than more spontaneous and active displacements of objects. Moreover, these habituation studies have involved the detection of a single perceptual category at a time. This seems different from the ability to analyze an array of different objects and place them in different categories.

A complementary approach to the problem of categorization concerns the way in

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which children spontaneously manipulate and organize objects from various categories, such as a set of four boxes and four balls. In these studies children's spontaneous sorting of objects changes qualitatively in the 12–24-month period (Langer, 1982; Nelson, 1973; Ricciuti, 1965; Starkey, 1981; Sugarman, 1981, 1982, 1983). Some types of active categorization behavior occur at early ages. Starkey (1981) found that 9-month-olds would touch all the objects in a category in sequence; for example, an infant might touch all four balls in an array without touching the boxes. Nelson (1973), Ricciuti (1965), and Sugarman (1981) report that somewhat older children serially touched all the objects in two categories in succession, for example, first touching all the balls and then touching all the boxes; they also report that older children placed all the objects in one category in a group, for example, putting all the balls in a pile. All these types of behaviors could, however, still be interpreted as showing that infants simply have perceptual preferences for some objects rather than others—for example, that they prefer to touch balls rather than boxes (see Sugarman, 1983). The clearest example of genuine active categorization comes when children begin to sort objects into two spatially distinct groups, placing all the balls in one pile and all the boxes in another pile. Typically, 18–24-month-old children, though generally not 12-month-olds, produce such behaviors.

Because this type of active categorization behavior seems to emerge at about 18 months, it may be related to other significant cognitive developments in this period, such as the development of the ability to deduce the location of invisibly displaced objects, or to use insight to solve complex means-ends tasks. Aside from the general temporal concordance among categorization, object-permanence, and means-ends behavior, there are also theoretical parallels among these three domains. To actively categorize objects, deduce an object's location, or use insight, children must be able to consider the present or potential properties of objects, independently of their immediate perceptions of those objects or their actions on them. When children actively categorize all the objects in a set, they

seem to begin by assuming that the object belongs in some (as yet undiscovered) category and then use perceptual information to decide *which* category it belongs to. Although children may use the perceptual similarities and differences between objects as a basis for categorizing particular objects, the more abstract and general notion that all objects belong in *some* category cannot itself be defined in strictly perceptual terms. It is this general notion that motivates children to actively sort the objects.

Similarly, to solve complex object-permanence problems, children must be able to hypothesize that an object exists at a particular location even when they have no perceptual evidence that the object is at that location. Finally, the ability to solve problems using insight also implies an ability to hypothesize or imagine possible future states of affairs even when there is no direct perceptual evidence for those hypotheses. In all three cases, children treat objects as if they were genuinely independent of their immediate experience of them. In each case the children seem to develop a theory of how the world should work and bring this theory to the particular tasks.

In addition to these relations between categorization and other cognitive developments, there is also reason to believe that active categorization might be related to linguistic development. There are specific relations between particular semantic and cognitive developments in this age period. For example, there are relations between the development of disappearance words, such as “gone,” and object-permanence abilities (Corrigan, 1978; Gopnik, 1984; Gopnik & Meltzoff, 1984, 1986; McCune-Nicolich, 1981; Tomasello & Farrar, 1984) and between the development of “success/failure” words, such as “there” and “uh-oh,” and means-ends achievements (Gopnik & Meltzoff, 1984, 1986). We have suggested (Gopnik & Meltzoff, 1985, 1986, 1987) that there might be a similar relation between the development of categorization and the development of “the naming explosion,”¹ the sudden burst of names that occurs at around 18 months (Bloom, 1973; Nelson, 1975). Nelson and Lucariello (1985) have made a similar sugges-

¹ A number of different terms, including “the naming explosion,” “the vocabulary spurt,” and “nominal insight,” have been used to describe this phenomenon. Some of these terms imply that the naming explosion involves a general change in linguistic competence rather than involving a particular semantic category, namely, words that refer to classes of objects. A “vocabulary spurt,” for example, could include verbs as well as names. The term “naming explosion” captures what we take to be the essence of this phenomenon—that children suddenly develop an intense interest in naming objects, and that this leads to a sharp increase in the number of names they use.

tion. Sorting objects into different groups and giving objects different names both involve an ability and indeed an inclination to place objects into categories. The conceptual developments that are involved in the naming explosion seem to be relevant to the specific skill of categorization. However, aside from Sugarman's (1983) records of the language that was produced during the categorization tasks themselves, there have not been any studies of the developmental relation between spontaneous categorization and language.

Some investigators have also suggested that the naming explosion might be specifically related to object-permanence development (Bloom, 1973). Corrigan (1978) found that the three children in her study all produced a naming explosion during "stage 6" of object permanence. Bloom, Lifter, and Broughton (1985) and Lifter and Bloom (1985) reported a relation between a vocabulary spurt and spontaneous object hiding and finding behavior. This possibility deserves further investigation.

This study has three aims: (a) to provide a more detailed, longitudinal test of the development of active categorization in the second year than has been provided by the previous cross-sectional work; (b) to investigate relations between the development of categorization and the other types of cognitive developments, such as the development of object permanence and means-ends understanding; and (c) to investigate relations between all these cognitive developments and linguistic developments, particularly the onset of the naming explosion.

Method

Subjects

Twelve children, nine males and three females, served as subjects. The mean age of the subjects at the first visit was 470 days (15.46 months), and the range was 410–552 days. The mean age at the end of the study was 601.67 days (19.79 months). The subjects were all from monolingual English-speaking households and had middle-class white parents. The subjects were recruited through advertisements placed in the local newspapers.

Procedure

The children were tested in the laboratory approximately once every 3 weeks from the time of their initial recruitment until they had passed all the cognitive tests that were administered and had achieved a naming explosion. If subjects dropped out of the study

before achieving these criteria, they were replaced. The three types of cognitive tests were: (a) tests of object permanence, (b) tests of means-ends understanding, and (c) tests of object categorization. During each tri-weekly visit, cognitive tests were administered and the language records were collected. The cognitive tests were administered in a different randomly determined order in each session. The cognitive testing typically lasted 30–45 min and took place while the child was seated on the mother's lap across from the experimenter at a small table (120 × 60 cm). Tests were scored during the session by an observer who did not have access to information about the child's language. All test sessions were videotaped.

Object permanence.—The tasks used to assess the children's level of object permanence are described in Table 1 and were adapted from the Uzgiris and Hunt (1975) infant assessment scales. Children's performance was generally scored according to the criteria given by Uzgiris and Hunt and those described previously by Gopnik and Meltzoff (1984, 1986). Specifically, children were scored as having passed a given object-permanence task if their initial search was appropriate on four out of seven trials. An independent observer coded 25% of the sessions from videotape record, and there was high interobserver agreement (96%) on the level passed by the children.

Much of the classical discussion of the relation between linguistic and cognitive development has focused on cognitive stages. There are difficulties with the notion of stage, both theoretically and operationally, and many different definitions of "stage 6" object permanence have been given (Corrigan, 1979). We have therefore concentrated on specific tasks, rather than stages, in our analysis.

The most difficult type of invisible displacement task is one involving serial invisible displacements with controls to ensure that magical procedures are not used (Task 14). Children who can solve this type of complex invisible displacement task are very likely to have developed the complete theory of object movement, appearance, and disappearance that is the culmination of the development of object permanence. Children who are unable to solve this task are less likely to have attained a complete understanding of object permanence. This is reflected in the fact that this is the most difficult type of object-permanence task in the Uzgiris and Hunt

