

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

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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 Uzgis and Hunt (1975) infant assessment scales. Children's performance was generally scored according to the criteria given by Uzgis 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 Uzgis and Hunt

TABLE 1
DESCRIPTION OF THE OBJECT-PERMANENCE AND MEANS-ENDS TASKS

Task No.	Task Description
Object concept tasks:	
13	Finding an object following one invisible displacement with three screens (7 trials): Object is hidden in hand, hand is placed under A, B, or C, object is left at A, B, or C. Child must search at correct cloth.
14	Finding an object following a series of invisible displacements (7 trials): Object is hidden in hand, hand is placed under A, then B, then C. Object is left under C. Child must search under A, then B, then C, or directly under C.
Means-ends tasks:	
9	Use of a vertical string to obtain an object.
10	Use of stick to obtain an object.
11	Placing a necklace in a bottle.
12	Stacking rings on a post, avoiding one solid ring.

(1975) scales (see Gopnik, 1984; Gopnik & Meltzoff, 1986; Piaget, 1954; Uzgis & Hunt, 1975, for further discussion). Moreover, success on Task 14 is closely related to other cognitive and linguistic achievements in the one-word stage (Gopnik, 1984; Gopnik & Meltzoff, 1984, 1986, 1987). We therefore focused on this task in our analysis. In accordance with the past studies, infants were scored as having achieved the "highest level of object permanence" when they passed Task 14.

Means-ends understanding.—The tasks used to assess means-ends understanding are described in Table 1, and were also adapted from the Uzgis and Hunt scales. In accordance with the scoring procedures described by Uzgis and Hunt, children were scored as having passed a means-ends task if they immediately solved the problem as soon as it was presented to them in a session, without groping or engaging in trial-and-error behavior in that session. The emergence of these immediate "insightful" solutions to difficult tasks seems to reflect an important change in children's understanding of the relations between means and ends at this point (Koslowski & Bruner, 1972; Piaget, 1952, 1954). Infants become able to anticipate or predict the effects of their actions without actually having to perform the actions themselves.

Also in accordance with several authors who have used these same items (Gopnik & Meltzoff, 1984, 1986; Uzgis & Hunt, 1975), infants were scored as having reached the "highest level of means-ends understanding" if they used insight to solve any one of Tasks 10–12. Typically, children pass these three tasks at about the same time, in no consistent order except that they all consistently appear

after the solution of Task 9. An independent observer coded 25% of the sessions from videotape record, and there was high interobserver agreement (92%) on the level passed by the children.

Categorization.—In the categorization tasks, children were presented with a set of eight objects, four of one type and four of another. Three such sets of objects were presented. In Task 1 there were four flat yellow rectangles (10 × 5 cm) made from .2-cm thick masonite and four brightly colored plastic human-like figures measuring 5.5 cm in height and 1.5 cm in diameter. In Task 2 there were four 1-cm high transparent pillboxes (2.5 × 2.5 cm) made of hard plastic, and four balls 3 cm in diameter made from red Play-Doh. These two sets of objects are similar to those that elicited sorting in the Ricciuti (1965) and Starkey (1981) studies. In Task 3, there were four plastic Raggedy Andy dolls (approximately 6 × 2 cm) and four red plastic cars (7 × 3.5 cm). This set of objects was more similar to ones used in the Nelson (1973) and Sugarman (1983) studies. The objects were presented to the child in a predetermined random arrangement on a table, in the spatial arrangement specified by Ricciuti (1965) and Starkey (1981). As in the Ricciuti (1965) study, the experimenter told the child to "play with these things" or "fix them all up" but refrained from any more specific prompts, and mothers were instructed to do likewise. In pilot studies, children were likely to sort objects into the mother's or experimenter's hands. The experimenter therefore sat with hands placed palm upwards on the table with each hand equidistant from the child. Objects were presented on the table top for 3 min and then removed. The observer recorded all instances of serial touching or object grouping.

We focused on three types of behaviors in our analyses: (1) Single-category grouping: This response type was scored if infants systematically displaced four objects of one kind and spatially grouped them together. The other category need not be manipulated. We refer to this as level-1 categorization behavior. (2) Serial touching of two kinds of objects: This response was scored if infants sequentially touched or manipulated first the four objects from one group and then the four from the other group. Infants were not required to sort the objects spatially but only to group them in time by touching four of one type and then four of the other type. We refer to this as level-2 categorization behavior. (3) Two-category grouping: This response type was scored if infants spatially displaced all eight objects from the original location such that they were systematically sorted into two clear groups or piles. Infants were also assigned to this level if they placed all eight in one-to-one correspondence, for example, if they formed a row of one type of object and then systematically placed one of the other type on top of each of the bottom ones (see also Sugarman, 1983), although the latter correspondences rarely occurred. We refer to this as level-3 categorization behavior.

Infants were scored as having achieved a particular level of categorization if they produced at least one instance of the operationally defined behavior on any of the three categorization tasks. A randomly selected 50% of the categorization tests were rescored by an independent observer from the videotape record, and the interobserver agreement was high (86%).

Naming explosion.—Children's mothers were asked to fill out a questionnaire concerning their child's use of language at the start of each session. At the end of each session the mothers took a copy of the questionnaire home with them and were asked to note any new word uses on it. Thus the questionnaire also served as a diary record of the child's language development. The questionnaire included an item asking the mothers to list all the names their child was using. It also included a space for mothers to record the specific contexts in which their child used each name.

Words were only counted as object names if they were clearly used to refer to a category of objects. Thus, for example, a use of "mama" as an all-purpose call for help would not be counted as a use of an object name. An independent language scorer, who was a trained linguist, went over the ques-

tionnaires with the mothers and reached a final decision as to the number of new names acquired in each session. This scorer was not involved in the cognitive testing in any way and did not know the results of the cognitive tests at any point in the study. Thus the language measures and the cognitive measures were obtained by completely independent observers. This type of maternal questionnaire combined with an intensive interview yields results that are comparable to those yielded by analyses of spontaneous speech (Gopnik, 1984; Gopnik & Meltzoff, 1984, 1986).

Results

We examined four aspects of the infants' behavior: (1) the infants' performance on the categorization tests, (2) the onset of the naming explosion, (3) the relation between the categorization measures and the other cognitive measures, and (4) the relation between the cognitive and linguistic measures. Each of these four issues is examined in turn below.

Categorization.—The mean age of the infants when they first displayed each of the three types of categorization behavior was as follows: (a) single-category grouping = 16.04 months (range: 13.68–19.31), (b) serial touching of two kinds of objects = 16.39 months (range: 14.18–20.00), and (c) two-category grouping = 17.24 months (range: 15.53–20.86). To test statistically this developmental ordering we examined the sequencing of the different kinds of behaviors for individual children. Of the 12 children, only one violated the assumed developmental ordering by producing level-2 behavior (serial touching of two kinds) before producing level-1 behavior (spatial grouping of one kind). This developmental change in categorization behavior can be assessed by means of a nonparametric trends test (Ferguson, 1966): the ordering from level 1 to 2 to 3 was significant ($z = 2.11$, $p < .05$).

Lower-level behaviors continued to be produced even after children began to produce more sophisticated behaviors. Thus children might produce serial touching or single-category grouping behavior in the same session in which they produced two-category grouping. However, the first instances of two-category grouping consistently appeared after the first instances of the other types of behaviors.

Naming explosion.—Different investigators have used slightly different criteria for defining the naming explosion. Determining

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an appropriate criterion depends at least partly on the range of ages of children included in the study. If the study includes some relatively older children, a criterion such as the "session with the greatest increase in vocabulary" will not capture the first, sudden burst of naming, because vocabulary obviously continues to increase as children grow older. For this reason the naming explosion in this study was operationalized as the first session in which more than 10 new names were acquired. Previous investigators who have examined children of this age range have used a comparable definition (Bloom et al., 1985; Lifter & Bloom, 1985). The mean age of achieving the naming explosion was 18.33 months (range: 15.53–21.45).

There was a particularly sharp increase in naming at the point at which more than 10 new names were acquired, and this supports the notion that this is an appropriate criterion for the naming explosion. First, seven children actually had increases of 15 words or more in the naming explosion session. Second, eight children acquired fewer new names in the session after the naming explosion session than in the naming explosion session itself, while only one child acquired more new names in the following session than in the naming explosion session itself. However, three children did show greater increases in naming at a later point in their development. Thus there seemed to be a particular developmental point at which, for the first time, many new names were suddenly acquired. Then the rate of acquisition of names leveled off, though there could be further increases later on.

Relations between categorization, object permanence, and means-ends understanding.—We compared the subjects' attainment of the highest level of categorization (level 3, two-category grouping) with the highest levels of object permanence (Task 14) and means-ends understanding (Tasks 10–12). The mean age of emergence of these three behaviors is remarkably similar. As shown in Table 2, there is a difference of only 4 days between the three means. This suggests that important object-permanence, means-ends, and categorization behaviors all emerge at about the same point in development, at around 1.5 years, as is commonly assumed.

However, a more detailed analysis of individual subjects yields a more fine-grained and interesting picture. Although the group means were similar, individual children did not necessarily produce these three behaviors at the same time. In fact, these behaviors were acquired at a wide variety of ages, ranging from 15 months to 21 months (Table 2). Moreover, individual children could produce one of these behaviors more than 3 months before they produced another type of behavior (e.g., subject no. 10). It is also of interest that there is not a consistent ordering of these three cognitive developments. For each pairing of these three domains, about half the children produced one type of behavior before the other, while the other half reversed this order.

Another way of examining the relation between these three cognitive tasks is to consider the correlations between the age of acquisition of one behavior and another. Is a child who produces one type of behavior

TABLE 2
AGE OF ACQUISITION OF THE HIGHEST-LEVEL OBJECT-PERMANENCE, MEANS-ENDS, AND
CATEGORIZATION BEHAVIORS AND OF THE NAMING EXPLOSION

Subject No.	Object-Permanence Task 14	Means-Ends Tasks 10–12	Level-3 Categorization	Naming Explosion
1.....	478	536	472	472
2.....	544	523	634	634
3.....	525	463	498	539
4.....	448	539	475	475
5.....	532	490	556	652
6.....	493	528	567	567
7.....	508	508	479	508
8.....	499	533	520	555
9.....	500	522	500	522
10.....	650	587	552	629
11.....	545	545	545	545
12.....	526	492	492	590
Mean:				
Days	520.67	522.17	524.17	557.33
Months	17.13	17.18	17.24	18.33

early also likely to produce the other behaviors early? There was essentially no correlation ($r = 0.19$) between means-ends abilities and categorization. There was a weak correlation between means-ends abilities and object-permanence abilities ($r = 0.36$), and a slightly stronger correlation between object-permanence abilities and categorization ($r = 0.48$, $p < .06$). There thus seems to be some developmental independence between achievements in these three cognitive domains (see also Gopnik & Meltzoff, 1987).

Relations between cognitive and linguistic development.—All children used their first words well before any of the three cognitive developments. There were no violations of this ordering. In fact, there could be gaps of up to 2 months between the appearance of the first words and the solution of any of these three tasks. Evidently, these cognitive developments are not a prerequisite for the first words.

However, there was an interesting relation between the onset of the naming explosion and these cognitive developments. There was evidence of a specific relation between the development of the highest level of categorization (level 3, two-category grouping) and the development of the naming explosion. First, none of the children achieved a naming explosion before they displayed level-3 categorization. Second, children frequently developed a naming explosion very shortly after they first produced level-3 categorization. In fact, five of the 12 children first produced level-3 categorization in the very same session in which a naming explosion was first recorded. The mean gap between these two developments was only 33.17 days, suggesting that the two developments occur fairly closely together. Third, there was a large and significant correlation between the age of the naming explosion and the age of

development of level-3 categorization ($r = 0.78$, $p < .005$).

The finding that there is a specific developmental link between categorization and the naming explosion is complemented by the finding that not every cognitive achievement of the 18-month-old period is related to the naming explosion. This is true even when the other cognitive achievements emerge, at a group level, at the same mean age as categorization. In particular, the relation between means-ends abilities and the naming explosion is very different. There was no evidence of a close temporal relation between the solution of means-ends Tasks 10–12 and the development of the naming explosion. At maximum, there were gaps of up to 162 days between these two developments (Table 2). The mean gap, 56.50 days, was significantly larger than the mean gap between categorization and naming ($p < .05$, Wilcoxon test, one-tailed). In addition, there was no significant correlation between the age of acquisition of the means-ends abilities and the development of the naming explosion (Table 3).

As might be expected on theoretical grounds, the relation between the development of object-permanence abilities and the naming explosion falls somewhere between these two extremes. The mean gap between the development of object-permanence Task 14 and naming was 41.17 days, greater than the categorization to naming explosion gap and smaller than the means-ends to naming explosion gap, although neither of these differences was statistically significant. There was a significant correlation between the age of acquisition of object-permanence Task 14 and naming ($r = 0.70$, $p < .01$), although this correlation was lower than the correlation between categorization and the naming explosion (Table 3). Finally, it is noteworthy that partialing out the effects of object perma-

TABLE 3
PEARSON CORRELATION COEFFICIENTS BETWEEN THE AGE OF THE ACQUISITION OF
THE HIGHEST LEVELS OF OBJECT PERMANENCE, MEANS-ENDS, AND
CATEGORIZATION AND THE NAMING EXPLOSION

	Means-Ends Tasks 10–12	Level-3 Categorization	The Naming Explosion
Object-permanence Task 1436	.48	.70*
Means-ends Tasks 10–1219	-.017
Level-3 categorization78**

* $p < .01$.

** $p < .005$.

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nence has a minimal effect on the correlation between categorization and the naming explosion, which remains large at $r = 0.70$, $p < .01$. Partialing out the effects of categorization has a greater effect on the object-permanence to naming correlation, which drops to $r = 0.59$, $p < .05$.

Discussion

Children apparently begin to sort objects into two spatially distinct groups at about the same time that they begin to solve complex object-permanence tasks (serial invisible displacement tasks) and begin to use insight to solve means-ends problems. However, there is also some independence among these cognitive developments. Individual children seem to solve these three problems at slightly different times and in different orders. One child may begin by concentrating on problems of means-ends relations and only start to work on problems of categorization a few months later, while another child may reverse this order. Moreover, each child's specific cognitive interests and achievements seems to be reflected in their semantic development. In particular, the results suggest that the development of the naming explosion is related to the development of two-category grouping and is also related to object-permanence development.

How can we best explain the links between cognition and language that were found in this study? Given the design of the study and the analyses used, these findings cannot simply be explained either in terms of age or in terms of some very general relation between cognitive and linguistic development. These cognitive and linguistic developments take place at a wide variety of ages. In addition, because the naming explosion was *not* related to certain cognitive developments (means-ends abilities), these findings could not be the result of some general relation between linguistic and cognitive development.

The longitudinal design of this study provided fine-grained detailed information about the sequence of the various types of developments and the temporal gaps between them. A possible factor in a longitudinal study of this type is the effect of practice on the infant's performance on the cognitive tasks (Fischer, 1980). Cross-sectional studies should also be conducted to see whether the relations found here are also found when children are only tested once.

The findings reported here are consistent with "the specificity hypothesis" we have

proposed previously to account for developmental relations between early thought and the emergence of language (Gopnik & Meltzoff, 1986). The essence of this hypothesis is that although general links between cognition and language may be difficult to document (see Gopnik & Meltzoff, 1986, for a review), there nonetheless will be strong developmental relations between very specific cognitive developments and specific relevant semantic developments. In the present study we found a specific relation between high-level categorization and the naming explosion, and this makes good sense theoretically. Both developments seem to reflect 18-month-olds' understanding that objects belong in categories. At this point in their development, infants seem to want to divide the world into "natural kinds," both in word and in deed.

In addition, in this study as in the studies of Corrigan (1978) and Lifter and Bloom (1985), there was also a relation between object permanence and naming. This may be because naming, categorization, and object permanence all involve knowledge about objects.

Children are solving a number of different conceptual problems in the 15–24-month-old period, although individual children may solve different problems at different times. These conceptual problems include understanding the way objects fit into categories, the permanence of objects, and the means-ends relation between actions and objects. As individual children tackle each of these problems, they develop linguistic devices, such as names, or "disappearance" and "success/failure" words that are relevant to those cognitive problems. In this way individual children's early semantic development may be shaped by their specific cognitive concerns.

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