Relations between Semantic and Cognitive Development in the One-Word Stage: The Specificity Hypothesis

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GOPNIK, ALISON, and MELTZOFF, ANDREW N. *Relations between Semantic and Cognitive Development in the One-Word Stage: The Specificity Hypothesis.* CHILD DEVELOPMENT, 1986, **57**, 1040–1053. We develop a hypothesis, which we call the "specificity hypothesis," concerning the interrelation between early linguistic and cognitive development. This hypothesis states that there are specific relations between particular linguistic and particular cognitive developments in the 1-word period. It suggests that the acquisition of words encoding disappearance is related to the development of the object concept, while the acquisition of words encoding success and failure is related to the development of means-ends understanding. The results of a longitudinal study of 19 children confirm this "specificity hypothesis." The results show that children acquired disappearance words within a few weeks of their solution of a complex object-permanence task involving invisible displacements and acquired success/failure words within a few weeks of their solution of complex means-end tasks. The cross-relations did not hold; that is, there were no similarly close relations between disappearance words and the means-ends tasks or between success/failure words and the object-permanence tasks. These findings show that there are at least 2 specific relations between semantic and conceptual development in the 1-word stage.

There have been a number of recent studies investigating the relation between linguistic and cognitive development in 12–24-month-old children. Many of them have used fairly general measures of cognitive and linguistic development. They have explored the possible relations between measures of the children's general level of cognitive functioning, such as their sensorimotor "stage," and measures of general language development, such as M.L.U., vocabulary size, or the emergence of the first words (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Corrigan, 1978; Dihoff & Chapman, 1977; McCune-Nicolich, 1981a; Miller, Chapman, Branston, & Reichle, 1980; Smolak, 1982). These studies have revealed few strong links between these general measures of cognitive and linguistic development. Such links have been difficult to demonstrate empirically, and the reasons for this have been the matter of some discussion (Corrigan, 1979; Harris, 1982).

Several authors have suggested, however, that it might be easier to demonstrate empirical relations between more specific measures of early cognitive and language skills (Bloom, Lifter, & Broughton, 1981; Corrigan, 1979; Fischer & Corrigan, 1981; Gopnik, 1982, 1984a, 1984b; Gopnik & Meltzoff, 1984, 1985, 1986). There are three types of specific relations that have attracted attention.

First, *general* linguistic or communicative development might be related to some *particular* areas of cognitive development but not others. Several recent studies have explored this possibility. For example, Bates et al. (1979) report that the general emergence of prelinguistic communicative gestures is related to the development of "stage 5" means-ends skills but is not related to object-concept

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skills. Similarly, it has been suggested that there are relations between general linguistic development and the specific cognitive development of symbolic play (McCune-Nicolich, 1981b, Ungerer & Sigman, 1983).

A second possibility, essentially the mirror image of the first, has also been advanced—namely, that *general* cognitive development might be related to *particular* linguistic developments but not others. For example, McCune-Nicolich (1981a) and Smolak and Levine (1984) have suggested that a general "stage 6" level of cognitive functioning might be a prerequisite for the development of certain kinds of language or communicative behavior but not others. Similarly, Corrigan (1978) has suggested that a general "stage 6" level of functioning might be a prerequisite for the naming explosion.

A third possibility, the one we favor, will be referred to here as the "specificity hypothesis." This proposes that there are highly specific links between specific cognitive developments and specific linguistic achievements. Many such relations are possible, but we will consider one type of specific-to-specific link here, a link between particular semantic developments and particular related conceptual developments.

Gopnik (1982, 1984b) has suggested that children may develop certain kinds of meanings at about the same time that they solve specific related problems. In particular, disappearance words like "gone" encode concepts that are related to the complete object concept that is required to solve complex object-permanence problems. In their spontaneous speech, children use words such as "gone" whenever they cannot see an object. They use such disappearance words when they turn away from an object and when an object is visibly or invisibly displaced. This very general notion, that an object may exist without being seen, seems to be related to the concept of the object that allows children to deduce the location of invisibly displaced objects (see Gopnik, 1984b, for further discussion). Similarly, words such as "there" and "uh-oh" encode concepts of success and failure that involve an understanding of means-ends relations. Children use these words in their spontaneous speech when their plans succeed or fail. In order to use these words in this way, children must be able to compare different plans and make generalizations about them. This ability to reflect on plans, to consider and compare them, also seems to underlie the ability to immediately invent new solutions to means-ends problems—the ability to use insight (see Piaget, 1952; see Gopnik, 1982, for further discussion).

Several studies suggest that specific relations between semantic and cognitive development may exist. For example, several studies have reported relations between the development of disappearance words and the solution to certain object-permanence problems (Corrigan, 1978; Gopnik, 1984b; Gopnik & Meltzoff, 1984; McCune-Nicolich, 1981a; and Tomasello & Farrar, 1984). Similarly, Gopnik and Meltzoff (1984) have recently reported a relation between the development of words that encode success and failure and the development of means-ends skills.

These findings are interesting because they suggest highly specific links between language and cognition. However, rather than reflecting such specific links, they might also reflect a broader relation between the emergence of "relational" or "function" words in general and the development of "stage 6" intelligence in general. Or, they might reflect some as yet undiscovered general relations between linguistic and cognitive development. In short, the present data do not allow us to determine just how specific the relations actually are.

We here report the results of two studies investigating the specificity of language-cognition relations. First, a cross-sectional study of 30 children was conducted. Next, an analysis of longitudinal studies of 19 children is reported. In both studies, *two* types of semantic developments (the acquisition of disappearance words and success/failure words) were compared to performance on *two* types of cognitive tasks (object-permanence and means-ends tasks). This helped us to assess the specificity of the relations between the linguistic and cognitive achievements. In addition, the longitudinal study provided information about the ordering of the semantic and cognitive developments and the exact temporal intervals between the developments. The results support the hypothesis that there are interesting and highly specific links between the acquisition of specific types of words and specific cognitive achievements.

Methodological Issues

There are a number of methodological problems that arise when we try to relate linguistic and cognitive development. Below we examine several of these problems and describe the techniques for dealing with them that were used in these studies.

Age.—Previous studies exploring the relation between early semantic and cognitive development (e.g., Gopnik & Meltzoff, 1984; McCune-Nicolich, 1981a; and Tomasello & Farrar, 1984) were not able to control for age. This raises the possibility that children may simply happen to acquire certain types of meanings at the same age at which they develop certain cognitive skills, but that there is no deeper relation between these two developments. In fact, in several earlier studies, apparent correlations between linguistic and cognitive development disappeared when age was partialed out (Corrigan, 1979; Miller et al., 1980). We have dealt with this problem in Study 1 by using children who were all the same age. The question was whether cognitive and linguistic behavior were related even when age was controlled. In the longitudinal study, Study 2, we used a statistical procedure that allowed us to control for the effects of age.

Scorer bias.—A second potential problem is that of scorer bias. Many earlier studies involved a small number of children in a relatively uncontrolled setting, using one experimenter to score both the cognitive and linguistic tasks. Judgments of children's linguistic and cognitive levels are often not entirely clear-cut (Corrigan, 1979). It is possible that the investigators' judgment of the child's cognitive behavior may have been influenced by knowledge of the child's linguistic behavior or vice versa. Scorers may have inadvertently imposed relations on the data. In the present studies we have primarily used two independent cognitive and linguistic scorers, one for the cognitive measures and one for the linguistic measures.

Language assessment.—There are two principal methods of assessing early language: maternal diaries and intermittent recording by an observer. Both have drawbacks. Mothers vary greatly in their skill as diarists, and they are particularly likely to miss early relational words. However, observers are also likely to miss very early appearances of words if they simply rely on a limited number of recording sessions.

In the present studies we used a questionnaire that described disappearance and success/failure contexts in some detail. Mothers received the questionnaire before testing began and were encouraged to focus their attention on these particular words, rather than trying to record everything the children said in an open-ended diary. In addition, in most cases, an interviewer went over the questionnaire with the mother and answered any questions she might have about it.

In order to ensure that children were not simply imitating words, or using them in a single, limited context, children were only counted as having acquired a word if they were reported to use it spontaneously in three different appropriate contexts. In addition, any spontaneous uses of disappearance or success/failure words during the session were noted, and children were also scored as having acquired the word if they used it appropriately during the recording session.

It is important to note that the scoring always took into account the meaning of the child's words, as deduced from context, rather than only the form of the words themselves. For example, children who used "no" to refuse food but did not use "no" to indicate the failure of a plan were not scored as having acquired a success/failure word (see Gopnik & Meltzoff, 1985). Similarly, children who used less common words such as "did it," "good girl," or "oh my" consistently to indicate the success or failure of plans were counted as having acquired a success/failure word.

Cognitive assessment.—We adapted the Uzgiris and Hunt infant assessment scales (Uzgiris & Hunt, 1975) for our cognitive testing. Children received the tasks listed in Table 1, and were scored as having passed an object-permanence task if they searched for the object appropriately on more than half the trials. Children were scored as having passed a means-ends task if they found the correct solution immediately, without a period of trial and error.

There are several different tasks within the Uzgiris and Hunt scales that seem to measure similar cognitive abilities. Thus object-concept tasks 10–15 might all be taken to be measures of "stage 6" achievements. In several previous studies, however, two of these tasks, tasks 13 and 14, were most closely related to the development of disappearance words (Gopnik, 1984b; Gopnik & Meltzoff, 1984; Tomasello & Farrar, 1984). Moreover, there are theoretical and practical reasons why these two tasks may be thought of as particularly appropriate measures of the development of the complete object concept in studies of this kind.[1] We have therefore

[1] Task 10—the invisible displacement with one screen—can be solved rather easily if the child develops the "magical procedure" that picking up cloths leads to objects reappearance (see Piaget,

TABLE 1

DESCRIPTION OF THE OBJECT-PERMANENCE AND MEANS-ENDS TASKS

Task No.	Task Description
Object-concept tasks:	
4	Finding a completely covered object (3–5 trials). Object is hidden under cloth A. Child must search at A.
8	Finding an object after successive visible displacements (3–5 trials). Object is hidden at A, then hidden at B, then hidden at C. Child must search at C.
10	Finding an object following one invisible displacement with a single screen (3–5 trials). Object is hidden in hand, hand is placed under A, object is left under A. Child must search at A.
13	Finding an object following one invisible displacement with three screens (5–7 trials). Object is hidden in hand; hand is placed under A, B, or C; object is left under A, B, or C. Child must search at correct cloth.
14	Finding an object following a series of invisible displacements (5–7 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.
15	Finding an object following a series of invisible displacements by searching in reverse order. After child has searched at C three times on task 14, object is hidden in hand, hand is placed under A, then B, then C; object is left under A. Child must search under C, then B, then A.
Means-ends tasks:	
9	Use of string vertically to obtain object
10	Use of stick to obtain object
11	Placing a necklace in a bottle
12	Stacking a set of rings on a post, avoiding one solid ring

concentrated on these two tasks in our analyses. We have assumed that children who could not solve even task 13 were unlikely to have developed the complete object concept, that children who solve 13 but not 14 were more likely to have developed the concept, and that those who solved task 14 had almost certainly developed the concept.

Similarly, means-ends tasks 9–12 could all be taken as indicators of the development of "stage 6" means-ends abilities. In previous studies (Gopnik & Meltzoff, 1984), means-ends task 9 (the string task) was solved before the other three tasks, but there was no consistent ordering among means-ends tasks 10–12. Uzgiris (1973) and Uzgiris and Hunt (1975) also report this pattern. We therefore analyzed the data in terms of three levels of means-ends skills. We assumed that children who could not pass even task 9 were unlikely to be able to use insight to solve means-ends problems; that children who passed task 9 but not tasks 10, 11, or 12 were more likely to have developed this ability; and that children who passed any one of tasks 10–12 were very likely to have developed this ability.

Study 1

METHOD

The subjects were 30 children, 13 males and 17 females, whose parents were solicited from the birth announcement listing in a local paper in Seattle. All the children were 18 months old plus or minus 1 week when they were tested (mean age = 77.93 weeks). Parents filled out a questionnaire about the child's use of relational words at home. When they arrived in the lab, an interviewer (who was not involved in the cognitive testing) went over the questionnaire with them again and answered any questions they had. The tasks listed in Table 1 were administered in two 15-min sessions with a 10-min break be-

1954). This procedure is particularly likely to develop in a study in which the child is receiving many object-permanence tasks sequentially. For this reason, this task is not a conservative measure of the development of the object concept. Task 15—the solution of the serial invisible displacement by searching in reverse—is a particularly convincing demonstration, but according to the Uzgiris and Hunt scales it can only be administered after the child has solved task 14 several times using a particular strategy. This means that many children who easily pass task 14 cannot be tested on task 15. Thus it is a difficult measure to use in practice.