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.

TABLE 2

PERCENTAGE OF SUBJECTS AT THREE DIFFERENT LEVELS OF OBJECT-CONCEPT AND MEANS-ENDS UNDERSTANDING AND THEIR USE OF DISAPPEARANCE (Top) AND SUCCESS/FAILURE (Bottom) WORDS

	COGNITIVE MEASURE[a]					
	Object-Concept Level			Means-Ends Level		
LANGUAGE	<13	=13	>13	<9	=9	>9
Disappearance words:						
Percent using words	16.7	42.9	64.7	100	50	42.1
N	6	7	17	3	8	19
Success/failure words:						
Percent using words	66.7	85.7	76.5	66.7	62.5	84.2
N	6	7	17	3	8	19

[a] See Table 1 and text for a description of the tasks used to assess the object-concept and means-ends levels.

tween them. Half the children received the object-concept tasks first and half received the means-ends tasks first. Within each session the tasks were administered in random order. The testing was carried out by an experimenter, who did not know how the child scored on the language questionnaire. All testing sessions were videotaped. The children's performances on the cognitive tasks were scored from the videotape record by an independent scorer who did not see the mothers' questionnaires.

RESULTS AND DISCUSSION

There was a relation between children's performance on the object-concept tasks and their use of disappearance words. Children who did better on these tasks were more likely to use disappearance words than those who did not. As shown in the top-left portion of Table 2, there was a monotonic increase in the percentage of children using disappearance words as a function of the three levels of object-permanence attainment (16.7%, 42.9%, 64.7%). However, expected frequencies in each cell were too low to allow a measure of the statistical significance of these data. Of equal interest is the fact that the same monotonic increase did not obtain between these same words (disappearance words) and performance on the other cognitive test (the means-ends tasks), as shown in the top-right portion of the table.

The results of this study also provide limited support for the hypothesis that the use of success/failure words is related to performance on means-ends tasks. Children who used insight to solve difficult means-ends tasks were more likely to use success/failure words than those who did not. As shown in the lower-right portion of Table 2, 84.2% of those who solved tasks 10–12 used these words, whereas children with less advanced means-ends understanding were much less likely to use these words. Moreover, as shown in the lower left portion of Table 2, this same relationship did not obtain between the use of these same words (success/failure words) and performance on the other cognitive test (the object-concept task).

Study 2

While the results of Study 1 provide trends suggesting that there may be specific relations between the use of disappearance words and object-permanence level and between success/failure words and means-ends level, these results could not be assessed statistically due to the small *N*. Moreover, in this study there were relatively few children who used one type of word but not the other, or who had mastered one type of cognitive skill but not the other. Such children are important for a strong test of the specificity hypothesis. In addition, the cross-sectional study could only give indirect evidence about the ordering of the linguistic and cognitive developments and about the exact temporal interval between the developments.

We therefore followed 19 children longitudinally,[2] comparing their semantic and cognitive development. Three questions were investigated. (1) What is the ordering of the semantic and cognitive developments? Do the semantic developments occur first, do the cognitive developments occur first, or do both

[2] Data from the first five of these subjects were reported in Gopnik and Meltzoff (1984).

developments appear together? (2) What is the temporal gap between the particular semantic and cognitive developments? Do they occur within several months of each other, within one month, or within weeks? (3) Is there any correlation between the age at which children acquire certain words and the age at which they acquire related cognitive skills? Will children who say *gone* early, for example, also solve object-concept problems early, even if they do not solve other cognitive tasks early?

These questions are also relevant to the specificity issue. If the relations between specific semantic and cognitive developments simply reflect a more general relation between language and cognition, or between "relational" words and the "stage 6" cognitive skills, there should be equally short temporal gaps and equally strong correlations between disappearance words and both the means-ends and object-concept achievements. Similarly, we would expect close relations between the success/failure words and both of the cognitive achievements. On the other hand, a different pattern of results would support the hypothesis that there are *specific* relations between particular semantic and cognitive developments. According to the specificity hypothesis, there should be shorter temporal gaps and stronger correlations between disappearance words and object-concept achievements than between disappearance words and means-ends achievements. Similarly, there should be shorter gaps and stronger correlations between success/failure words and means-ends achievements than between these same words and object-concept achievements.

Method

Subjects

The subjects were all recruited through a local preschool play group in Toronto. The group included 14 males and five females. The children's ages during the first session ranged from 13 months 14 days to 19 months 11 days. An interesting feature of this study is that we were able to include three children learning languages other than English. Subjects 8, 10, and 11 were exposed to Finnish, Polish, and Hebrew, respectively, as well as English.

Cognitive Testing

All the children were tested in the laboratory, and all testing sessions were videotaped. In each testing session the children received the tasks listed in Table 1. Subjects 1–5 were tested approximately once every month, subjects 6–11 were tested approximately once every 2 weeks, and subjects 12–19 were tested approximately once every 3 weeks. Sixteen of the subjects were tested until they had acquired both disappearance words and success/failure words and had passed both object-permanence task 14 and means-ends tasks 10–12. Subjects 10 and 17 withdrew from the study before they began using a disappearance word, and subject 14 withdrew before he solved task 14.

Cognitive Scoring

The scoring procedures were basically the same as those described in Uzgiris and Hunt (1975) and Study 1. In addition, however, children had to pass a particular task in two successive sessions before they were considered to have gained that particular cognitive skill. This ensured that subjects were only scored as having developed an ability when they displayed that ability consistently and stably. Subjects 1–11 were scored by the experimenter during each session. Subjects 12–19 were scored by an independent observer from the videotaped record. This observer turned off the sound on the recordings and did not know that the study concerned language.

Language Scoring

At each session the children's parents received a detailed questionnaire concerning their children's use of relational words, as described in Study 1. They were asked to record whether their child had begun using a word spontaneously in three different disappearance or success/failure contexts. The parents of bilingual children were asked to record any such words in the second languages.

For subjects 1–11, the language questionnaire was filled out by the mothers and handed in at the end of each session. For subjects 12–19, an independent language scorer administered the questionnaire, interviewed the mothers at the start of each session, and decided whether the subject should be scored as having acquired the word. This observer did not participate in any way in the cognitive testing or scoring. The cognitive tester had no access to the questionnaire data until the study was completed. In addition, the use of disappearance or success/failure words during the session was recorded. Children were counted as having acquired a word if they used it appropriately during the session or if they used it on the questionnaire.

Results and Discussion

The raw data are presented in Table 3. We will first consider the results of the cogni-

TABLE 3

AGE (in Days) AT WHICH SUBJECTS FIRST SOLVED OBJECT-CONCEPT AND MEANS-ENDS TASKS AND FIRST USED DISAPPEARANCE AND SUCCESS/FAILURE WORDS

Subject No.	Object Concept Task 13	Object Concept Task 14	Means-Ends Task 9	Means-Ends Task 10–12	Disappearance Word	Success/ Failure Words
1.....	492	492	520	520	492	520
2.....	511	555	483	483	555	483
3.....	464	464	464	593	464	558
4.....	557	557	518	518	557	518
5.....	626	665	500	626	665	626
6.....	636	608	590	727	608	698
7.....	572	585	543	585	599	599
8.....	535	570	555	588	588	555
9.....	575	612	535	535	612	535
10.....	475	514	475	580	*	580
11.....	551	565	551	677	565	661
12.....	541	541	502	541	583	562
13.....	498	498	519	564	519	564
14.....	594	*	531	594	594	594
15.....	574	574	422	506	555	555
16.....	446	478	536	536	502	536
17.....	484	544	544	523	*	484
18.....	525	525	417	463	572	463
19.....	432	448	432	539	448	518

* These three subjects withdrew from the study before they solved task 14 or used a disappearance word (see n. 3).

tive tests and the linguistic data separately before discussing the relation between the two areas of development.

Cognitive Development

The results confirmed the ordinality of the object-concept tasks. Only one child solved task 14 before task 13. However, the results of this study, like the results of Gopnik and Meltzoff (1984), Uzgiris and Hunt (1975), and the results of the present Study 1, suggest that the means-ends tasks are not this clearly ordered. Task 9 (the string task) was solved before tasks 10–12. Only one child solved task 9 after 10, 11, or 12. However, there is little evidence for the ordinality of tasks 10, 11, and 12. Children seem to solve all three of these tasks at about the same time, but they may be solved in any order (Table 4). Therefore, as in Study 1, we classified means-ends skills in terms of three levels of development: a level at which the child cannot pass task 9, a level at which the child passes task 9 but not tasks 10–12, and a level at which the child can pass at least one of these three tasks.

The findings also support the suggestion of Uzgiris and Hunt and others that there is some independence between "stage 6" means-ends and "stage 6" object-concept development. There were gaps of up to 129 days between the solution of object-permanence task 14 and the solution of means-ends tasks 10–12 (the mean gap was 59.84 days) (Table 5). Moreover, these two developments could take place in either order: nine children solved object-permanence task 14 before means-ends tasks 10–12, eight children reversed this pattern, and the remaining two children developed both skills in the same session (Table 3). In addition, there was a relatively small and nonsignificant correlation between the ages at which the two types of skills were developed ($r = .37$, $p > .05$). Children who solved one type of stage 6 cognitive problem early did not necessarily solve the other type of problem early (Table 6).

Clearly, the ability to solve both the complex object-permanence and the complex means-ends tasks developed at roughly the same time, between 15 to 21 months, with a mean of about 18 months (means = 17.90 and 18.52 months, respectively). In that sense, Piaget's notion of a general "stage 6" ability receives some support. But within that general period, there is a fair degree of independence between these two skills. A child may attain one of these "stage 6" achievements as much as 3 months before attaining the other.

Linguistic Development

Before the age of 2, all of the children in this study used some success or failure word,

TABLE 4

NUMBER OF SUBJECTS ACQUIRING MEANS-ENDS TASKS 10, 11, AND 12 IN DIFFERENT ORDERS

	ORDER OF ACQUISITION								
	10 < 11	10 = 11	11 < 10	10 < 12	10 = 12	12 < 10	11 < 12	11 = 12	12 < 11
No. of subjects	11	4	4	13	0	6	7	3	5

NOTE.—The acquisition of one task before, or at the same time as, another is indicated with the symbols <, =, respectively.

TABLE 5

MEAN GAP[a] (in Days) BETWEEN THE FIRST SOLUTION OF OBJECT-PERMANENCE TASK 14 AND MEANS-ENDS TASKS 10–12 AND THE FIRST USE OF DISAPPEARANCE AND SUCCESS/FAILURE WORDS

Cognitive Achievements	Mean Gap
Object-permanence task 14 and disappearance words	27.95
Object-permanence task 14 and success/failure words	55.68
Means-ends tasks 10–12 and disappearance words	64.63
Means-ends tasks 10–12 and success/failure words	13.53
Object-permanence task 14 and means-ends tasks 10–12	59.84
Disappearance words and success/failure words	58.68

[a] The gap is the absolute value of the interval between one achievement and the other.

and 17 of 19 used some disappearance words. The mean age of acquisition of success/failure words was 18.37 months and the mean age of acquisition of disappearance words was 18.34 months. This finding supports the suggestion that these two semantic categories are both common in very early language (Gopnik, 1981, 1982).

Different children used different words to express these meanings. This was particularly true for success/failure words, which included *uh-oh, there,* and *no,* but also included words such as *did it.* The bilingual children were particularly interesting in this respect. The Finnish-speaking child used the Finnish *hukku* and *ae* to express disappearance and failure, respectively, the Polish-speaking child used *nema* to express disappearance, and the Hebrew-speaking child used the Yiddish *oy* to express failure. It seems that children are strongly motivated to encode these particular meanings and will pick up whatever words are available to them in the adult language in order to do so.

While these two semantic categories of disappearance and success/failure emerged at roughly the same time (18 months), there was some independence between them. These two semantic categories of words could occur in either order. Seven children acquired disappearance words before success/failure words, nine children reversed this pattern, and three children acquired both words in the same session. There were gaps of up to 182 days between the acquisition of the two types of words (the mean gap was 58.68 days), and there was a small nonsignificant correlation between the ages of the two semantic developments ($r = 26$, $p > .10$) (Tables 5 and 6).

Relationships between Cognition and Language

We may now consider the relation between the cognitive and linguistic developments. The literature suggests that there are two sublevels within the general development of the "stage 6" object concept. Children first solve task 13, a simple invisible displacement task, then solve task 14, a serial invisible displacement task. Similarly, there are two levels of means-ends abilities—solving task 9, and solving tasks 10–12. It is interesting that each of these levels of achievement is related to semantic development in a rather different way. Children seem to reach the earlier level of cognitive development before they acquire the related words, but reach the higher levels at about the same time that they acquire the related words.

Object-permanence task 13 and means-ends task 9.—Table 3 shows the relation between object-permanence task 13 and means-ends task 9 and the acquisition of disappearance and success/failure words. In general, these tasks were solved before the related words were acquired. Only two of the 19 children acquired a disappearance word

TABLE 6

PEARSON CORRELATION COEFFICIENTS BETWEEN THE AGE OF SOLUTION OF OBJECT-PERMANENCE TASK 14 AND MEANS-ENDS TASKS 10–12 AND THE ACQUISITION OF DISAPPEARANCE AND SUCCESS/FAILURE WORDS

	Disappearance Words	Means-Ends Tasks 10–12	Success/Failure Words
Object-permanence task 14	.70**	.37	.46*
Disappearance words		.23	.26
Means-ends tasks 10–12			.95**

* $p < .05$.
** $p < .001$.

before they solved object-permanence task 13. In fact, many children solved these tasks well before they acquired the related words; about half of them solved task 13 more than a month before they acquired a disappearance word. On average, the gap between these two developments was 42.95 days.

This pattern emerged even more strongly for means-ends task 9 and success/failure words. Only one of the children used a success/failure word before they solved this task. Of the 19 children, 12 solved this task more than a month before they acquired a success/failure word, and the mean gap between these two developments was 57.47 days.

These findings are consistent with the claims of other authors, notably Tomasello and Farrar (1984), that children solve simple invisible displacement tasks, like task 13, before they use disappearance words. In addition, these findings demonstrate that children solve means-ends task 9 before they acquire success/failure words.

Object-permanence task 14 and means-ends tasks 10–12: Gap scores.—There was a closer and more interesting relation between the higher-level cognitive achievements—object permanence task 14 and means-ends tasks 10–12—and the acquisition of disappearance and success/failure words (Tables 3 and 5).[3] Of the 19 children, 14 solved object-permanence task 14 within a month of their first recorded use of a disappearance word. On average, the gap between these two developments was only 27.95 days. Similarly, 15 of 19 children solved means-ends tasks 10–12 within a month of acquiring a word for success or failure. The mean gap between these two developments was only 13.53 days. Thus it seems that children acquire these words within a few weeks of their solution of the related cognitive problems.

These linguistic and cognitive developments can occur in either order; one is not a prerequisite for the other. Eight children solved object-permanence task 14 before they acquired a disappearance word, while two children reversed this order, and nine children acquired the word and solved the task in the very same session. Three children solved means-ends tasks 10–12 before they used a success/failure word, six children reversed this order, and 10 children acquired the word and solved the task in the same session. These results suggest that these semantic developments occur concurrently with the related cognitive developments.

This close relation between the two types of developments is not simply due to age. Children acquired disappearance words and solved object-permanence task 14 across a wide range of ages spanning 15–22 months. Similarly, they acquired success/failure words and solved means-ends tasks 10–12 at ages ranging from 15 to 24 months. But at whatever age they acquired the word, they solved the problem within a very short time.

Moreover, these close relations appear to be quite specific. The temporal gap between the acquisition of a disappearance word and the solution of object-permanence task 14 ($\bar{X}$ = 27.95) is significantly shorter than the gap between the disappearance words and the solution of means-ends tasks 10–12 ($\bar{X}$ = 64.63 days) ($z = 2.51$, $p < .05$, Wilcoxon test). Similarly, the gap between the acquisition of a success/failure word and the solution of means-ends tasks 10–12 ($\bar{X}$ = 13.53 days) is significantly shorter than the gap between success/failure words and object-permanence task 14 ($\bar{X}$ = 55.68 days) ($z = -3.38$, $p < .01$, Wilcoxon test). This suggests that, rather than dealing with a general relationship between "stage 6" semantic and conceptual developments, we are dealing with two dissociable and very specific relationships.

Object-permanence task 14 and means-ends tasks 10–12: Correlations.—So far we have been considering the size of the temporal interval between specific semantic and cognitive achievements. We can also consider whether there are correlations between the age at which each child acquires a particular word and the age at which he or she solves the related problems. Do children who acquire a disappearance word relatively early also solve object-permanence task 14 relatively early? This provides us with another assessment of the relation between these spe-

[3] As previously noted, three subjects withdrew from the study either before they began to use a disappearance word or before they solved task 14. These children could have started to use these words or solve these tasks at any time after they left the study. For purposes of analysis, we assigned these children an age of acquisition for these achievements that was 1 day later than the latest age of acquisition recorded for any child in the study. This can be considered a conservative estimate of the actual age of acquisition of these achievements, and would work against the specificity hypothesis being tested. In any case, all the data were also reanalyzed dropping the subjects with missing values. All significant values remained significant, and all the nonsignificant values remained nonsignificant.

cific semantic and cognitive developments, it allows us to control for the effects of age, and we can use partial correlations to test the specificity hypothesis more precisely.[4]

As shown in Table 6, there is a significant correlation between the age at which the children acquire disappearance words and the age at which they solve object-permanence task 14 ($r = .70$, $p < .001$). Similarly, there is a significant correlation between the age at which children acquire success/failure words and the age at which they solve means-ends tasks 10–12 ($r = .95$, $p < .001$). The cross-correlations are much smaller, that is, there are much smaller correlations between disappearance words and means-ends tasks 10–12 and between success/failure words and object-permanence task 14 ($r = .23$ and $r = .46$, respectively).

It is also possible to partial out the effects of means-end performance from the disappearance words–object-permanence correlation. Similarly one can partial out object-permanence performance from the success/failure words–means-ends correlation. Partialing out the effects of the unrelated cognitive achievement has virtually no effect on the predicted language-cognition correlations, which remain highly significant at $r = .68$, $p < .001$, and $r = .94$, $p < .001$, respectively.

The results of this study, then, suggest that there are strong and specific relations between particular semantic developments and particular cognitive developments. Remarkably, these cognition-language relations are stronger than those between the different areas of semantic development or the different areas of cognitive development themselves (Tables 5 and 6). The temporal gap between the solution of object-concept task 14 (one "stage 6" cognitive measure) and the solution of means-ends tasks 10–12 (another "stage 6" measure) was significantly larger than the gap between the solution of object-permanence task 14 and the acquisition of disappearance words ($z = 2.01$, $p < .05$, Wilcoxon test) and the gap between the solution of tasks 10–12 and the acquisition of success/failure words ($z = 3.38$, $p < .001$, Wilcoxon). Similarly, the gap between the acquisition of disappearance words (one type of relational word) and success/failure words (another type of relational word) was significantly greater than either the disappearance word → task 14 gap ($z = -2.31$, $p < .05$) or the success/failure → tasks 10–12 gap ($z = -3.07$, $p < .01$, Wilcoxon). The same pattern emerges from the correlational analysis; the correlation between the two types of cognitive tasks ($r = .37$) and the two types of words ($r = .26$) is much weaker than that between the object-concept task and the disappearance word ($r = .70$) or between the means-ends task and the success/failure word ($r = .95$) (Tables 5 and 6).

General Discussion

Is there support for the specificity hypothesis? Are there specific links between particular semantic developments and particular cognitive developments, or are such links due to more general relationships between language and cognition?

Three kinds of results suggest that there are links between the acquisition of disappearance words and the solution of particular object-concept tasks and between the acquisition of success/failure words and the solution of particular means-ends tasks.

First, the cross-sectional study suggested that children who solved more difficult object-concept tasks were more likely to use disappearance words than those of the same age who did not solve these tasks; and children who solved more difficult means-ends tasks were more likely to use success/failure words than those of the same age who did not. Second, in the longitudinal study there were very small temporal gaps between the solution of the object-concept task 14 and the acquisition of disappearance words, and between the solution of means-ends tasks 10–12 and the acquisition of success/failure words. Third, there are strong correlations between the age at which children first solved object-permanence task 14 and the age at which they first acquired disappearance words, and between the age at which children first solved means-ends tasks 10–12 and the age at which they first acquired success/failure words. Moreover, these correlations remain virtually unchanged when the irrelevant cognitive measure is partialed out. In fact, these particular cognition-language correlations are stronger than the correlations between the different types of cognitive and language measures themselves.

[4] Parametric statistics are reported in the text because this approach allows significance levels to be assessed using partial correlations. The data were also reanalyzed using nonparametric correlations, and the pattern of results was comparable in all respects.

These results show that there are strong links between cognitive and linguistic achievements during the one-word stage. But the results of the present studies also suggest a stronger claim. They provide support for the "specificity hypothesis"—the hypothesis that there are very specific links between particular cognitive and particular linguistic achievements.

If the results were due to more general relations between cognitive and linguistic development in this period, we would expect to find close relations between each cognitive development and *both* types of semantic development, and vice versa. In fact, however, the cross-sectional study suggested that children who solved the more difficult object-concept tasks were not more likely to use success/failure expressions than those who did not, and, similarly, children who solved the more difficult means-ends tasks were not more likely to use disappearance expressions than those who did not.

These findings were replicated and strengthened in the longitudinal work. In this study, the gaps between the object-concept achievements and the disappearance words, and between the means-ends achievements and the success/failure words, were significantly shorter than the cross gaps (the gaps between the solution of object-concept task 14 and the acquisition of success/failure words or between the solution of means-ends tasks 10–12 and the acquisition of disappearance words). Also, in the longitudinal work, the correlations yielded a similar pattern. The correlations between the object-concept achievements and disappearance words were much stronger than those between the object-concept achievements and the success/failure words, and, similarly, the correlations between the means-ends achievements and success/failure words were much stronger than those between the means-ends achievements and the disappearance words.

None of these results could simply be due to age. In the cross-sectional study, the children were all the same age. In the longitudinal study, the semantic and cognitive developments took place across a wide range of ages. Moreover, the correlations between the age of acquisition of particular semantic and cognitive developments would not have yielded significance if the relation between these two developments was simply due to age itself.

Finally, the pattern of results emerges even when linguistic and cognitive scoring are carried out independently. This means that these results could not simply be due to scorer bias.

In sum, these results show that there are two specific, dissociable relations between semantic and cognitive development in this period. There is one relation between the acquisition of disappearance words and the solution of object-concept tasks, and a separate relation between the acquisition of success/failure words and the solution of means-ends tasks. Interestingly, these specific relations are stronger than more general relations between linguistic and cognitive development in this period, and moreover are stronger than the relation between the two types of cognitive developments themselves, or between the two types of semantic developments.

Implications for theories of the relation between language and thought.—While these relations appear to be specific and dissociable from each other, they have some interesting features in common. First, both relations involve the *content* of early language—the *meaning* early language expresses—rather than involving the structure of early language. In this respect, these relations are quite different from those that have been proposed in various theories of the relation between language and cognition in this period. Certain specific problem-solving abilities appear in conjunction with certain specific types of *meanings* and not others.

Second, at least some of these relations involve *concurrent* cognitive and semantic developments, rather than involving cognitive prerequisites for semantic developments. Obviously, some cognitive developments must take place before children can acquire disappearance and success/failure words. Our findings suggest that the very early "stage 6" abilities (e.g., solving object-permanence task 13 and means-ends task 9) may indeed be acquired before the relevant semantic developments take place. But it is perhaps more interesting that the more advanced cognitive abilities, required by object-permanence task 14 and means-ends tasks 10–12, seem to emerge within a few weeks of the related semantic developments. It seems that children acquire certain meanings at about the same time that they solve certain related problems. This raises the interesting possibility that conceptual and semantic development may occur concurrently, with each area of development influencing and facilitating the other. This possibility is similar to suggestions that have been advanced recently concerning later language development (Bowerman, 1980;

Kuczaj, 1982). The present results suggest that this pattern may occur even during the one-word stage of language development.

Finally, the semantic developments and the related cognitive developments both seem to require similar sorts of *underlying concepts*. We have shown that children begin to talk about disappearances at about the same time that they solve problems that involve disappearance. We have also shown that they begin to talk about aspects of plans, such as success and failure, at about the same time that they solve problems that involve relations between means and ends. There are theoretical reasons why there should be close relations between the specific concepts that disappearance and success/failure words encode and the specific concepts that underlie the ability to solve complex object-permanence and means-ends problems. In order to use a disappearance word such as *gone* in the way that they do, children must be able to generalize across a wide range of disappearances, including complex invisible displacements—they must be able to see that all these events share some common underlying similarity. A parallel ability to generalize across a wide range of disappearances seems to underlie the ability to solve the complex invisible displacement problems assessed in the cognitive test. Similarly, in order to use success/failure words, children must be able to consider, reflect on, and generalize about their own plans and the relation between these plans and the world. Similar abilities seem to underlie the ability to use insight to solve certain complex means-ends problems. The close connection between the underlying conceptual developments that allow children to solve specific types of problems and use specific types of words may help to explain the specificity of the early language-cognition relations.

Children seem to be motivated to acquire words that are relevant to the particular cognitive problems they are working on at the moment. A child on the verge of solving complex object-concept problems may acquire a word such as *gone*, which is relevant to these problems, while a child who is busy working out the relation between means and ends will be more likely to say *uh-oh*, *there*, or *did it*.

These very specific relations may reflect a general functional characteristic of early language. It is possible that, in general, children are beginning to apply words to their particular cognitive concerns in this period. If this is true, we might expect to find other specific, concurrent relations between semantic and conceptual developments. For example, the specificity hypothesis might predict that spatial words would be acquired at about the time that the child solved certain spatial problems, and that the naming explosion would be contemporaneous with changes in classification skills that take place during the transition from infancy to early childhood—two issues that we have recently explored with some success (Gopnik & Meltzoff, 1986, and in press). These relations would parallel the specific relations we have discussed here between disappearance words and object-concept achievements and between success/failure words and means-ends achievements.

These findings suggest that semantic and conceptual development are closely intertwined. Children's specific cognitive concerns seem to play a significant role in determining the shape of their early language. Moreover, the concurrent development of semantic and conceptual abilities raises the interesting possibility that specific linguistic developments may also play a role in determining the child's specific cognitive achievements.

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