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Development of selected conservation skills and the ability to judge sentential well-formedness in young children

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DEVELOPMENT OF SELECTED CONSERVATION SKILLS AND THE ABILITY TO JUDGE SENTENTIAL WELL-FORMEDNESS IN YOUNG CHILDREN

by

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ABSTRACT

DEVELOPMENT OF SELECTED CONSERVATION SKILLS AND THE ABILITY TO JUDGE SENTENTIAL WELL-FORMEDNESS IN YOUNG CHILDREN

by

Gloria Schlisselberg

Advisor: Professor Helen S. Cairns

The present study examined the relationship between cognitive development and metalinguistic development in young children. Cognitive ability was measured using standard Piagetian tasks and a modified conservation of number task. The standard task tested conservation of substance, continuous quantity, and weight according to instructions developed by Goldschmid and Bentler (1968). The modified task was adapted from research by Rochel Gelman (1982a). Children were trained to realize the invariance of equal numbers of items whether or not the items were presented in one-to-one correspondence. A testing segment immediately followed the training, wherein children were tested according to the standard administration.

Metalinguistic ability was measured using an acceptability task. Subjects were asked to judge the well-formedness of well-formed and ill-formed sentences using an interview format similar to the one created by

Cairns and McDaniel (1988). In addition, for any sentence that was rejected by a subject as not being "the right way to say it," a correction was requested.

Twenty-nine nursery school and kindergarten children ranging in age from 3;5 to 6;6 participated in the study. All experimental tasks -- standard conservation, modified conservation, and well-formedness -- were administered to each subject. Children were seen individually for two interviews. The first interview included administration of the standard conservation task and one half of the acceptability task. The second interview, held on a different day but within one week of the first, consisted of the modified conservation task and the second half of judgment task.

Results of the conservation tasks yielded a positive correlation between conservation ability and age. However, within that general trend, variability was noted in the distribution of the results. The data were categorized along a developmental continuum of conservation ability. Categories ranged from no ability to conserve even on the modified task, to attainment of a perfect score on the standard task. Evidence of conservation behavior in children younger than those previously reported in the literature gave support to Gelman's accessing account of development. The findings were discussed relative to that theory.

Results of the acceptability task revealed that ability to judge well-formedness covaried with age, however variability was found within that overall relationship. Results were analyzed according to a developmental continuum of judgment ability. The categories that were developed ranged from zero judgments to accurate judgments on all of the sentences. Analysis of correction data helped to determine that children's judgments were form-based.

The overall results of the study were discussed with respect to methodological factors that should be considered when measuring conservation ability using standard administration.

For my mother and father, who always valued education

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I have looked forward to writing this part of the dissertation, so that the people to whom I have said "Thanks" would get the recognition in print that they so richly deserve. That is because, although only my name appears on the title page, there were many significant backstage contributors without whose help and support this production would not have been realized.

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CHAPTER I

INTRODUCTION

There is an ever-increasing body of research examining the emergence of metalinguistic ability or awareness. Often, it is contrasted with other aspects of child development, including language and cognition. Samples from existing research in each of these areas will be presented, and then related to the design of the present study.

Metalinguistic awareness and language development

Metalinguistic development seems to represent a second stage of language development, where "a more abstract level of language use" is acquired, "beginning at age 5 and continuing for a number of years" (Wallach, 1984, p. 83). During this period, children learn new strategies for interpreting the verbal code. It is not a separate development, but rather an extension of the skills a language user must acquire in order to gain true competence in communicating. And, in addition to mastering the verbal code, children are learning to interpret the language of the written code during this second phase.

A crucial skill that must be acquired at this level of language development is the ability to deal with language as an object for analysis and reflection. Ordinarily, language is treated as "transparent," used primarily as a tool of communication. Developing linguistic awareness requires that the child see language as "opaque" to attend to it and analyze it (Cazden, 1976).

Researchers have tried to elicit evidence from children about their ability to focus on and analyze language "in its own right." They have used puppets (deVilliers and deVilliers, 1972), stuffed animals (Pratt, Tunmer and Bowey, 1984), and interview techniques (Gleitman, Gleitman and Shipley, 1972; Cairns and McDaniel, 1988) to obtain, directly or indirectly, children's intuitions about synonymy, segmentation, ambiguity detection, and well-formedness.

The present study chose an interview technique to elicit judgments of sentential well-formedness from young children. It was proposed that the judgment-plus-correction paradigm that we used would add further evidence to the present body of knowledge that exists about children's ability to analyze the language they have acquired. In addition, it was predicted that the judgments obtained from the children in this study would be form-based. That would contrast with earlier findings of research in which judgments elicited from youngsters were content-based, and it was not until around age 7 that children were believed able to offer form-based acceptability judgments (see, for example, Hakes, Evans, and Tunmer, 1980).

Metalinguistic awareness and cognitive development

Whereas metalinguistic ability develops after language is acquired, it seems to develop in tandem with certain cognitive behaviors. "The cognitive ability to consider several dimensions of a problem simultaneously and to separate one's personal perspective from the problem is associated with the development of metalinguistic judgments of linguistic forms and meanings" (Rice and Kemper, 1984, p. 119). The level of cognitive development being described is the concrete operational stage according to Piaget's (1983) model and emerges during the age span 7-11 years. The ability described, which is believed to underlie cognitive and metalinguistic skills at this level, is the ability to decenter one's focus and attention. (This skill will be discussed in greater detail in the next chapter.)

Research has been conducted by Hakes et al. (1980) and by Wankoff (1983) to test the theory that metalinguistic abilities develop, and co-vary, with attainment of the concrete operational stage of cognitive development. They determined cognitive level of functioning by testing the ability to conserve some critical attribute such as weight, quantity, and/or number. Data from the cognitive task were analyzed along with information obtained from at least one measure of metalinguistic ability (e.g., segmentation, acceptability, ambiguity detection). The researchers' results supported the theory that decentration accounted for both the conservation ability and the metalinguistic ability observed in their experimental subjects.

The present study replicated previous research in that it compared performance on metalinguistic and cognitive tasks. However, we extended the conservation section of the design to include a modification of the standard task based on evidence offered by Gelman (1982a), Donaldson (1978), Rose and Blank (1974) and Samuel and Bryant (1984). These researchers found that the instructions used in the standard conservation task contained miscues for the subject which led to failure, especially for a young child. We replicated the method used by Gelman (1982a) which was found to be less confusing and misleading for the child. It was proposed that the current methodology would replicate the results obtained in the research cited above which used modified conservation tasks.

In summary, the empirical goals of the present study were:

1) To trace the development of conservation behavior in young children, using both standard and modified conservation tasks.

2) To trace the development of young children's ability to judge the well-formedness of sentences, and to offer corrections of sentences they rejected as being ill-formed.

3) To investigate the nature of the relationship between the ability to judge well-formedness and the ability to conserve.

CHAPTER II

LITERATURE REVIEW

In this chapter, selected research in linguistic and cognitive development will be presented. The literature to be reviewed focuses on the development of metalinguistic awareness in children, and on children's increasing ability to conserve. The various methods used to gather information about children's behavior in these several areas will be described and contrasted with the methods developed for the present study.

Hakes and his colleagues (1980) considered the close relationship between linguistic awareness and cognitive functioning. They investigated the relationship between the emergence of metalinguistic awareness and levels of cognitive development in accordance with a Piagetian model; specifically, they focused on the transition from the preoperational subperiod to the operations subperiod of the concrete operational stage (Piaget, 1983).

The child who is characterized as being at the stage of concrete operations is said to have developed internalized mental representations of objects and events in the environment that obey logical rules of organization. Such a child has acquired an ability to "decenter" attention, that is, to approach tasks analytically rather than intuitively; to be able to focus on more than one aspect of a problem or situation; to deal systematically with relationships between aspects of a situation (Hakes et al., 1980, p. 14).

In contrast, as van Kleeck described in her review of research in this area, preoperational thought is characterized by the ability to focus on/attend to only one aspect of a given situation at a time (centration or lack of decentration). Moreover, lack of reversibility (i.e., the ability to shift focus back and forth between aspects of a situation) is a related restriction that typifies children's thought at this stage (van Kleeck, 1982, p. 243).

For example, a child who could not decenter would, on a standard conservation task, focus on some aspect of the perceptual difference that is introduced by the investigator during the transformation stage of the exercise. Unable to compensate cognitively for the new appearance or remember the initial state of equality, the child would respond "No" to the conservation question "Now are they the same (weight, length, number, etc.)?" when two quantities were indeed equal on whatever critical attribute was being measured.

The concrete operational child seems to possess a cognitive flexibility that the preoperational child described above lacks. This flexibility enables him/her to succeed on cognitive tasks such as conservation which, when presented according to standard administration, are disembedded tasks. That is, when there is no accompanying context, story or explanation offered with the procedure to give added meaning to the manipulation of the stimuli or to the experimenter's questions, the child who is able to decenter attention can nevertheless complete the experimental task. Instead of focusing on the perceptual variance evident in these exercises, s/he is able to realize the quantitative invariance that exists, and provide a conserving response.

In their research, Hakes and his colleagues sought parallels in later language development that would coincide with the cognitive changes that were emerging with the attainment of the concrete operations stage (Hakes et al., 1980). They proposed that the decentering ability was responsible for the child's new emerging metalinguistic skills, involving a systematic means of reflecting upon linguistic problems and properties. Moreover, Hakes hypothesized that metalinguistic development was the linguistic reflection of the general cognitive development that was unfolding as part of the emergence of concrete operational thought. The ability to decenter, to "mentally stand back from a situation in order to think about the relationships it involves" was therefore proposed as characterizing the cognitive abilities needed for successful performance on both metalinguistic tasks and on concrete operational tasks.

Analysis of children's performance on tasks used to measure these skills (e.g., synonymy judgments, segmentation exercises, conservation experiments) yielded a picture of a child who was developing a unified ability to deal with an increasing variety of tasks. Acquisition of the ability to decenter included the use of more systematic, effective means of approaching the various tasks presented than was possible at the earlier stage of cognitive development.

Experimental results did, in fact, support the prediction that metalinguistic development parallels the transition from preoperational to concrete operational thought. The explanation offered for these results was that the child acquires a general ability to decenter attention and focus, enabling him/her to reflect upon the formal properties of language. This theory was echoed by van Kleeck (1982), who suggested that the developmental, qualitative changes in children's performance on metalinguistic tasks (around age 6-7 years) may be a direct reflection of changes in cognitive strategies for approaching these tasks.

Further empirical support for this view was obtained from research conducted by Wankoff (Wankoff, 1983). She investigated the relationship among ambiguity detection, segmentation skill and conservation ability in kindergarten through third grade children. Analysis of the correlations found among the variables that were tested led Wankoff to conclude that a common cognitive thread was a necessary (although not sufficient) prerequisite for success on conservation, ambiguity detection and segmentation tasks.

Conservation reponses have been obtained from subjects younger (3;6 - 5 years old) than those who achieved success on the standard Piagetian tasks. It was reported in research by Gelman and her colleagues (Gelman, 1982a and b; Gelman, Meck and Merkin, 1986) and by Donaldson and her colleagues (McGarrigle and Donaldson, 1974; Donaldson, 1978, 1982).

Gelman's (1982a) research focused on conservation of number, using three- and four-year-old children as subjects. She demonstrated to them the role of one-to-one correspondence in defining and establishing number equivalence of sets of objects. She used the children's counting ability to show them how to judge the effects of relevant and irrelevant transformations, thereby enabling them to supply conservation of number responses. Gelman (1982b, p. 162) pointed out that "to successfully perform the number conservation task, the child has to know that whenever the items in one set can be placed in one-to-one correspondence with those in another set, both sets have the same number."

Gelman conducted a two-phase experiment (training and conservation transfer) to make explicit to the children the relationship between the principle of one-to-one correspondence and perceptual variance/ invariance. Training was performed using set sizes that the children could count (i.e., 3 or 4). Two rows of items (blue plastic turtles) were placed horizontally in one-to-one correspondence. In the training phase, cardinal values and equivalence were established by having the children count the number of turtles in each row. They then reported those cardinal values, and were shown that equal numbers meant equivalent rows. Then the experimenter lengthened or shortened one of the rows, and asked if the cardinal value of each was still the same. A judgment of equivalence was elicited and an explanation of the judgment was obtained (for incorrect responses, the children were asked to recount and judge again).

In the conservation transfer phase, both small (4 or 5) and large (8 or 10) set sizes were used, and two types of number conservation (equivalence and non-equivalence) were tested. These test trials were conducted according to standard number conservation instructions; children were discouraged from counting. Evidence of conservation in this phase required a correct judgment and explanation on at least one small set and one large set item to eliminate the likelihood that the children responded correctly as a result of counting before responding.

The results yielded evidence of conservation (according to the criteria stated above) in 75% of the three-year-olds and 88% of the four-year-olds who were in the experimental group. The components of the conservation task that were analyzed included children's judgments and explanations. The 3-year-old group offered correct judgments 68% of the time (as compared to 6% for the controls), and gave adequate explanations of those judgments 82% of the time. The 4-year-old group judged correctly 74% of the time (contrasted with 15% for the controls), and explained 93% of their judgments.

Gelman concluded that the high rates of explanations firmly indicated conservation behavior in children years younger than those who typically demonstrate conservation ability. These results lend support to an accessing account of development (Gelman, 1982a), meaning that the usual failure by young children to conserve is due to the failure to access their competencies rather than to a lack of cognitive ability. As Gelman stated, "although the competence model for preschool counting grants the implicit use of one-to-one correspondence, it does not follow that the child has ready access to the knowledge" (Gelman, 1982a, p. 211). This implicit ability was indeed made explicit by the methodology employed in this study.

Donaldson and her colleagues explored a different aspect of the conservation task than Gelman did in her research. They effected conservation responses in young children by altering the standard methodology of Piagetian tasks (see, for example, Donaldson, 1978; McGarrigle and Donaldson, 1974). Their work focused on the possible disparity between the experimenter's intentions and the child's interpretation of the procedure. They were interested in determining how the presentation of the task was perceived by the young child, and how it may have influenced the child's responses.

McGarrigle and Donaldson (1974) hypothesized that the manner in which a transformation occurred would affect children's responses to the post-transformation question. They believed that a young child's response to that question may rely heavily upon "the meaning of the (whole) situation" (Donaldson, 1978, p. 62). That is, after initially asking the child if two arrays are the same, the experimenter deliberately manipulates the material, with instructions to the child to "Watch what I do." Based on this procedure, McGarrigle and Donaldson postulated: "Is it not then reasonable that the child should think this change will be relevant to what follows--to the next question which will be asked?" (Donaldson, 1978, p. 61). Thus, the responses that were obtained were contextually appropriate, though incorrect with respect to ability to conserve.

To test their hypothesis, they introduced a teddy bear called "Naughty Teddy" who messed up the array of experimental material. By creating an "accidental" transformation, the experimenter's repetition of the conservation question seemed "excusable". The hypothesis was supported, as more children between four and six years old gave conserving responses than on standard administration.

Other young conservers have been discovered in research whose focus was the nature of the instructions to the child. For example, Rose and Blank (1974) wondered about asking the same question ("Are they the same?") before and after transforming the stimulus array according to the critical attribute being manipulated. They hypothesized that a two-judgment experimental paradigm contained "subtle contextual factors" which cued the child to change his/her first judgment (usually one of equality). They offered the explanation that, ordinarily, one "would never ask the identical question twice if a significant change had not occurred in the material that was being observed" (p. 499). The authors felt that that second asking of the equality question in the conservation task suggested to the child that s/he should change his/her first answer (i.e., from 'Yes" (equality) to 'No' (inequality)).

Rose and Blank designed a one-judgment task wherein the child was questioned about (number) equality only after the transformation stage of an equivalent/ nonequivalent problem. This one-judgment condition was contrasted with a standard conservation task, and a fixed-array task where the child only saw the rows in a transformed state. Disks were arranged in sets of 6 and 6, 5 and 5, 6 and 4, and 5 and 7.

Each child was tested on only one of the three conditions, and was asked whether the two rows had the same number of disks. Results using first grade subjects (mean age was 6;3 years) showed that conservation errors were more than halved in the one-judgment condition relative to the standard conservation test and the fixed-array condition. The results led to the conclusion that when a judgment of equivalence has been offered, the request for a second judgment signals the child to change his/her response.

Rose and Blank's variation of the traditional task was borrowed for a study conducted by Samuel and Bryant (1984). They sought to extend the previous results to "other versions of the conservation task" (p. 315) and to a wider age range of subjects. These researchers believed, as did Rose and Blank, that "the child may think that the experimenter asks the question the second time because he wants another answer" (p. 315). Their study replicated Rose and Blank's experimental conditions, using the one-judgment task condition and contrasting it with a standard conservation task and a fixed-array control. Conservation of mass, number and volume were tested.

Subjects ranged from 5 to 8-1/2 years of age, with children of equal mean age being placed in each condition. Results supported Rose and Blank's findings. The one-judgment task was easier (measured by mean number of errors across tasks) than the other two conditions for all three types of conservation tested, although the number task was determined to be easier than the mass and the volume tasks. Statistical analysis revealed a significant difference between every age group; the older groups performed consistently better than the younger. The authors concluded that the repetitive questioning, and not necessarily a lack of knowledge of invariance, leads to errors by children on traditional conservation tasks.

What is it about conservation ability that leads to failure by young children on standard Piagetian tasks and yet is accessible in young subjects such as those in Gelman's and Donaldson's research? The answer seems to lie in the methodology of the tasks, and not in a lack of cognitive ability, according to the research presented here (Rose and Blank, 1974; Donaldson, 1978, 1982; Gelman, 1982a; Samuel and Bryant, 1984).

Implicit contextual cues (e.g., asking the same question before and after transforming the array) may play a large role in the child's responses (Rose and Blank, 1974). The child may have difficulty with the sheer linguistic form of the task, being unable to separate the meaning of the language used from its relationship to the situation. Donaldson (1978) cited as a reason for failure the child's lack of ability to pay scrupulous attention to language in its own right. As a result, s/he is unable to respond to questions as disembedded words, and therefore looks upon the experimenter's (post-transformation) question as a unity of words-and-context.

This builds into the standard conservation task sources of failure which Piaget's theory may not have anticipated (Donaldson, 1982, p. 206). Grieve, Tunmer and Pratt (1983) suggested that, whereas young children are not without intellectual abilites, "the exercise of these intellectual skills...is context-dependent rather than context-free" (p. 291). Note, that Gelman and Baillargeon (1983) cautioned against crediting the preschool child with too much cognitive ability based upon performance on these tasks, since they were "tailored". Nevertheless, young children did provide conservation responses and explanations.

In the authors' discussions of the research presented above, much emphasis was placed on the role of metalinguistic awareness relative to successful performance on cognitive tasks. That is, development of the ability to analyze and reflect upon language form--separate from the contextual support of a situation--was considered in the writings of Gelman (e.g., Gelman, 1982a) and of Donaldson (e.g., Donaldson, 1978) to be a key factor in the development of the ability to reflect upon and control one's thoughts. As Donaldson explained (in a discussion of what is necessary for success in school), the child must become aware of language as "a separate structure, freeing it from its embeddedness in events" (p. 90).

Donaldson's view represents a strong meta-linguistic awareness hypothesis, wherein metalinguistic awareness is considered to have a fundamental infuence on thought (Pratt and Grieve, 1984, p. 138). Note that this is a much stronger claim than the suggestion that metalinguistic skill enables the child to deal with questions which are confusing or misleading relative to the context (such as those in the standard Piagetian conservation tasks). We will return to this issue in the Discussion chapter.

It is important, too, to note that the experimental tasks referred to in the studies cited above had in common the creation of some meaningful, facilitating context or explanation. The context seemed to enable young children to perceive invariance of the critical attribute being transformed. This methodology differs from the standard Piagetian battery of conservation tasks (Goldschmid and Bentler, 1968) wherein the tasks and the instructions to the children are disembedded (Donaldson, 1982). No story or other context is provided, no training is permitted, no character is introduced or situation set up as part of the task. The difference in the degree of embeddedness of the tasks may account for the developmental difference seen in conservation ability, since, as van Kleeck (1982) pointed out, the preoperational child is incapable of treating language in a decontextualized manner.

The evidence presented relative to conservation ability seems to form an interesting parallel with results of research in metalinguistic development. As mentioned earlier, Gelman proposed that the model for children's counting entails an ability to incorporate the notion of one-to-one correspondence. However, the implicit use of that concept does not mean that the knowledge is accessible to the child at a conscious level for analysis.

A similar argument may be applied to the discrepancy noted in children's rule-governed ability to produce and understand language despite their inability to access those rules on metalinguistic tasks (Gelman, 1982a). Perhaps in each instance, the child can only deal with the concepts in a pragmatic, means-ends fashion such as counting or speaking and understanding. What may be lacking developmentally may be Cazden's (1976) notion of being able to make ordinarily 'transparent' concepts--number or language--'opaque' as objects for analysis.

As noted above, there is substantial evidence of a developmental trend in children's ability to analyze and reflect upon language. DeVilliers and deVilliers (1972) were able to elicit correct judgments of semantically anomalous sentences from young children of 2;4 years of age.

They used a Cookie Monster puppet who said things "all the wrong way round" (p. 303). In the discussion of their experimental results, the authors stated that content-based judgments were evidenced developmentally prior to meta-linguistic judgments about word order, which is a formal property of sentences.

As exemplified by the deVilliers and deVilliers (1972) research, form-based errors may be interpreted and judged according to comprehensibility or content for young children. In contrast, for older children and adults, a more complex criterion is met, allowing them to separate out and consider syntactic well-formedness as well. Van Kleeck (1984) dealt with this distinction in quality of response by defining two stages of language awareness. Stage one included the preoperational child, who can focus on language as a communicative tool <u>or</u> an object of play, but not both. Stage two described the concrete operational child who, as mentioned earlier, can decenter attention and focus, and shift back and forth between language content and form analysis.

Further evidence for the developmental trend in achieving metalinguistic awareness was obtained in the study by Hakes et al., (1980) involving subjects from four to eight years old. On tasks requiring synonymy judgments, acceptability judgments and the ability to segment spoken syllables, the experimenters noted quantitative differences across ages, indicating that these abilities developed over the age span studied. Further, their findings yielded a qualitative difference in the basis for metalinguistic judgments that progressed correspondingly with increased age of the children in the study.

For example, younger subjects (4-year-olds, and 5-year-olds to some extent) based their acceptability judgments upon what the sentence asserted, and were seemingly not able to deal with language form as a disembedded, decontextualized entity separate from meaning. Older subjects (7- and 8-year-olds) were able to base judgments of acceptability on syntactic rule violations, and seldom gave content-based reasons for rejecting a sentence.

In contrast to the findings just reported, the research that follows offers results that, like the conservation results, can be mitigated by task alterations. For example, Fox and Routh (1975) were able to elicit word and syllable segmentation ability in three- and four-year-olds by instructing them to repeat progressively smaller "bits" of sentences given to them by the experimenter. In contrast, Liberman, Shankweiler, Fischer and Carter (1974), using a standard methodology (tapping a wooden dowel on a table) elicited syllable segmentation in only 46% of their 4-year-old subjects. No 3-year-olds were tested.

Read (1980) described research designs for eliciting judgments of vowel categorization in children.

His first attempt "didn't work at all with five-year-olds" and failed to obtain consistent results from six- and seven-year olds. But then "a relatively small (methodological) change"--introduction of a puppet named Ed who liked words that sounded like his name (e.g., Ted, sled, fled)--yielded success with younger children. Eighty-two percent of the kindergarteners reached criterion, leading Read to conclude that "this change in the task made (vowel categorization) accessible to most kindergarten children, two years younger than those" who performed consistently in the earlier study (Read, 1980, p. 76).

Lloyd and Donaldson (1976) recruited help from a 'friend'--a two-and-a-half foot tall "talking" toy panda named Chu-Chu--to elicit true/false judgments from children ages 3;0 to 5;0. Theirs was a descriptive study (i.e., no hard data were reported). They wanted "to reduce the effect which an adult authority might have on the judgments of truth and falsity" (p. 413). They told the children that Chu-Chu needed help from them to learn to talk better. The authors felt that the children responded very well to a situation where they were neither being tested nor were merely playing. The child's role was "a position of responsibility", and s/he took that role seriously and tried to do the job well.

Researchers have also used the method of eliciting corrections of structural violations to assess grammatical awareness in children. Pratt, Tunmer and Bowey (1984) asked 5- and 6-year olds to correct morpheme errors and word-order violations in sentences presented by puppets (one per task). This time there was no judgment task used. The children were told that everything the puppet said was incorrect, and their job was to repeat all the sentences correctly.

The results showed very high scores for correction of morpheme errors (the mean percentage correct was 90.1 and 93.8 for the 5- and 6-year groups, respectively). The word-order task was "considerably more difficult for both age groups of children" (p. 139), yielding mean percentage correct scores of 47.9 and 76.6 for 5- and 6-year olds, respectively. The reason offered for this comparatively poor performance was the higher demand required to restore sentences with word-order violations to grammatical sentences. Despite the differences found in subjects' performance on the two tasks, the authors recommended a corrections task over an acceptability task (even one where explanations of judgments were given). They concluded that the sentence correction task clearly involves grammatical awareness. An acceptability task may not, since the child may not be able to explain the basis for his/her judgment of a sentence.

Cairns and McDaniel (1988) were able to elicit form-based judgments of grammaticality from young children--without the use of circuitous means such as creating an artificial context. Rather, their study incorporated a training task and a method of eliciting intuitions from subjects which was to ask them directly. Subjects ranged in age from 3;8 to 5;4 years. The authors found, as did Lloyd and Donaldson (1976), that the chidren enjoyed thinking and talking about language and liked to be of help to the experimenters in obtaining the information they needed. All of the twenty-two children interviewed were capable of judging the grammaticality of sentences presented, and it was clear to the researchers that responses were not based on content. In addition, most children were able to correct ungrammatical sentences. Some even attempted to give explanations even though they hadn't been asked to do so.

In summary, recent research in the areas of later language learning and cognitive development have yielded conflicting results about children's abilities. Conservation ability has been used as a measure of cognitive growth. Studies that employed a standard task administration (e.g., Hakes et al., 1980; Wankoff, 1983) yielded success with children aged seven years or older, and little success with youngsters below first grade.

However, research designs that used alterations in task procedures (e.g., Donaldson, 1978; Gelman, 1982a; Rose and Blank, 1974; Samuel and Bryant, 1984) revealed that children as young as three years old displayed conserving behavior. Yet, is this 'true' conservation, or is it 'modified' because the methodology is? Results of both kinds of procedures seem valid as measures of conservation ability. Perhaps, as suggested in this chapter, the answer to the conservation issue lies in the linguistic nature of the conservation task methodology. Relative to this issue, research in the area of later language ability was presented in this chapter.

When tasks measuring metalinguistic abilities were used, once again theories differed as to the amount of ability young children should be credited with vis-a-vis linguistic awareness. Some research with preschool youngsters (deVilliers and deVilliers, 1972; Hakes et al., 1980) yielded support for the view that early metalinguistic skill is content-based and context-dependent. Form-related judgments were not evidenced until developmentally later (i.e., 7 or 8 years old).

But, once again, results using modified methods revealed metalinguistic ability in children as young as 3 years old (e.g., Fox and Routh, 1975; Read, 1980; McDaniel and Cairns, unpublished). As was the case with the conservation studies, results of research in metalinguistic awareness shed new light on the abilities of preschool youngsters. In addition, new questions were raised by the conflicting results.

The research presented in this chapter was taken into consideration when developing the methodology for the present study. Standard procedures as well as current modifications included in the literature influenced the materials and methods used in this research. We examined young children's (3;5-6;3) performance on standard conservation tasks, a modified conservation task, and a metalinguistic judgment task.

The standard conservation task conformed to Goldschmid and Bentler's (1968) methodology. The methodology used for the modified task replicated Gelman's (1982a and b) conservation of number paradigm. If conservation responses were elicited from a) children younger than those who typically succeed on the standard task, and b) children who fail the standard tasks presented in this study, support would be demonstrated for the accessing account of development proposed by Gelman, and discussed earlier in this chapter.

The metalinguistic task used in this study was a grammaticality judgment task that employed Cairns and McDaniel's interview method, requesting from youngsters both well-formedness judgments and corrections for sentences that they rejected (Cairns and McDaniel, 1988). It was predicted that this context would replicate their findings and elicit form-based acceptability judgments from children at a younger age than that reported in the literature (e.g., Hakes et al., 1980).

In summary, this study was designed to achieve the following empirical goals:

1) To demonstrate a developmental continuum of conservation ability preceding complete success on the standard conservation task.

2) To trace the development of the ability to discriminate well-formed from ill-formed sentences.

3) To trace the development of the ability to offer corrections of sentences rejected as ill-formed.

4) To replicate the finding that metalinguistic ability co-varies with cognitive ability, and that both of these abilities are related to age.

5) To obtain empirical evidence relative to the nature of the relationship between cognitive abilities and metalinguistic abilities.

CHAPTER III

METHOD

In this chapter, the subjects and the materials and methods used in the study will be described. First, there will be a brief explanation of the children who participated in the experiment. Following that section, the procedures that were administered to each of the subjects will be fully described. The methods used to measure subjects' performance on the experimental tasks are also included in this chapter.

Subjects

There were twenty-nine children who participated as subjects in this study. Twenty-three of them were in nursery school, and ranged in age from 3;5 years to 5;4 years. The remaining six, ranging in age from 5;6 to 6;6, were in kindergarten. The mean age of the subjects was 5;0 (4;8 for nursery children, 6;1 for kindergarteners). There were 16 females and 13 males.

All children were from a primarily white middle class environment. Each child was considered to be of normal intelligence based on teacher assessment and/or class placement, and was without suspected hearing, learning, emotional or intellectual deficits. English was the first language for all the children. (Identifying information on the 29 subjects is listed in Appendix A.)

Materials and Methods

Standard Conservation Task (SC)

The Substance, Continuous Quantity, and Weight tasks of the Concept Assessment Kit--Conservation (Goldschmid and Bentler, 1968) were administered as a measure of conservation skill. Standard directions and verbal instructions were followed for each of the tasks, as was scoring. For each task, a subject was shown two items (either balls of play-doh or glasses of water) that were equal with respect to the critical attribute that was being measured. S/he was asked to judge equivalence, for example, "Is there as much play-doh (water) in this ball (glass) as in that one, or does one have more?" (In the case of weight comparison, the question asked was "Is one ball as heavy as the other, or is one ball heavier than the other?")

Once the subject reported that the two were equivalent, the experimenter changed the appearance of one item (e.g., one play-doh ball was flattened into a pancake or rolled into a hot dog, or the contents of one glass of water was poured into a low, flat dish). The subject was asked to report on the equivalence of the two items after the transformation was performed (e.g., "Now is there as much play-doh (water) in this one as in that one, or does one have more?" or "Now, is the ball as heavy as the pancake, or is one heavier?")

The criteria for awarding points for the SC task conformed to the scoring established by Goldschmid and Bentler (1968). A child received one point per task for a correct (i.e., conserving) response. In addition, an explanation that reflected conservation ability was awarded one point. Note that the explanation point was only awarded if the response that preceded it was correct. Three tasks were taken from the Goldschmid and Bentler Kit. Therefore, performance on this task was based on a total possible score of six points--three for correct judgments and three for correct explanations.

Modified Conservation task (MC)

This task was used as a measurement of the ability to conserve number. The method used in this study was modeled after the methodology described by Gelman (1982), except that Pepperidge Farm Goldfish Crackers measuring 3/4 of an inch in length were used as stimuli instead of blue toy turtles. (Parental permission was obtained in writing in case a subject wanted to eat some of the crackers upon completion of the task.) The task included a training segment and a testing section.

Training

The subject was shown Goldfish crackers placed in two horizontal rows and in one-to-one correspondence. The rows contained small sets so that they could be counted, and were either of equal (3 and 3) or unequal (4 and 3) value. Rows of equal value were the same length, and rows of unequal value were of different lengths. The order of presentation of the equal and unequal trials was randomized. The child was instructed to count the number of Goldfish in one of the rows, and then to report the sum. This procedure was repeated for the other row. Then the child was asked for a judgment of equivalence, that is, to tell whether each row they had just counted contained the same number of Goldfish or whether one of the rows had more. Feedback about correctness was provided by the interviewer (including recounting as necessary) until the child answered correctly.

Once a correct answer was obtained, the child was directed to watch as the examiner changed the length of one of the rows by shortening or lengthening it; the type of transformation performed was randomized. The manipulation yielded either rows of equal number differing in length or even rows of unequal number. After this manipulation, the child was asked to make a second judgment of equality, with an explanation requested for each judgment. The form of the question was analagous to that used in the standard conservation paradigm: "Now, are there the same number of fish in this row as in that row, or does one have more?" In case of errors made in post-transformation judgments, the child was asked to recount the rows and then to judge equivalence again before proceeding. (Note that no subject required more than one recount to arrive at the correct judgment.)

Testing

The conservation post-test consisted of a four-part task and was administered immediately after the training phase for each subject. Set size (small and large) and type of number conservation (equivalence and non-equivalence) varied, and were grouped as follows (the order of presentation was randomized across subjects):

Trial type	Number of items in the rows
small equal	5 and 5
small unequal	4 and 5
large equal	10 and 10
large unequal	8 and 10

The experimenter presented the child with two rows in one-to-one correspondence, according to the combinations listed above. A judgment of equivalence was requested from the child (i.e., s/he was asked "Do these rows have the same number of Goldfish or does one row have more?"). Children were discouraged from counting. Following a response-- regardless of correctness--the appearance of one of the rows was altered (either lengthened or shortened). As with the training segment, the resulting rows were of either equal number differing in length, or the same length containing different numbers of Goldfish. After the manipulation, the child was asked again whether the rows contained the same number of Goldfish, or whether one row had more. In addition, regardless of correctness of the response, an explanation of the judgment was elicited.

A subject was awarded a point if his/her response reflected conservation of number ability. An additional point was awarded if, after an acceptable response was given, an explanation was supplied that also indicated number conservation. Since there were two small set trials and two large set trials, a total possible score of eight points could be obtained on the MC task.

To illustrate this scoring procedure, suppose that a subject obtained a total MC score of '2,1 + 1,1', for a total of 5 points. See, for example, the 'MCScore' for subject #17, Nicole A., in Appendix B. This means that she gave conserving answers to the 2 small set trials (i.e., 4 or 5 items) and explained 1 of them adequately. In addition, a conserving response was given for 1 of the large set trials (i.e., 8 or 10 items) and it was explained adequately.

Measurement of a subject's conservation ability included analysis of his or her performance on both the modified conservation (MC) task and the standard conserva- tion (SC) task. A subject's combined performance on the MC and SC tasks was assigned to a category of conservation ability. Since the tasks used in this study examined the development of conservation rather than an all-or-none measurement, the categories were developed to represent a plausible continuum of conservation ability across subjects. A subject was placed in a particular conservation category according to whether, for Time 1 and/or Time 2, s/he received:

1) 0 points on both the MC and the SC task (No Conservation);

2) Any points for a correct judgment and/or explana- tion on either the small set or the large set of the MC task, and 0 points on the SC task (Partial MC);

3) At least one correct judgment and explanation on both a small set and a large set item on the MC task (totaling 4 or more points), and 0 points on the SC task (MC Only);

4) Any points for correct judgment and/or explanation on the SC task, but not a perfect score (Partial SC); or

5) A perfect score of 6 points (i.e., 3 conserving responses and 3 explanations) on the SC task (SC).

Note that inclusion in categories 4 and 5 meant that the subject had passed the MC task according to the criteria delineated in category 3. The criteria used to define the MC Only category above were adopted from the guidelines used by Gelman (1982a) in her study. Her requirement for a subject's 'passing' the task was correct performance (i.e., conservation responses on both judgment and explanation) on one small set and one large set trial. Her premise was that evidence on even one trial, including a 'non-counting' (large) set size, was sufficient to demonstrate number conservation ability in the preschool child. The present study, in replicating Gelman's method, conformed to her criteria for success as well.

To illustrate classifying a subject's performance according to the categories defined above, suppose that a subject received an MC score of '2,2 + 2,1' (i.e., 7 points total) and an SC score of '4'. That child fell into the conservation classification of 'Partial SC'. (See, for example, the MC and SC scores for subject #27, Alana E., in Appendix B.)

Well-formedness judgment task

Subjects' ability to judge syntactic well-formedness was measured using the method described in a study by Cairns and McDaniel (1988). The two sets of toys used for this task were the Fisher-Price Sesame Street Clubhouse and the Fisher-Price Little People Little Mart.

The Clubhouse measured 17 inches x 10 inches x 9 1/2 inches, and contained a tire swing, a front door that opened and closed, a roof that opened and closed, a revolving back door, a four-seater spinning ride, a crank that turned to rotate a 'crow's nest' seat on the roof of the house and a ledge that led to a slide, a set of 3 steps, and a chute that led through a hidden passageway to a side exit. The Sesame Street characters that were used with this toy were each 2 inches high and included Bert, Ernie, Cookie Monster, The Count and Grover.

The Little Mart measured 8 inches x 13 inches x 6 inches, and contained three adjacent sections: a gas station with a gas pump that included a nozzle on a rope and a handle that turned and made a clicking noise; a grocery store with press-to-open 'automatic' doors and a checkout counter; and a car wash that included a suspended roller with suds pictured on it, and a handle-and-lever for pushing cars through to be 'washed' under the roller. The pieces that came with the Little Mart included a man, a woman, a boy, a dog, a shopping cart, a bag of groceries, a two-seater car, a tow truck and a phone booth. The tow truck and phone booth were not used for this study.

There were two sets of stimuli developed for this task (see Set #1 and Set #2 in Appendix C). Each set contained 20 experimental and 6 trial sentences that were parallel in structure to those in the other set, and corresponded with one of the toy sets described above. The sentences consisted of one well-formed and one ill-formed version of ten sentence pairs, and were the simple affirmative active form of either a declarative or an interrogative statement. One grammatical rule or structure was manipulated in each sentence pair. Variations of the same form were used in order to test intrasubject reliability across interviews. Appendix D lists the sentence pairs according to the grammatical features contrasted in each pair.

The order of presentation of a particular set was randomized between Time 1 and Time 2, although the order of the sentences remained constant within and across sets. Sentences containing the structures represented in the test stimuli were piloted using preschoolers and an interview format similar to that of the present study. This was done to ensure that the grammatical structures were part of the grammar of children at the age being tested, and that the ability to make form-based judgments was not being affected by comprehensibility.

The following introduction and training were presented to each subject during the first of two interviews:

> I need your help today to find out about language. We're going to talk about the language that we speak. Babies can't talk when they're born, right? They don't speak or understand

> language. But someday they will, just the way you do. I'm trying to find out how people like you learned so much about talking and understanding. I'd like to know what you think about the way we speak, so I'm going to ask you some questions about that, okay? Great! Thanks.
>
> Suppose I don't know the right way to say things, and I'm trying to learn ...and you're teaching me. If I don't know how to speak very well, and I do this: [SET #1: Have the Count turn the handle/ SET #2: Have the man buy groceries] and I ask you, "Is the right way to say this '*The Count the handle turned'/'*The man groceries was buying'?" what would you tell me, Teacher? (Pause for response.) Right, you'd say "No, that's not the right way to say it, you have to say: (SET #1:) 'The Count turned the handle'/ (SET #2:) 'The man was buying groceries'." You see, if I didn't know how to speak, sometimes I'd get things wrong, and sometimes I'd get things right. And you're going to be the teacher and help me learn. Let's say I need your help to talk about some things I'm going to do....

The examiner then proceeded to whichever set of sentences was being used during Time 1. First, the six trial sentences that accompanied the experimental set were presented to the subject. Before each trial was presented, the activity that was described in the sentence was acted out as explained in the introductory interview above. The act-out procedure was used intermittently during presentation of the experimental sentences.

The child was asked to judge whether each sentence was said "the right way." In addition, a correction was requested for any sentence that was judged by the child to be ill-formed. During the trial sentences segment, the interviewer provided feedback on the accuracy of the subject's judgment. Additional examples and assistance were given to any child who did not seem to understand the task. The interviewer did not proceed to the experimental sentences segment until the child succeeded at judging both a well-formed and an ill-formed sentence. It was in fact the case that, for all twenty-nine children, this criterion was met and each subject was able to proceed to the experimental sentences segment of the study.

The experimental sentences for Time 1 were then presented immediately following the trials. For each of the stimuli, a judgment of well-formedness (e.g., "Was that the right way to say it?") was requested. If the child judged the sentence as ill-formed, a correction was requested. The interviewer offered no feedback about accuracy of response, and a correction was requested for each sentence that the child judged as ill-formed despite the accuracy of the correction that focused on the structure or rule that had been targeted.

A subject's score on the well-formedness (WF) judgment task consisted of three measures each for Time 1 and Time 2: accurate judgments of well-formed sentences; accurate judgments of ill-formed sentences; and corrections of sentences that were accurately judged as being ill-formed.. These three scores are listed for each subject in Appendix B.

To illustrate the scoring system, suppose a subject achieved a WF score of "9-6-5" for Time 1 and "9-6-5" for Time 2. See, for example, the data for subject #9, Mark R., in Appendix B. This means that, for each interview, he accepted all 9 grammatically well-formed sentences; he rejected 6 of the ill-formed sentences; and he was able to 'fix' 5 of those that had been judged as not being the "right way to say it."

It should be mentioned here that, although 10 sentence pairs were presented to all subjects, only nine of them were used to analyze ability to judge well-formedness. (See Appendix D for a list of the sentence sets.) There were an excessive number of failures on sentence #5 for set 1 ("*Grover and Cookie Monster was on the spinner.") and set 2 ("*The man and woman was in the car."). (See Table 2, Error Analysis.) It was not possible to distinguish whether the errors made were a result of a subject's inability to judge the well-formedness of the sentence, or whether subject-verb agreement was not yet part of the grammar of the child being tested.

A similar problem was encountered by Cairns and McDaniel (1988) in their study with preschoolers. They included two sentences which contained agreement errors. There were children who accepted the sentences "*The animals is drinking water" and "*The tree are green" as being well-formed. Those children did, however, reject other ungrammatical sentences. The Cairns and McDaniel interpretation of this finding was that, because other sentences were rejected by the children, their judgment these sentences seemed to represent their actual grammar.

The same pattern was found in the present study. Many subjects who accepted the sentences containing agreement errors were clearly able to judge well-formedness. It was determined that agreement rules were probably not in these children's grammars. Further, for 6 of the 14 children who obtained 6 or more WF points, sentence #5 was the only ill-formed sentence they did not reject for Time 1 and/or Time 2. This lends further support to the belief that the rules for agreement were lacking in their grammar, and that accepting the sentence was not a judgment error. As a result, sentence #5 was dropped from the analysis.

Four classifications of well-formedness judgment ability were established to analyze the results. The objective in dividing well-formedness judgment ability into categories was the same as that used when defining the conservation categories. That is, the ability to make well-formedness judgments was viewed in the present study as an emerging (as opposed to an all-or-none) skill. Classifications were therefore chosen to define a continuum of ability. The categories represented a range of well-formedness judgment points (WF Points), and were divided as follows (similar to the categorical divisions described earlier for conservation ability):

1) Failure to provide any correct well-formedness judgments (0 WF).

2) Any evidence of judgment ability, but fewer than half of the sentences correctly judged (1-5 WF).

3) Judgment of more than half of the ill-formed sentences, but not a perfect score (6-8 WF).

4) Attainment of a perfect score on the well-formedness judgment task (9 WF).

Each subject was tested twice within a week, but not twice on the same day. During the first interview, the standard conservation task was administered, as was the well-formedness judgment task for Time 1. For the second interview, the modified conservation task and the well-formedness judgment task for Time 2 were given. The order of presentation of the conservation tasks did not vary (i.e., all subjects received the standard task on the first day). This was done to ensure that the training and extended instructions included as part of the modified conservation task would not confound the results of the standard measure of conservation ability. The order of presentation of the well-formedness judgment task was randomly alternated with the conservation task within the interview. The administration of all tasks was audio tape- recorded.

CHAPTER IV

RESULTS

CONSERVATION

As described in the previous chapter, overall ability to conserve was measured by a subject's performance on the modified conservation (MC) task and the standard conservation (SC) task. Points were awarded on each task for responses that demonstrated conservation ability, and for explanations that followed those answers which also showed the child's ability to conserve. Measures of number (MC), substance (SC), continuous quantity (SC), and weight (SC) were obtained. To reiterate, the developmental continuum of conservation ability that was established to describe the results was as follows:

Category		Score
No Conservation	MC:	0 points
	SC:	0 points
Partial MC	MC:	any points: judgment and/or explanation, large and/or small set
	SC:	0 points
MC Only	MC:	at least 1 judgment and 1 explanation, small set and large set
	SC:	0 points
Partial SC	MC:	criterion met for MC Only
	SC:	any points (judgment and/or explanation)
SC	MC:	criterion met for MC Only

SC: perfect score of 6 points.

Thus, a previously all-or-nothing measure of conservation ability was converted into an ordinal scale through use of both the modified and the standard tasks. Results showed that, of the 29 children who participated in the study, 2 displayed no conservation ability; each was age 4;3. Thirteen were partially successful on the MC task, and ranged in age from 3;10 to 6;1. Nine subjects succeeded on the MC task only. They ranged in age from 3;5 to 6;3. Two children, aged 5;6 and 6;3, obtained partial success (i.e., a score of 4 points) on the SC task. The 3 subjects who achieved a perfect score of 6 on the SC task ranged in age from 5;0 to 6;6. In summary, 27 of the 29 subjects (i.e., 93%) demonstrated some conservation ability, obtaining at least partial success on the MC task.

Figure 1 illustrates subjects' performance on the conservation tasks as a function of age. The Pearson product-moment correlation was used to analyze the statistical relation between conservation ability and age. A correlation coefficient of .55 (p =.001) was obtained. This demonstrated that a statistically significant, positive correlation obtained between conservation ability and age, and supports the statement that older children generally have better conservation skills. Examination of the age distributions across categories of conservation ability, however, indicates variability within each grouping.

A general age trend may be seen across the developmental continuum of conservation ability, since the youngest subjects, three- and four-year-olds, are included in only the three lowest groups. On the other hand, five- and six-year-old subjects were included in four of the five categories. Further, the age range of subjects in the Partial SC group is contained in the age group of subjects who formed the SC category.

In summary, statistical analysis of the relationship between age and conservation supports the general notion of a continuum of conservation skill. However, examination of specific age ranges across categories in the continuum reveals variability within that general trend.

WELL-FORMEDNESS

As mentioned in the Methods chapter, a subject's score on the well-formedness (WF) judgment task consisted of three measures: accurate judgments of well-formed sentences; accurate judgments of ill-formed sentences; and corrections of sentences that were accurately judged as being ill-formed.

Four classifications of well-formedness judgment ability were established, as discussed in the previous chapter. As with the conservation categories, these divisions represent a gradually increasing ability to judge well-formedness: a) 0 WF points; b) 1-5 WF points; c) 6-8 WF points; d) 9 WF points.

A subject's ability to judge well-formedness was categorized according to his/her score in judging only the ill-formed stimulus sentences. This score was believed to be a more discriminating measure of the ability to make judgments than that obtained for the well-formed sentences. One reason for this belief was the response bias which was shown by the subjects in this study. In general, children accepted the sentence presented by the interviewer by answering 'Yes' to the question "Is that the right way to say it?" which followed each stimulus. For every subject, the score for the well-formed sentences (where acceptance was the correct response) was higher than that for the ill-formed sentences. In fact, the subjects who obtained a score of zero points on the ill-formed sentences had accepted all 20 sentences presented by the examiner, responding 'Yes' to the post-sentence question each time. Rejecting an ill-formed sentence, therefore, showed a subject's ability to discriminate sentences that differ in their grammaticality.

Note that all the children were asked to judge the trial sentences before the experimental sentences were presented. At that time, the interviewer was able to provide feedback about the correctness of the child's responses, and explain the concept of accepting or rejecting sentences on the basis of well-formedness. (See the Methods chapter for the contents of the interview). Discriminating responses to the trial sentences were obtained from all subjects before proceeding to the experimental set.

Figure 2 illustrates the distribution of subjects' performance on the well-formedness judgment task as a function of age. Performance of the 29 subjects on the well-formedness judgment task was distributed as follows: 7 children (24%) obtained a zero score; 8 subjects (28%) received between 1 and 5 points; 7 (24%) correctly judged between 6 and 8 sentences; and 7 (24%) achieved a perfect score of 9 sentence points. (Recall that one of the original 10 stimulus sentence pairs, #5, was eliminated from the analysis.) This indicated that the population of subjects in the present study was distributed approximately evenly among each of the four categories of well-formedness judgment ability that was established.

The relation between well-formedness judgment ability and age was evaluated using the Pearson product-moment correlation. A correlation coefficient of .34 was obtained ($p = .037$). This indicated a weak, positive relationship between age and the ability to make well-formedness judgments.

It may be seen from Figure 2 that the seven oldest subjects, aged 5;4 to 6;6, obtained WF scores of at least 6 points. However, it may also be seen that the two youngest subjects, aged 3;5 and 3;10, received WF scores of 6 and 9, respectively. This indicates that, though statistical analysis yielded a correlation between age and the ability to judge well-formedness, there is variability within that general trend as was noted with the results for the conservation task. Note, too, that a weaker correlation was found between well-formedness judgment ability and age than between conservation and age.

Figure 3 shows the distribution of subjects' performance on the experimental tasks of well-formedness (WF) judgments and conservation ('MC' is the modified task, 'SC' is the standard task). Entries in the 'cells' of the table were determined by a child's performance on both tasks.

The figure divides a subject's performance into the five categories of conservation ability that were defined earlier: No Conservation, Partial MC, MC Only, Partial SC and SC. Likewise, the range of well-formedness judgment ability, from 0 - 9 points, was included in the distribution, and was divided into the four categories of WF points: 0, 1-5, 6-8, and 9, that were defined for the analysis. Table 1 summarizes the information that was presented in Figure 3.

Statistical analysis yielded a highly significant correlation between conservation and ability to judge well-formedness (Pearson $\underline{r}$ =.69, p <.001; Spearman $\underline{r}$ =.70, p =.001). With age partialled out, a Pearson correlation coefficient of .65 was obtained (p <.001). In contrast, the correlations obtained for conservation and age ($\underline{r}$ =.55) and well-formedness judgments and age ($\underline{r}$ =.34) indicate a weaker relationship than that obtained for conservation and ability to judge well-formedness.

By examining the data, it appears to be the case that well-formedness judgment ability was a better predictor of conservation ability than performance on the cognitive task was of metalinguistic ability. Referring to the values in Table 1, it can be seen that there were 4 subjects who obtained a perfect score on the well-formedness judgment task and did not obtain any points on the standard conseration (SC) task. One of them attained only partial success on the MC (modified conservation) task and three of them succeeded on the MC task only. These findings offer evidence that children who can't conserve (on the standard task) can judge well-formedness.

In contrast, there were no subjects in this study who succeeded on the SC task (i.e., reached the category SC) who were not also successful in judging all of the sentences correctly. Note that the entries under the last column on Table 1, SC, are blank up until the row where the corresponding value for WF was 9 (perfect score). There the data for three subjects can be found. This indicated that there was no child who could conserve (on a standard task) who could not also judge well-formedness. This finding will be discussed further in the next chapter.

REPLICABILITY

Consistency of subjects' performance on the WF task was measured in two ways. First, the use of 2 sets of sentences enabled an across-interviews comparison of performance to be made. Each set of 20 sentences contained the same 10 grammatical constructions listed in the same order. The reason for keeping the sentence order constant across sets was that testing replicability would not have been possible if order effects were varied. In addition, sentence pairs each consisted of a well-formed and an ill-formed version of the same sentence. The only differences were in the form of the construction being tested and the vocabulary used (which was chosen to correspond with each set of apparatus).

As an example of the parallel construction of the stimuli, look at the sentences that tested acceptability of preposition placement (#4 and #19). They were, for Set 1 (used with the Sesame Street Clubhouse), "Ernie was putting the book down" and "*Ernie was going the slide down", respectively. The corresponding sentences in Set 2 (used with the Fisher-Price Little Mart) were "The man was putting the gas in" and "*The man was sitting the car in", respectively. As mentioned in the methodology chapter, each set of sentences was given on a separate day, and the order of presentation of the sets, but not the sentences, was randomized across subjects between Time 1 and Time 2.

Replicability of performance was measured by comparing consistency of subject's responses per sentence across sets. This was accomplished by counting the number of sentences on which a subject gave the same judgment for an ill-formed sentence across Time 1 and Time 2, whether the response was correct or incorrect. The possible range of values was from 0 to 9. Results of subjects' performance actually ranged from 3 to 9, with a mean replicability score of 7.65, and a standard deviation of 1.75. Twenty-five of the subjects obtained replicability scores that fell within 1 standard deviation of the mean.

In general, children who performed either very poorly or very well showed a high degree of stability in responses obtained between Time 1 and Time 2, and on Set 1 and Set 2. Figure 4 illustrates replicability with mean values reported for each of the WF categories defined in Table 1. Note from the distribution that the most reliable performance was exhibited by children who were either highly unsuccessful (0 WF points) or highly successful (9 WF points) at judging well-formedness. In addition, for those children who demonstrated some well-formedness judgment ability, as WF ability increased, so did replicability.

A related, though indirect, method of measuring the consistency of subjects' performance on the WF task was to formulate an error analysis of the ungrammatical sentence pairs. Table 2 illustrates how this measure of replicability was obtained.

Comparison of the number of errors made per item per set indicates the relative difficulty that subjects encountered with each member of a sentence pair. Examination of the total number of errors per sentence pair offers evidence as to whether a particular construction was either difficult for subjects to comprehend or difficult for subjects to judge. By scanning the per set column in Table 2, it may be seen that the values of errors between sentence pair members differed by one or zero. This provides evidence for the stability of performance by subjects across interviews, especially when considered along with the replicability data offered earlier.

Recall that the first sentence pair listed in Table 2 (#5 of the stimulus sentences) was addressed in the Methods chapter. It is clear from the number of errors reported on the Table that these sentences were of particular difficulty for the subjects in this study. The sentences were not included in the analysis of results. The reason, as explained in the previous chapter, was that agreement may not have been a part of the children's grammar, and therefore the errors may not have been a reflection of the child's inability to make grammaticality judgments.

CORRECTIONS OF WELL-FORMEDNESS JUDGMENTS

The well-formedness judgment task included a procedure for eliciting corrections from subjects in addition to judgments. Each time a sentence was rejected as being ill-formed--regardless of accuracy--a request for a correction, in the form "Can you fix it?", immediately followed. The number of possible corrections ranged from 0 to 18, but could actually be no higher than the number of sentences that a subject rejected.

Some examples of corrections offered by the children were (from the data of #28, Katie C.): *Grover kissed --> Grover kissed Ernie; *Who did Cookie Monster sleep? --> Who did Cookie Monster sleep with?; (from the data of #10, Shawn P.) *Who did the dog bark? --> Who did the dog bark at?; *The boy the car was washing --> The boy was washing the car and he swam into a bar.

As explained earlier, the number of correct corrections given by a subject was reported as the third measure of a three-part WF score (see Appendix B). Corrections data were not included in the statistical analysis that determined a child's level of well-formedness judgment ability. However, a percentage of corrections was calculated for the 14 subjects who provided 6 or more correct judgments (i.e., rows '6-8', and '9' of Table 1). These values appear in Table 3 in the form of group means by cell, as well as percentages of corrections provided by each of the children.

Values for the grouped data indicate that subjects who scored between 6 and 8 WF points (n=7) offered correct corrections an average of 76% of the time. Subjects with WF judgment scores of 9 (n=7) corrected 94% of their judgments. With respect to individual performance, note that Jarred P., the subject with the lowest qualifying scores for level 6-8 WF (6 judgments for Time 1, 4 judgments for Time 2), also obtained the lowest percentage of corrections (i.e., 2 corrections out of 10 judgments, or.20 for both days). The highest qualifier for level 9 WF, Katie C., gave 9 judgments for Time 1 and for Time 2, and corrected each rejected stimulus sentence (18 out of 18, or 1.00). These data offer evidence that, as subjects became better at judging well-formedness, they also became more proficient at 'righting' the rejected ungrammatical sentences.

CHAPTER V

DISCUSSION

In this chapter, the empirical goals that were presented at the end of the Literature Review chapter will be addressed. Each goal will be discussed relative to the methods and results of this study.

1. The study will demonstrate a developmental continuum of conservation ability that precedes complete success on the standard conservation task.

The tasks used in the present study to test conservation ability in young children were successful in enabling us to construct a developmental continuum of conservation ability. The use of a modified as well as a standard method of testing conservation behavior was key in eliciting conserving responses in youngsters before complete success on the standard task was evidenced.

The age range generally reported as being identified with attainment of the concrete operations stage is middle childhood, seven to eleven years old (Hakes et al., 1980; Piaget, 1983; Pratt and Grieve, 1984). All of the subjects in the present study were below that age. However, results reported in the previous chapter showed that at least some evidence of conservation behavior was obtained from twenty-seven of the twenty-nine subjects, covering an age span from 3;5 - 6;6. (See Figure 1.)

The results of this study may be compared with those obtained by Hakes et al. (1980). The age range of their subjects, 4-8 years, represented the transition period of cognitive development from preoperations to concrete operations. In that study, there were no conservers found among the 4- to 5-year-old subjects. Likewise, in the present study, 2 of the 3 subjects in the SC category were over age 6 (i.e., 6;1 and 6;6). However, there was a subject aged 5;0 who was also in the SC category, indicating success on the standard task at a younger age than predicted.

More important than these findings, though, is the information obtained from this study about the 24 subjects whom Hakes and his colleagues would have grouped together in the category of preconservers. Recall that the method of scoring used on the modified conservation task in this study conformed to the standard instructions and constraints developed by Goldschmid and Bentler (1968) and used by Hakes et al. (1980). Therefore, any success on the MC task showed evidence of conservation ability. And this ability was present in 22 subjects, ranging in age from 3;5 to 6;3. Twenty of those youngsters were younger than the youngest subjects in the Hakes et al. study who demonstrated conservation ability.

The significance of these results is the support that is given to Gelman's (1982a) theory of an accessing account of cognitive development. Replicating Gelman's method, fortunately, also replicated her results, and complements her findings. By modifying the standard task in the training segment, the present study was able to go beyond the Hakes et al. results and to access young children's ability to conserve. Twenty-two children who failed the traditional Piagetian tasks were able to conserve number according to standard scoring once their potential was brought to a conscious level.

Use of the modified conservation task was largely responsible for obtaining a distribution of conservation scores that could be categorized along a developmental continuum. The combination of the modified task and the standard task revealed an emergent vs. an all-or-none ability to conserve--somewhat independent of age. (See Results chapter for a discussion of the variability found among conservation scores vis-a-vis age.)

Two subjects showed no skill on either conservation task. Thirteen subjects showed at least partial success on the modified task (Partial MC); another nine children passed the criterion for the MC Only category. The notion of an emerging ability was supported by the fact that no subject who failed the modified task succeeded on the SC task. Likewise, the five subjects who obtained points on the standard conservation task (2 in the Partial SC category, 3 in the SC category) all succeeded on the modified task.

In contrast, the experimental design of the Hakes et al. (1980) study used only standard conservation tasks; there was no modification of the procedure. Their category "conserving" corresponds to the category SC in the present study, where a perfect score was obtained on the standard tasks presented. "Transitional conservers" in the Hakes et al. study would be the Partial SC category members. More importantly, their category "preconserving" corresponds to the three categories below Partial SC in the present study. Those children provided zero or one conserving response according to standard administration and no conserving explanations. Look at the additional information that was obtained by the combined procedures used in the present study. Not only was conservation behavior evidenced in younger children than in the Hakes et al. study, but more qualitative, developmental insight was obtained by using the modified conservation task as well as the standard tasks.

Support for the methods used in the present study can be found in a chapter by Brown and DeLoache (1978). They were writing on the subject of children's self-regulation and control of psychological processes involved in, among other tasks, problem solving and memory development. They believed that development can best be studied within the framework of a task that is within the children's repertoire across a wide age range and one that appears to represent an important cognitive activity. Further, they proposed that the starting, intermediate, and ending states should all be traceable, and that it should be possible to map a developmental progression. According to Brown and DeLoache, the training of such skills should result in cognitive gains and, as a result, some method of externalizing the flexibility with which the child controls and governs his own behavioral repertoire should be measurable (p. 18). These criteria seem to have been met by the methodology and subsequent results presented here.

2. The study will trace the development of the ability to discriminate well-formed from ill-formed sentences.

The acceptability task that was used in this study to elicit well-formedness judgments from subjects was successful in producing a developmental continuum of metalinguistic ability for this task. Subjects were able to discriminate sentences that were correct from those that were "not the right way to say it," and results obtained across subjects allowed for categories of performance to be constructed.

Van Kleeck (1984) distinguished between two stages of language awareness, accounted for by the child's level of cognitive abilty. Preoperational children (below age 7) were thought unable to decenter attention and focus. As a result, they would be unable to provide judgments of sentences that did not reflect a content-based, contextually-bound criterion of evaluation. The concrete operational child (age 7 or older) was considered able to judge sentences on the basis of structure because of his/her decentering ability.

Evidence for Van Kleeck's theory was obtained from the Hakes et al. (1980) study. Based upon the explanations the subjects offered for rejecting sentences, it was concluded that 4- and 5-year olds found sentences unacceptable because of what was asserted rather than because of structural errors. The 7- and 8-year-old subjects rarely gave content-oriented reasons for sentences they rejected.

In contrast, twenty-two children in the present study judged at least one ill-formed sentence correctly for Time 1 and/or Time 2. Eighteen of them gave form-based corrections, which offers evidence that the sentences were being judged on the basis of form, not content. These data appear in the WF categories 1-5, 6-8, and 9 on Table 1. All of the children were below age 7, and 17 of them were below age 6.

Further, we were successful in developing a measure of metalinguistic skill sufficiently sensitive to reveal developmental differences among our subjects. Within the age span of the population, there was a range in well-formedness judgment scores from 0 to a perfect 9 points. The distribution of scores yielded a continuum that represented increasing ability to discriminate ill-formed sentences and reject them as such. As a result, ability to judge well-formedness was shown to be an emerging (rather than an all-or-none) skill. Independent of age, skill in judging sentences was divided into those with no ability to judge (0 points), those with little ability to judge (1-5 points), those with moderately strong ability to judge (6-8 points) and those who scored perfectly (9 points). And, approximately one-fourth of the sample was included in each of the levels of well-formedness judgment ability. (See Figure 2.)

Thus, the range and distribution of subjects' performance on the well-formedness judgment task offer empirical evidence of a developmental continuum for this metalinguistic skill. This finding complements the Hakes et al. (1980) results on an acceptability task which yielded "the appearance of a smooth, continuous increase in the ability to judge deviant sentences to be unacceptable" (p. 79).

The results obtained on the well-formedness judgment task may be credited to the form of elicitation used by the examiner. The informal instruction and interview technique was developed by Cairns and McDaniel (1988), and yielded linguistic judgments from all twenty-two children who participated in their study. Children were asked to judge whether a sentence was "the right way to say it." This wording was chosen, along with the interview technique, to keep the children focused on the words and the form of the stimuli when accepting or rejecting sentences.

That same format--with much of the same wording--was used for the training part of the well-formedness judgment task in the present study. It, too, was successful in eliciting judgments on the sample sentences for all of the subjects (i.e., 29). The methods of the two studies differed, however, in that Cairns and McDaniel guided their subjects more through longer training sessions in the first two of the three interviews held.

The methodological difference just discussed may be the reason why seven children who seemed to understand the task during training scored zero when judging the ill-formed sentences during the test procedure. Therefore, the interview context, though effective in eliciting well-formedness judgments, may be more successful with young children in a non-testing situation. In that context, the adult may offer feedback and probe for further information about the child's intuitions than with the method used in the present study.

The fact that this study and the Cairns and McDaniel study were able to elicit form-based judgments of grammaticality from young children may lend a different explanation to the Hakes et al. (1980) results reported earlier. We suggest that the content-based judgments Hakes et al. obtained from 4- and 5-year olds may have been related to the form of many of the stimulus sentences. For example, a sentence with 'Word-order changes' such as "*The string chased the kitten" is not grammatically ill-formed, it is semantically anomalous, as are sentences with 'Selectional restriction violations' such as "*The playground walked to the store," "*The teacher read a chicken," and "*The sleepy rock was in the middle of the road."

In addition, Hakes et al. included six sentences which they stated were "both meaningful and syntactically well-formed, but were empirically false" (p.50). How could those stimuli, such as "*The big fish was swimming in the sandbox" be rejected on the basis of form if they were syntactically correct? Therefore, sentences could have been rejected by subjects of any age in the Hakes et al. study on the basis of "what they assert" (p. 85), especially for the types of violations exemplified in the sentences above.

3. The study will trace the development of the ability to offer corrections of sentences rejected as ill-formed.

The methodology developed for this study, which included a judgment-plus-corrections paradigm for the metalinguistic task, was successful in eliciting corrections of sentences that the children had rejected as being ill-formed. The distribution of subjects' performance allowed for a developmental continuum to be constructed of the ability to offer form-based corrections.

For any sentence that was rejected by a subject as being ill-formed, a correction was requested. Since it is not possible to know the basis for a child's rejecting a sentence, the correction data served to ensure the experimenter that the basis for rejection was structural vs. content-based. Eighteen of the 22 subjects who rejected at least one ill-formed sentence for Time 1 and/or Time 2 also offered corrections which were form-based, and rendered the sentence grammatical.

With respect to the development of the ability to correct rejected sentences, a trend may be seen in the grouped data from the present study. (The seven subjects who accepted all of the sentences were not asked for corrections.) Of the eight subjects who were in the 1-5 WF points category, four offered corrections of at least one sentence in at least one interview.

The subjects who scored 6 or more WF points for their judgments offered corrections of sentences during both interviews. Their data are summarized in Table 3. Seven of those, in the 6-8 WF category, corrected an average of 76% of their rejected sentences. The seven subjects in the 9 WF category offered corrections for an average of 94% of the sentences they rejected. These results offer empirical evidence that children below the age typically associated with attainment of concrete operations (many were not concrete operational) can supply judgments about "the right way to say" sentences, and further, can give form-based corrections of sentences they reject as ill-formed.

The use of a judgment plus correction task in the present study points out an important weakness in the Pratt et al. (1984) method of using corrections as the only response form to judge metalinguistic ability. This is shown in the following illustration from this study. The interviewer (informally) attempted to discover what the child was processing when s/he accepted an ill-formed sentence. Intermittently, the child was asked to repeat what s/he heard as the sentence that was to be judged. Quite often, the child did not repeat the ill-formed stimulus, but rather gave the well-formed version of what was presented. The subject was told by the experimenter that that was not what was said. The stimulus was then re-presented for the child, and was accepted again in its ill-formed state.

The above illustration exemplifies a possible reason for subjects' high performance on Pratt et al.'s morpheme deletion task. As the authors wrote, the children in that study, as in the present one, may have "spontaneously edited out the minor violations in the sentence presented to them" (p. 138). The use of a judgment task made it possible to 'catch' the children who spontaneously edited or corrected anomalous sentences. Pratt et al. may have accepted such children's responses as being deliberate corrections of ill-formed stimuli.

Whereas it may not be possible to know the basis for a response in a judgment-only task or even a judgment-plus-explanation task (Pratt et al.'s criticism of Hakes et al.'s methodology), a corrections-only task carries its own unknowns. Therefore, a judgment-plus-corrections paradigm seems to yield the most accurate information about a child's basis for rejecting ill-formed sentences.

4. The study will replicate the finding that meta-linguistic ability co-varies with cognitive ability, and both of these abilities are related to age.

The aspect of metalinguistic awareness that was measured in this study, well-formedness judgment ability, was contrasted with conservation skill as a measure of cognitive ability using both a standard and a modified task. Statistical analysis performed on the subjects' responses on the three tasks presented showed that metalinguistic ability covaried with cognitive ability relative to age and independent of age.

Statistical analysis performed on the data from the conservation tasks and the well-formedness judgment task were presented in the previous chapter. Conservation ability was found to be significantly correlated with age, according to the Pearson product-moment correlation coefficient. It was also noted, however, that there was variability within the general developmental trend noted. (See Figure 1.)

Analysis of the relationship between age and the ability to judge well-formedness was also performed. Similar to the results for conservation and age, there was found to be a statistically significant correlation between ability to judge well-formedness and age, although again variability was found when the distribution of results was examined. (See Figure 2.) In addition, the Pearson correlation coefficient of .34 indicated a weaker relationship between these two abilities than was found between conservation and age.

The statistical relationship between judgment ability and conservation performance was analyzed and presented in the Results chapter. (See Table 1.) Both the Pearson and the Spearman correlation coefficients were found to be highly significant (Pearson $\underline{r}$ =.69, p <.001; Spearman $\underline{r}$ =.70, p =.001), thus demonstrating validity for the hypothesis that metalinguistic ability and conservation co-vary. Furthermore, as indicated in the previous chapter, a high, positive correlation between these two abilities was maintained independent of age (Pearson $\underline{r}$ =.65, p <.001 with age partialled out).

The findings just reported are generally in agreement with those of Hakes et al. (1980). They performed a qualitative analysis of the data for metalinguistic tasks (synonymy, phoneme segmentation, and acceptability) and conservation. They used contingency coefficients to evaluate the interrelationships among the 4 tasks. All of their coefficients were significant beyond the .001 levels. Hakes et al. reported that "the significant correlations among the performances on the four tasks indicate that performance on each of the tasks is related to performance on each of the others..." (p. 94).

The metalinguistic-cognitive link demonstrated in the present study underscores results obtained by Wankoff (1983). Statistical analysis was performed on data obtained from ambiguity detection tasks (lexical and structural), a phonemic segmentation task and standard Piagetian conservation tasks. Correlation coefficients obtained between ambiguity detection and conservation were positive and significant. Likewise, a "statistically significant, substantial and positive relation" was found to exist between segmentation ability and ability to conserve.

In summary, results of this study add to the growing body of empirical evidence supporting the notion that metalinguistic ability (measured in a variety of tasks) co-varies with cognitive ability (measured by performance on conservation tasks).

5. The study will obtain empirical evidence relative to the nature of the relationship between cognitive abilities and metalinguistic abilities.

The experimental tasks that were chosen to assess metalinguistic ability and cognitive level of functioning enabled statistical analysis to be performed on subjects' responses. As a result, empirical evidence was obtained that offers insight into the nature of the relationship between these two skill areas.

As noted earlier, statistical analyses using Pearson product-moment correlation and Spearman rank-order correlation yielded a highly significant, positive correlation between these two skill areas, which was discussed earlier in this chapter. (See Section 4.) This supports the view that metalinguistic development and cognitive development are related abilities. A Pearson product-moment correlation supported this finding independent of age.

Results of related reseach by Hakes et al. (1980) and by Wankoff (1983) have already been discussed. Information and evidence obtained in those studies supports the view that cognitive ability precedes and determines metalinguistic ability. Conservation was the measure of cognitive achievement as it was in the present study. However, only standard administration was used in the other two studies. The metalinguistic tasks have varied: Hakes et al. used synonymy, segmentation, and acceptability tasks; Wankoff used segmentation and ambiguity detection tasks.

Hakes et al. realized that there was no one measure of general metalinguistic ability (p.91). However, they determined from their qualitative analysis (using contingency coefficients) that "performance on each of the metalinguistic tasks is closely related to performance on the conservation tasks" (p. 94). They inferred that the same variable, the ability to decenter, was reflected in metalinguistic performance as in conservation task performance, and concluded that developmental changes seen in both tasks reflected one underlying ability.

Wankoff found that there were no subjects in the preconservers category who attained the highest levels of ambiguity detection for lexical or structural ambiguities. Also, there were no preconservers in the highest category of segmentation ability. Her results led to the conclusion that performance on the metalinguistic tasks presented was dependent upon the child's level of cognitive ability as measured by ability to conserve on standard Piagetian tasks, and agreed with Hakes et al. that the ability to decenter underlay performance on both tasks.

The findings of the present study contradict the conclusions of Hakes et al. (1980) and of Wankoff (1983). To examine these results further, look at the distribution of subjects in the cells of Table 1. There were four subjects who achieved perfect scores of 9 WF points who did not succeed fully on the conservation tasks. Subject #10, Shawn P., was in the Partial MC category. The other three children, #17, Nicole A., #16, Hana M., and #12, Dana T., succeeded at the MC Only level.

On the other hand, it may be seen that the only three subjects in the SC category (obtaining a perfect score on the standard conservation task) achieved a perfect score of 9 points on the well-formedness judgment task (#25, Samara P., #26, Lauren M., and #28 Katie C.). That is, there were no subjects in the SC category at lower levels of well-formedness judgment ability. The seven children who scored at the 6-8 WF level demonstrated varying degrees of conservation ability, but reached only as high as the Partial SC category. Subjects in the 1-5 WF category reached as high as MC Only; those with 0 WF scores only performed as high as Partial MC. Unlike previous research which concluded that metalinguistic skill depends upon cognitive success, these data offer evidence that limited ability to view language as an object of analysis and reflection may restrict subjects' ability to succeed on the standard conservation task.

In summary, the results of the present study show that metalinguistic ability--that ability which enables language users to analyze, reflect upon, and "pay scrupulous attention to" language form--is necessary, although not sufficient, for children to succeed on the standard administration of Piagetian conservation tasks.

Our interpretation of the results is, comparatively speaking, not as strong as the one offered by Donaldson, who concluded on the basis of her research that language influences thought. Likewise, we did not find support for the theory proposed by Hakes and his colleagues. Our results did not provide evidence for the presence of one underlying ability, the ability to decenter, which Hakes concluded was necessary for success on conservation and metalinguistic tasks. Rather, the results obtained in the present study suggest that children's performance on the standard conservation task is affected by the methods used in that task. The standard task methodology includes a test of cognitive skill, plus a metalinguistic component that confounds what is actually being assessed. The research findings of McGarrigle and Donaldson, Rose and Blank, and Samuel and Bryant presented in earlier chapters lend support to the idea that the standard task instructions are confusing, misleading, and almost contradictory in nature from subjects' expectations.

Evidence from the present study is offered by the data from the modified conservation task, where the misleading context was mediated by the training segment. Successful performance was obtained on the subsequent test segment for 24 children who failed the standard task, and seemed to tap their cognitive ability.

There is another point to be made relative to the issue of cognitive abilities and metalinguistic abilities. Although statistical analysis of subjects' performance on the well-formedness judgment task and the conservation task revealed that they were related, perhaps these skills should not continue to be evaluated according to a child's relative ability to succeed on one or the other. It is possible that the comparison of metalinguistic tasks and cognitive tasks is a comparison of 'apples and oranges'. Perhaps the various methods that have been used to compare and contrast these two areas of development are truly tapping different functional bases. A theory developed by Howard Gardner (1985) addresses this issue.

Gardner proposed a theory of "multiple intelligences," consisting of several relatively autonomous human intellectual competences (p.8). Each intelligence must contain a set of problem solving skills that enable the individual to resolve genuine problems or difficulties s/he encounters and the potential for creating new problems, thereby laying the groundwork for the acquisition of new knowledge (p. 61). In addition, each intelligence, in order to be defined as such, must conform to a set of criteria or signs, such as:

1. Potential to be destroyed, or spared, in the event of brain damage.

2. Existence of an individual who exhibits a highly uneven profile of abilities and deficits (e.g., idiots savants, prodigies).

3. Existence of identifiable information-processing operations or mechanisms which can deal with specific kinds of input.

4. Susceptibility to encoding in a symbol system.

(These examples were excerpted from a larger list found in Gardner, 1985, pp. 63-67.)

Examples of intelligences include: linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic and personal. In accordance with Gardner's theory, metalinguistic tasks tap a child's linguistic intelligence. In contrast, conservation tasks (based on Piaget's model of cognitive development) assess a child's ability relative to logical-mathematical intelligence. If that is the case, performance on tasks measuring these two skill areas may be tapping related, but distinct intelligences.

To summarize, refer back to the three subjects who obtained perfect scores on the judgment task and on the standard conservation task. We do not assume that the levels of attainment in each of these areas is 'perfect,' or even equivalent. It may be that these subjects' performances on the two tasks differed in difficulty, or in ability, or, possibly, even in intelligences being measured. Perhaps methodological and statistical comparisons made between metalinguistic "apples" and cognitive "oranges" do not contrast skill areas which are parts of each other, but rather are components of Gardner's "fruit salad" of multiple intelligences.

CHAPTER VI

SUMMARY AND CONCLUSIONS

This study examined the relationship between aspects of cognitive development and metalinguistic development. Level of cognitive development was determined by measuring conservation ability on selected tasks. The metalinguistic task measured children's ability to judge sentences containing structural violations.

Conservation ability was measured in two ways. A series of standard Piagetian tasks was used to test conservation of substance, weight, and continuous quantity. A modified task was used to measure conservation of number, and was modeled after a method used by Rochel Gelman (1982a).

The metalinguistic task measured children's ability to judge sentential well-formedness, and to give corrections for sentences that they rejected as being ill-formed. Two sets of sentences were constructed to test the same grammatic constructs, with each set designed to match a different piece of apparatus.

The subjects who participated in the study (aged 3;5 to 6;6) were younger than those previously believed to be capable of conserving and of supplying form-based judgments and corrections using standard methods. This allowed a comparison to be made between studies using "traditional" methods of measuring these two skill areas, and those where standard procedures had been mitigated to effect conservation behavior and/or metalinguistic awareness in young children. The children were seen individually for two interviews on two separate days within a week's time. For Time 1, they were given the standard conservation task and one set of sentences for the judgment task. On Time 2, they were given the modified conservation task and the second set of sentences for the judgment task.

The results yielded statistically significant correlations between well-formedness judgment ability and age (Pearson $r=.34$); conservation ability and age (Pearson $r=.55$); and conservation ability and well-formedness judgment ability (Pearson $r=.69$, and $r=.65$ independent of age). Each of the skills examined in the study was shown empirically to be developmental, emerging gradually instead of blossoming all at once. Results were grouped into categories along a continuum for well-formedness judgment ability and for conservation, ranging from No Ability to Perfect performance for each skill area. Also, it was found that the replicability of subjects' responses across interviews increased as overall ability to judge well-formedness increased.

Further, the data offered evidence that the metalinguistic skill of judging well-formedness may be necessary, although not sufficient, to predict success on the standard conservation task because of the linguistic nature of that task. There were no subjects who appeared in the highest conservation category (SC) who did not also obtain a perfect score (9) on the well-formedness judgment task. Conversely, there were four subjects who performed at the highest metalinguistic level who did not score any points on the standard conservation task.

Additional results included corrections given by subjects for sentences that were rejected as being ill-formed. These data offered evidence that subjects' judgments were made on the basis of form, and were not content-based as was concluded in previous research (e.g., Hakes et al., 1980).

Whereas it may not be "news" to say that the methods used in any research will affect the outcome of an experiment, the combination of methods used in the present study was unique. Young children were tested on both well-formedness judgment and conservation tasks using standard and non-standard techniques. They were asked to judge both well-formed and ill-formed sentences, and to correct those that they judged to be ill-formed.

Results of this study revealed the following:

1. Metalinguistic ability and conservation ability co-vary.

2. A continuum of well-formedness judgment ability was developed, and, in contrast with previous research, included successful performance by young children.

3. A continuum of conservation ability was developed, and, in contrast with previous research, included successful performance by young children, especially with the use of the modified task.

4. Success on the modified conservation task, especially for children who did not succeed on the standard task, supported Gelman's accessing account of cognitive development.

5. Evidence that well-formedness judgment ability was needed in part to succeed on the standard conseration task supported research by Donaldson and her colleagues. That is, the results indicated that a child must possess a certain level of metalinguistic ability, the ability to pay scrupulous attention to language form, in order to succeed on the standard Piagetian task of conservation because of the language component built into the standard two-judgment task administration.

In summary, we offer that measurement of the ability to conserve using the standard task is confounded by a linguistic component created by the two-judgment procedure. The findings of the present study echo the conclusions of research by Donaldson, Rose and Blank, and Samuel and Bryant that the standard procedure includes miscues that affect the results, especially if the subject cannot tease apart the actual cognitive phenomenon being tested from the context in which it is being presented. The metalinguistic component that is part of the standard conservation task serves to impede performance and success, especially for young children.

In addition, there was lack of support in the present study for conclusions made by Hakes and by Wankoff that one underlying ability (the ability to decenter focus and attention) was 'the center' of both metalinguistic and conservation development. Alternatively, the current findings support the conclusion that separate, distinct although related abilities (or intelligences to use Howard Gardner's term) are being tapped in each of the experimental tasks that was examined. That is, linguistic intelligence underlies the metalinguistic task, and logical-mathematical intelligence forms the basis of Piaget's model of cognitive development being assessed through the administration of the standard conservation battery.

Along with the results that have been discussed, there are also several implications that arise from the findings of this study. The correlation found between conservation ability and metalinguistic performance shows the importance of considering the child's level of linguistic, metalinguistic, and cognitive functioning when planning remediation. After all, communicative competence, which is the ability to use language in ways that are appropriate to a situation, is the goal of speech-language intervention, and encompasses all of these areas.

In contrast, the difference that was discovered between the cognitive and metalinguistic bases for development of the skills examined in this study serves as a caution against teaching conservation as a prerequisite for metalinguistic development. It is, rather, an independent though related skill and should be taught with that understanding. In addition to remediation, the evidence that was obtained about the interference of language in the administration of the standard conservation task shows the importance of performing a task analysis when looking at formal and informal assessment tools. In that way, the examiner may be ensured that s/he is truly measuring what is claimed to be tested.

The early evidence of metalinguistic skill found in the youngsters who participated in this study offers insight for teachers and clinicians about tapping reading readiness with respect to ability to analyze and pay attention to language form. Support for this view was obtained in a recent longitudinal study conducted by Tunmer and his colleagues (Tunmer, Herriman, and Nesdale, 1988). They examined the relationship between metalinguistic abilities and what they referred to as 'cryptanalytic intent' (i.e., the relationship of print to spoken language) and knowledge of grapheme-phoneme correspondence. They administered three metalinguistic tasks (phonological awareness, syntactic awareness, and pragmatic awareness), both prereading and reading achievement tests, a test of receptive vocabulary ability, and measures of concrete operational thought to over 100 children over a two-year period.

The results obtained by Tunmer et al. (1988) confirmed that a correlation exists between metalinguistic skills--especially syntactic awareness--and beginning reading in first and second graders. Phonological awareness was seen as aiding letter-name knowledge and being necessary, but not sufficient to phonological recoding.

The procedures used and results obtained in this study raise new research questions as well as provide information about the issues that were addressed. It is hoped that future research will be conducted to pursue the notions that were explored here.

Because of the successful results that were obtained by modifying the standard number conservation task, the question arises whether modification of the methods for assessing other types of conservation would likewise yield conserving behavior in young children. Either a training task could be used like the one in this study, or a modification of the instructions could be tried such as the one-judgment method used by Rose and Blank and replicated by Samuel and Bryant. As an example, to train conservation of volume, perhaps the child could perform the transformation on the play-doh that is part of the standard procedure, and then restore it to the original shape and size to restore equivalence. The fact that the child does the manipulation may facilitate his/her realizing that the pre- and post-transformation play-doh masses are "the same."

Similar to the idea of testing other types of conservation, other types of metalinguistic tasks could be presented as well using the interview technique that was successful in this study. Judgments of, for example, paraphrasing, ambiguity detection, and/or synonymy could be elicited from young children. Perhaps the extended probing of subjects' responses used by Cairns and McDaniel in their study could be contrasted with the method used in this study to see if that was the reason for their success in eliciting judgments from all twenty-two of the subjects they interviewed. Recall that seven of the twenty-nine children in our study offered correct judgments in training and none on the testing portion when no assistance could be given.

The results of the metalinguistic task could then be analyzed relative to subjects' performance on several conservation tasks as suggested above. It may be discovered that some metalinguistic skills are more highly correlated with cognitive development than others, and more specifically, with certain types of conservation than with others.

Because of the finding that language interferes with success on standard conservation tasks, perhaps the administration of two standard cognitive tasks--conservation and one that doesn't seem to entail a metalinguistic component--would yield data to identify true cognitive ability as distinct from metalinguistic influences. Examples of appropriate cognitive tasks measuring concrete operational skills might be classification or seriation, whereas a task like class inclusion may rely upon metalinguistic awareness in a similar way to the instructions used in the conservation task.

As a final note, in addition to the methodological variations that have been suggested, the present research design should be replicated in order to verify the results that have been obtained here. More young children who can succeed on standard conservation tasks should be tested to corroborate the findings on the well-formedness judgment task and the modified conservation task. Although this study succeeded in adding new information to the existing body of research in the development of both metalinguistic and cognitive skills in young children, further research is needed to explore the questions raised here, to obtain new insight into evaluating these two important areas of child development.

Table 1. Subjects' Performance on Well-Formedness Judgment and Conservation Tasks

	Continuum of Conservation Ability					
WF Score	No Conservation	Partial MC	MC Only	Partial SC	SC	Total
0	2	5	0	0	0	7
1-5	0	5	3	0	0	8
6-8	0	2	3	2	0	7
9	0	1	3	0	3	7
Total	2	13	9	2	3	29

Note. MC = Modified Conservation; SC = Standard Conservation. WF = Well-Formedness judgments.

Table 2. Error Analysis of Well-Formedness Judgments of Ungrammatical Sentences

Set	Sentence	Errors[a] Per Set	Total
1	*Grover and Cookie Monster was on the spinner.	9	
2	*The man and woman was in the car.	10	19
1	*Grover kissed.	6	
2	*The woman pushed.	7	13
1	*Where Cookie Monster was going?	4	
2	*Where the dog was going?	3	7
1	*was opening the door.	3	
2	*was opening the doors.	2	5
1	*Who did Cookie Monster sleep?	2	
2	*Who did the dog bark?	1	3
1	*Bert the handle was turning.	2	
2	*The boy the car was washing.	1	3

Table 2 (continued)

Set	Sentence	Errors[a] Per Set	Total
1	*The Count Bert kissed.	1	
2	*The dog the man licked.	2	3
1	*The Count went the stairs.	1	
2	*The man went the store.	2	3
1	*Bert was looking at herself in the mirror.	1	
2	*The woman was driving himself to the store.	1	2
1	*Ernie was going the slide down.	0	
2	*The man was sitting the car in.	0	0

[a] The values presented in the Errors columns of this table represent data for only those 14 subjects who judged more than half of the ill-formed sentences correctly for Time 1 and/or Time 2. Therefore, the total number of judgments per construction is 28.

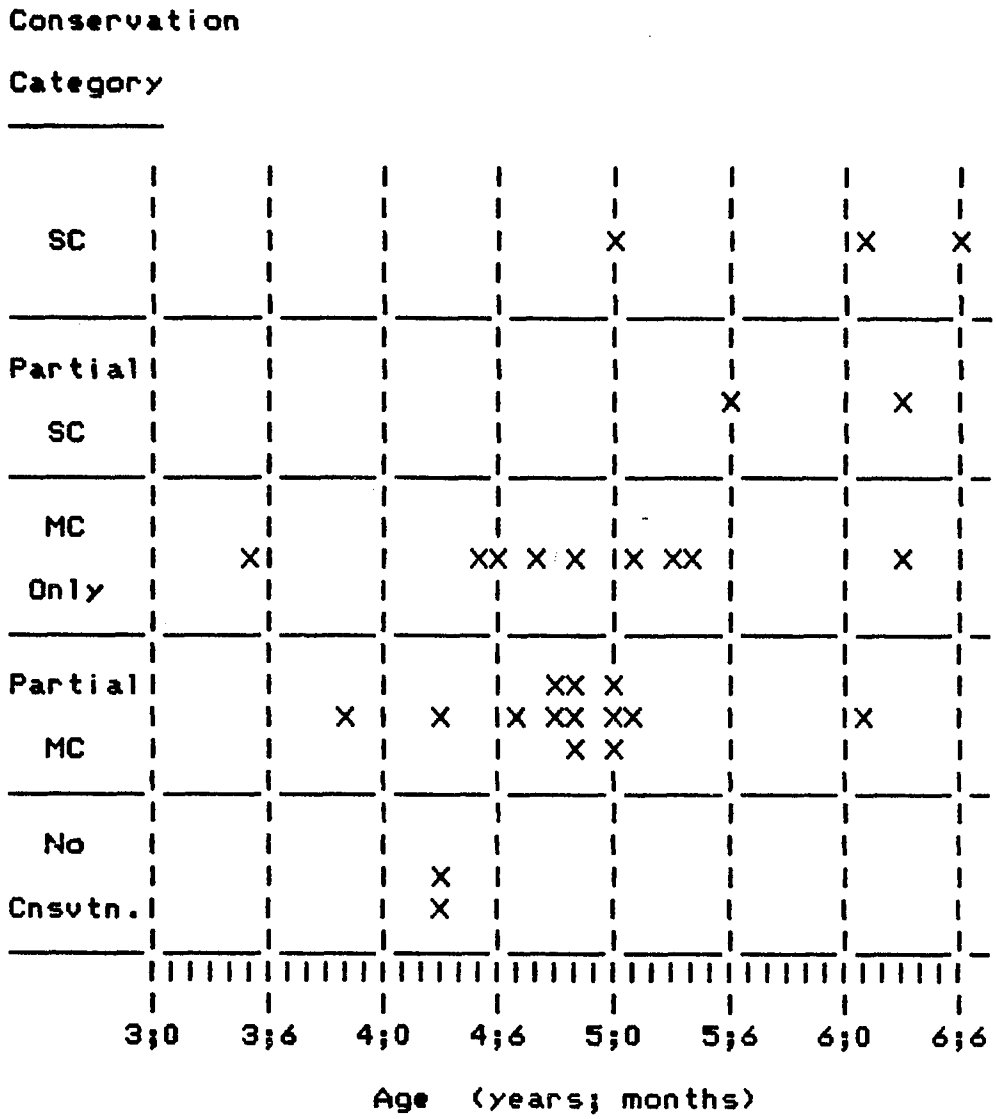
Table 3. Percentage of Corrections of Well-Formedness Judgments By Group

WF Score	No Conservation	Partial MC	MC Only	Partial SC	SC	$\bar{x}$
	Conservation Ability					
6-8	---	.50 (n=2)	.90 (n=3)	.87 (n=2)	---	.76 (n=7)
9	---	1.0 (n=1)	.92 (n=3)	---	.90 (n=3)	.94 (n=7)
$\bar{x}$		.67 (n=3)	.91 (n=6)	.87 (n=2)	.90 (n=3)	

Note. The values presented are the data for only those 14 subjects who successfully judged more than half of the ill-formed sentences for Time 1 and/or Time 2.

MC = Modified Conservation; SC = Standard Conservation.

WF = Well-Formedness judgments.



MC = Modified Conservation

SC = Standard Conservation

<u>Figure 1.</u> Performance on the conservation tasks as a function of age.

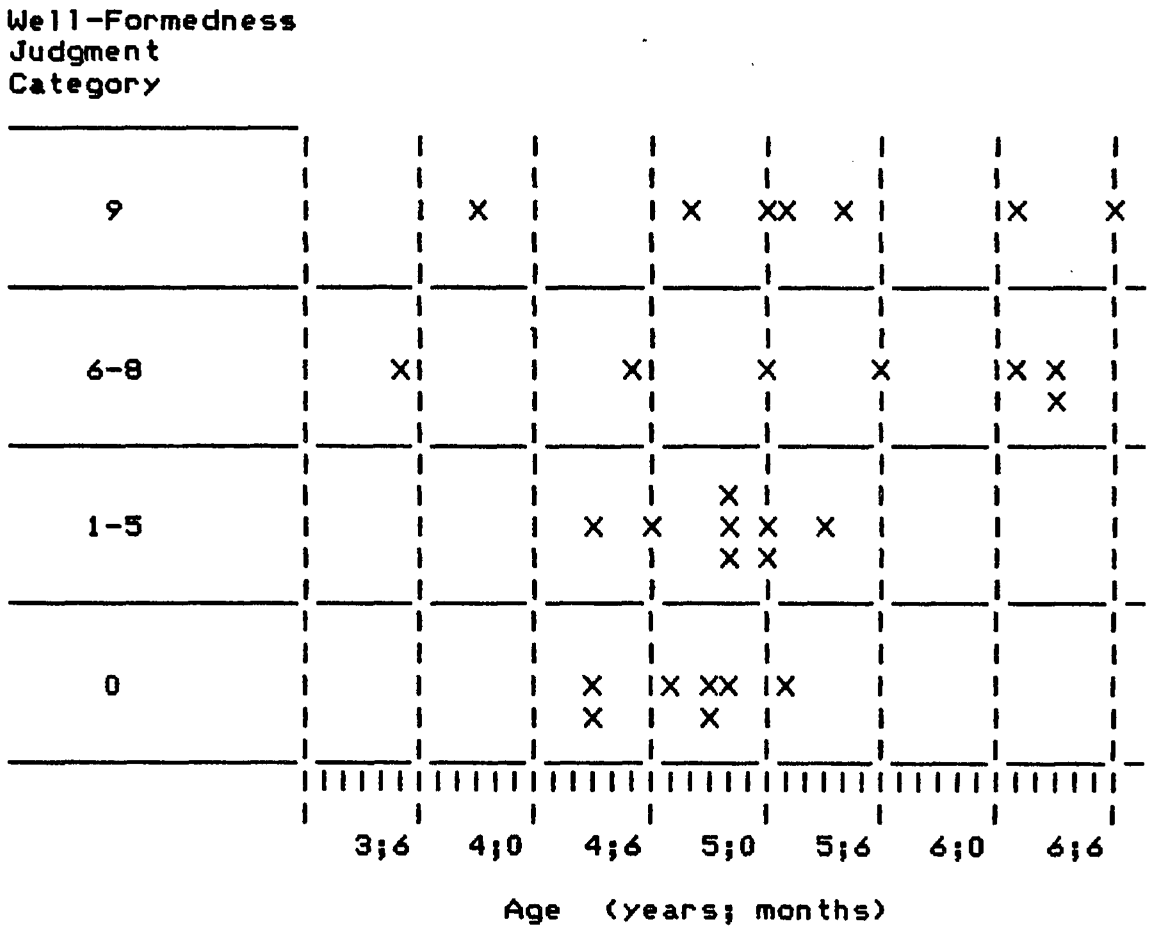


Figure 2. Performance on the well-formedness judgment task as a function of age.

WF Judgment Score	Conservation Category: No Consvtn.	Partial MC	MC Only	Partial SC	SC
9		X	XXX		XXX
8		X	X	XX	
7			X		
6		X	X		
5		X			
4					
3		X	X		
2		X			
1		XX	XX		
0	XX	XXXX			

MC = Modified Conservation

SC = Standard Conservation

Figure 3. Subjects' performance on the well-formedness judgment task and the conservation tasks.

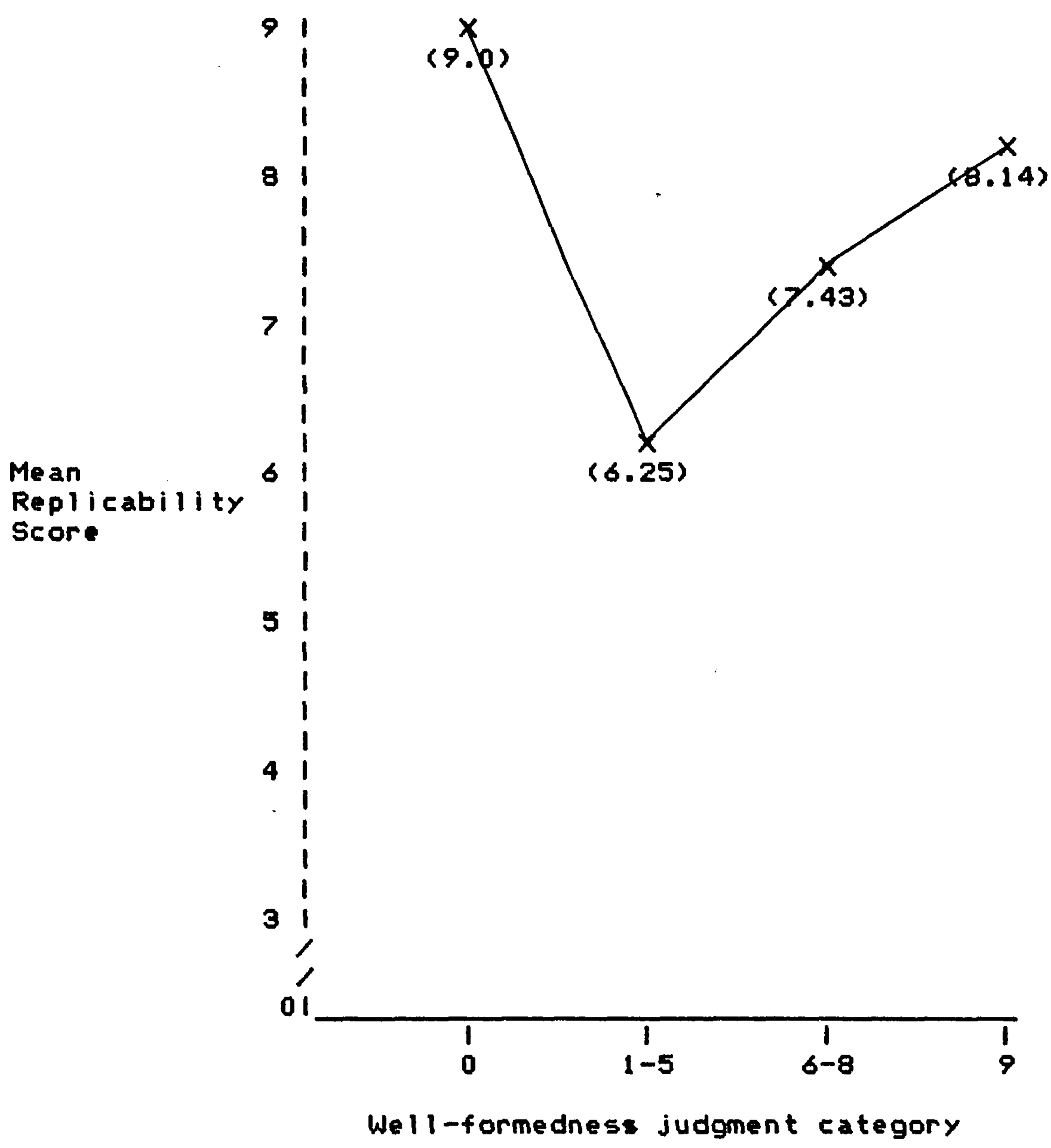


Figure 4. Replicability of subjects' responses on the well-formedness judgment task across Time 1 and Time 2.

APPENDIX A

EXPERIMENTAL SUBJECTS

(Arranged According to Chronological Age)

Name	Age
Mark R.	3;5
Shawn P.	3;10
Cimberly K.	4;3
Brett S.	4;3
Adam Z.	4;3
Justin S.	4;5
Natasha P.	4;6
Joseph N.	4;7
Nicole A.	4;8
Rachel L.	4;9
Bryan R.	4;9
Jordan L.	4;10
Andrew N.	4;10
Karen P.	4;10
Joshua V.	4;10
Barbara B.	5;0
Emily H.	5;0
Samara P.	5;0
Jarred P.	5;0
Ian K.	5;1
Hana M.	5;1
Danielle D.	5;3
Dana T.	5;4
Margaret H.	5;6
Deborah B.	6;1
Lauren M.	6;1
Alana E.	6;3
Benjamin H.	6;3
Katie C.	6;6

APPENDIX B

Subjects' performance on the well-formedness judgment task and the conservation tasks

Name	Subj. No.	WFScore Time 1 / Time 2 wf-if-c/wf-if-c	MCScore SmSet+LgSet jdg/exp+jdg/exp	SC Score
Brett S.	15	9-0-0 / 9-0-0	0,0 + 0,0	0
Cimberly K.	24	9-0-0 / 9-0-0	0,0 + 0,0	0
Ian K.	20	9-0-0 / 9-0-0	1,0 + 0,0	0
Bryan R.	2	9-0-0 / 9-0-0	1,0 + 1,0	0
Andrew N.	18	9-0-0 / 9-0-0	1,0 + 1,0	0
Joseph N.	3	9-0-0 / 9-0-0	1,1 + 0,0	0
Rachel L.	4	9-0-0 / 9-0-0	0,0 + 1,1	0
Natasha P.	1	9-1-0 / 9-0-0	2,2 + 2,2	0
Barbara B.	8	9-0-0 / 9-1-0	2,0 + 1,0	0
Joshua V.	5	8-0-0 / 9-1-1	1,1 + 1,1	0
Karen P.	6	9-1-1 / 9-0-0	0,0 + 1,0	0
Jordan L.	13	5-2-0 / 9-2-0	0,0 + 1,1	0
Danielle D.	19	9-1-0 / 9-3-1	2,2 + 2,1	0
Emily H.	7	8-5-0 / 9-3-0	1,0 + 1,0	0
Adam Z.	23	9-3-1 / 9-5-5	0,0 + 1,0	0
Jarred P.	21	9-6-1 / 9-4-1	2,0 + 0,0	0
Mark R.	9	9-6-5 / 9-6-5	1,1 + 1,1	0
Justin S.	11	9-7-7 / 9-6-6	2,2 + 2,1	0
Margaret H.	14	9-6-6 / 9-8-7	2,2 + 2,2	4
Nicole A.	17	9-6-5 / 9-9-8	2,1 + 1,1	0
Deborah B.	22	9-7-7 / 9-8-5	0,0 + 1,0	0
Alana E.	27	9-8-7 / 9-7-5	2,2 + 2,1	4
Benjamin H.	29	9-8-8 / 9-8-7	2,2 + 2,2	0
Dana T.	12	9-9-7 / 9-8-8	1,1 + 2,2	0
Hana M.	16	9-9-9 / 9-8-8	2,2 + 2,2	0
Lauren M.	26	9-8-8 / 9-9-7	2,2 + 2,2	6
Samara P.	25	9-9-7 / 9-9-8	2,2 + 2,2	6
Shawn P.	10	9-9-9 / 9-9-9	2,2 + 0,0	0
Katie C.	28	9-9-9 / 9-9-9	2,2 + 1,1	6

<u>WFScore</u>=Well-Formedness Score
wf=well-formed sentence
if=ill-formed sentence
c=correction of rejected sentences

<u>MCScore</u>=Modified Conservation Task Score
jdg=judgment
exp=explanation of response

<u>SC Score</u>=Standard Conservation Task Score

APPENDIX C

Stimulus sentences used on the well-formedness judgment task

<u>Trial sentences</u>

<u>Set #1</u>

(T1) The Count went up the steps.

(T2) *Ernie and Grover was spinning.

(T3) Where did Grover hide?

(T4) *Ernie the door was opening.

(T5) *Cookie Monster Bert kissed.

<u>Set #2</u>

(T1) The man sat in the car.

(T2) *The boy and the dog was running.

(T3) Where did the dog hide?

(T4) *The woman the car was driving.

(T5) *The dog the boy chased.

Stimulus sentences

SET #1

1. Grover kissed the Count.
2. Bert was turning the handle.
3. *Who did C.M. sleep?
4. Ernie was putting the book down.
5. * Grover and Cookie Monster was on the spinner.
6. *Grover kissed.
7. Bert was looking at himself in the mirror.
8. Grover and Cookie Monster were on the spinner.
9. *Bert was looking at herself in the mirror.
10. *Bert the handle was turning.
11. The Count went home.
12. *Where C.M. was going?
13. Ernie was opening the door.
14. *The Count Bert kissed.
15. Who did C.M. hit?
16. *The Count went the stairs.
17. *was opening the door.
18. Where was C.M. going?
19. *Ernie was going the slide down.
20. The Count kissed Bert.

Set #2

1. The woman pushed the shopping cart.
2. The boy was washing the car.
3. *Who did the dog bark?
4. The man was putting the gas in.
5. *The man and woman was in the car.
6. *The woman pushed.
7. The woman was driving herself to the store.
8. The man and woman were in the car.
9. *The woman was driving himself to the store.
10. *The boy the car was washing.
11. The man went shopping.
12. *Where the dog was going?
13. The boy was opening the doors.
14. *The dog the man licked.
15. Who did the dog bite?
16. *The man went the store.
17. *was opening the doors.
18. Where was the dog going?
19. *The man was sitting the car in.
20. The dog licked the man.

APPENDIX D

Grammatical contrasts contained in the stimulus sentence pairs

1. **Subcategorization (transitivity of verb)**

   Who did Cookie Monster hit?
   *Who did Cookie Monster sleep?

   Who did the dog bite?
   *Who did the dog bark?

2. **Subject-Verb Agreement**

   Grover and Cookie Monster were on the spinner.
   *Grover and Cookie Monster was on the spinner.

   The man and woman were in the car.
   *The man and woman was in the car.

3. **Subcategorization (transitive verb with/without object)**

   Grover kissed the Count.
   *Grover kissed.

   The woman pushed the shopping cart.
   *The woman pushed.

4. **Reflexive Reference**

   Bert was looking at himself in the mirror.
   *Bert was looking at herself in the mirror.

   The woman was driving herself to the store.
   *The woman was driving himself to the store.

5. **Word Order (progressive aspect)**

   Bert was turning the handle.
   *Bert the handle was turning.

   The boy was washing the car.
   *The boy the car was washing.

6. **Auxiliary Inversion**

Where was Cookie Monster going?
*Where Cookie Monster was going?

Where was the dog going?
*Where the dog was going?

7. **Word Order (simple past tense)**

The Count kissed Bert.
*The Count Bert kissed.

The dog licked the man.
*The dog the man licked.

8. **Subcategorization (adverbial prepositional phrase)**

The Count went up the stairs.
*The Count went the stairs.

The man went to the store.
*The man went the store.

9. **S-V-O Sentence Structure (presence of subject)**

Ernie was opening the door.
*was opening the door.

The boy was opening the doors.
*was opening the doors.

10. **Placement of Preposition**

Ernie was going down the slide.
*Ernie was going the slide down.

The man was sitting in the car.
*The man was sitting the car in.

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