THE UNIVERSITY OF MANITOBA

COGNITIVE LEVELS AND PRODUCTION OF THE PASSIVE VOICE SENTENCE

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

DEPARTMENT OF FAMILY STUDIES

WINNIPEG, MANITOBA

April, 1976

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ABSTRACT

Reversible operational schemes as described by Piaget were studied in Kindergarten and Grade I children's production and comprehension of the passive voice sentence. From the responses to three conservation tasks: elementary number, matter, and length, 18 non-conservers, 16 transitional conservers and 14 conservers indicated the presence of three passive voice forms: Transitional, Conceptual, and Syntactical in their production responses. Analysis of production scores demonstrated that the levels of production of passive voice forms corresponded to the children's cognitive levels. On the comprehension tasks, scores indicated a tendency for the comprehension of passive voice sentences to correspond with only the lower cognitive levels. As expected, on identification tasks comprehension of neither the active or passive voice sentences correlated with cognitive levels.

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to the members of my committee: Dr. L. Jackson, Dr. J. Whiteley and Dr. L. Brockman.

I would like to convey special mention to the children and staff of Oakenwald School whose participation and cooperation made this study possible.

To Dr. L. Brockman for her support, enthusiasm and patience is extended a special acknowledgement.

Finally, I would like to thank my husband, Tom, for his supportive interest throughout the study.

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CHAPTER 1

Introduction

Within the past decade, language and language development have not been studied in isolation but, as McNeil (1970, p. 72) observed from his extensive review of literature, language studies are increasingly relying on theory and empirical evidence drawn from the cognitive area, Bruner (1966), Chomsky (1966), and Whorf (1956) have provided impetus for this trend. Sinclair de-Zwart (1964) pointed out that in the terms "cognition" and "language," cognition precedes language for a basic reason, namely, to indicate that cognitive development is a prerequisite to linguistic development. This trend implies a recognition of the fact that structures of thought influence structures of language. This study focused on the relationship between reversible operations as defined by Piaget's theory and the syntactical structure of the passive voice sentence.

Research in the area of both language development and of Piagetian theory indicated that, at approximately ages five to six, a change in the young child's thinking processes becomes apparent. In language development this change is reflected in the child's ability to understand and use certain linguistic structures. The literature suggests that the child comprehends linguistic features before he can actually produce them spontaneously. For example, among five- to seven-year-olds, reports indicated that younger subjects comprehended the passive voice sentence in identification or imitation-type tasks, but found it more difficult to produce the passive voice sentences either verbally or in action.

According to Piaget's theory, at approximately ages five to six, the child relies less on sensorimotor and perceptual content, and more on representational and abstract content. This newly-developing awareness may be observed in the manner in which the child handles conservation tasks. The concept of conservation implies the logical necessity of using relevant past information in making a present judgement. The evidence from research in language development and cognitive development implies that the child's ability to use complex sentence patterns appropriately coincides with his ability to deal logically with past and present events in his environment. It can be argued, therefore, that the operations involved in comprehending and producing the passive voice sentence are not unlike the operations characteristic of conservation, specifically, reversibility. This study investigated the necessity for the attainment of reversible operations for the production of the passive voice sentence.

Cognitive Theory

Reversible Operations

The development of operational schemes as described by Piaget begins with the sensory motor period. During infancy, the functioning of the operational schemes is limited to sensorimotor content, that is, the cognitive structures are action schemes with no internal representation. With the onset of language, the external can be represented internally but the schemes are not yet reversible. Rather, the child's thought is preoperational or prelogical. Hence, the two- to six-year-old

characteristically describes objects and events as he sees them at the present moment, not as they are or were a few minutes previous. In addition, he is capable of seeing them only from his point of view (egocentricism). Furthermore, he considers only one aspect or dimension of an object at a time, for example, a bead is either yellow or wooden. He cannot understand that it can be yellow and wooden at the same time.

Concrete operational thought develops at about six or seven years of age. The child's operational schemes now become reversible; that is, in judging the present event he can take into account what the situation was before it was transformed. Hence, he can describe the reality and not just the present appearance. For example, if a ball of clay is flattened into a pancake, he will state that the amount of clay has not changed, it is just in a different shape, and he will prove it by rolling the pancake back into a ball. He can thus reverse his thinking and be said to conserve the amount. Furthermore, this child can consider two dimensions of the object simultaneously and indicate that the breadth of the pancake compensates for the height of the ball. In the identical situation, the preoperational child would describe only what he sees after the transformation and would describe it in terms of only one dimension. Hence, he would say either there is more clay in the pancake because it is bigger than the ball, or there is less clay in the pancake because it is not as high as the ball. Though the concrete operational child can think reversibly, his thought is limited to operational schemes that can be demonstrated through concrete manipulations. This behavior

is illustrated in the conservation of liquids experiment in which, to prove that the quantity of water remains the same, this child needs to pour it back into the original container.

Though the essential characteristic of a reversible operation is the ability to recognize the constant amid transformations, Piaget describes three forms of its expression. The first form generally evident in children's thinking involves the maintenance of the identity element. For example, a child will justify his recognition of identity by saying "We haven't added or taken anything away." The second form involves reversibility by inversion; for example, "You have only got to roll up the sausage and you'd see there's the same amount to eat." The third and the latest appearing form is reversibility by compensation of reciprocal relationships; for example, "We haven't added or taken anything away."

Conservation Concepts

Concepts of conservation in general, and conservation of physical quantities in particular, indicate the presence of underlying operational systems characterized by transformational properties. Their acquisition is attested to by the appearance of astonishingly similar arguments (i.e., identity, compensation by reciprocity and cancellation through reversibility). The particular interest of conservation tasks is the fact that they elicit judgements and arguments expressing these forms of reversibility. The three stages found in the development of the concepts of conservation are generally described in the following manner. The first stage is characterized by a number of answers and arguments indicating

an absence of conservation. In the second stage, responses of an intermediate type take the form of vacillation indicative of a semireversible operational understanding. True conservation is acquired in the third stage at which time reversibility by compensation and inversion are evident.

The essence of conservation concepts lies in the understanding that a certain quantitative property remains unchanged during transformation and that acquisition is in a constant chronological order. Research at Geneva (Piaget and Inhelder, 1941) has shown that children acquire the conservation concepts in the following order: discontinuous quantities, continuous quantities (liquids, solid matter such as modeling clay), and then length. The standardization studies undertaken in Geneva (Inhelder, Bärbel, Sinclair and Bovet, 1974) and by other researchers in various countries confirm this order, although the actual ages at which children acquire these concepts may vary with differences in individual capacities, in educational standards and in cultural environment. However reversible operations emerge through the conservation tasks in a relatively constant sequence. It has been found (Inhelder, Sinclair and Bovet, 1974; Costello, 1974) that specific conservation tasks, i.e., elementary number conservation (small collections), conservation of quantity of matter, and conservation of length, applied to a given population establish subject groupings corresponding to the three response stages.

The common characteristic of the first stage, in which children do not have the concept of conservation of quantity, is that they focus

either on the action carried out (for example, flattening of the modeling clay) or on the resulting appearance of the material. In the elementary number conservation problem, it is the change in position of the counters, resulting in a "longer" line, that causes the difficulty. In the conservation of length problems it is the tendency to make ordinal judgements based on ideas of going beyond, overtaking, etc. Such children neglect the fact that the final appearance of the material is determined by the action which brought about the change.

The responses of the intermediate stage are generally characterized by vacillation between nonconservation and conservation arguments. It is this stage that marks the point in development whereby the child begins to establish relationships between some of the features of the experimental material. Initially, these relationships are partial and are restricted to a few features only. In elementary number conservation, understanding of numerical correspondence may be acquired at a level corresponding to that of quotity, which Greco (1962) describes as constituting a semioperational scheme quite distinct from the concept of numerical quantity, but more advanced than the total irreversibility that precedes it. Similarly, a semioperational understanding of continuous quantities can be acquired before an understanding of the multiplicative relationships between the dimensions of the flattened clay and the elongated sausages is achieved. For example, if a child thinks that there is more modeling clay when it is made into a sausage, "because the sausage is longer," he has noted, apparently, the initial dimensional equality of

the two quantities of clay, and their subsequent inequality, but has failed to relate the two comparisons.

Also characteristic of the intermediary stage is the child's apparent capability of mentally returning to the starting point of the experimental situation. The child predicts that there will once again "be just as much to eat" although he judged that at present the quantity (of clay) has increased or decreased as a result of the change in shape. According to Inhelder (1974, p. 33) this type of judgement is called "empirical reversibility," i.e., it permits the possibility of an effective return to the initial state, to distinguish it from logical reversibility. The main difference between this reversal and logical reversibility is that, although the return action is the inverse of the transforming action, it neither cancels out this transformation nor compensates for it. It is merely a second action which, for the child, is completely independent of the first. Piaget (1970) elaborates upon this idea of a possible inverse action as being a system of a semilogical nature. Apparently the child establishes a series of one-way relationships of the type $y_1 = f(x_1)$ where x_1 is the action of lengthening the clay ball, y_1 is the decrease in thickness and f = the functional relationship between y_1 and x_1. The child then establishes $y_2 = f(x_2)$, where x_2 is the inverse action of flattening the sausage into a ball and y_2 is the reduction in length. At this level, however, these two covariations, or functions, are still envisaged successively and are not yet coordinated into a single system which will transform the covariations of dimensions into compensations between dimensions.

The semilogical system of one-way dependencies does not yet involve quantitative invariants, but only an idea of qualitative identity. At this point, the child in unable to distinguish between certain invariant and variant properties of an object. For example, the child will reply that "it's the same clay" even though he judges that the quantity has increased or decreased. For the child of this level, the permanent properties of objects are qualitative in nature and are observed directly, whereas for the child with reversible operations, quantity is conserved. Because of the inability to coordinate the actions, the intermediate stage child might keep changing his mind in one situation, or he might answer correctly in one situation and wrongly in another equally difficult situation. Inhelder et al (1974) report that prediction of which questions or experimental situations will elicit correct or wrong answers is impossible.

At the third level, the child maintains conservation of quantity and justifies it by arguments based on logical identity, reversibility by cancellation of the change, and by compensation between dimensions. The latter argument is based on an understanding of the reciprocity of the relationships, for example, every increase in length implies a corresponding decrease in thickness.

For the concrete operational child, every action has two aspects (Piaget and Garcia, 1971): it has a material result, which constitutes its causal part, and it requires very general coordinations, which constitutes its logical part. Piaget remarks (Piaget and Garcia, 1971) that the lack of true reversibility of the semilogical structures is due to

the primacy of causal actions over deductive operations. In addition, it has been found (Inhelder, Sinclair and Bovet, 1974, p. 34) that there is undoubtedly a continuity from the semilogical and qualitative identities to logical operations and conservation of quantities.

Concepts of conservation, therefore, are generated by logical systems of mental operations and are governed by very regular laws of development. These concepts are neither preformed in the child nor axquired by means of simple observation of real events, but are the product of a process of equilibration which effects development from irreversible to reversible operational schemes. The original conservation studies (Piaget and Inhelder, 1941) revealed that the child's initial understanding of conservation is based on a general undifferentiated concept of invariance which provides the basis for subsequent, more specific, quantifications and measurements.

Development of Syntax: The Passive Voice

In reviewing the literature on the development of syntax, a striking correspondence emerges between the age at which the child demonstrates reversible operations and the age at which he can produce a passive voice sentence. Only the four aspects of language development research that refer directly to this relationship are reviewed.

First, prior to 1960, a major portion of language development research concentrated on syntactic development in the two- to five-year age period. Since 1968, researchers (McCawley, 1968; Chomsky, 1969) have suggested that later language development is equally as basic and certainly warrants study.

The second aspect is that comprehension of language features occurs earlier in development than does production of the same features (McNeil, 1966). Evidence from empirical research and observational studies verify this claim (Fraser et al, 1963; Kessel, 1970; Turner and Rommetveit, 1967). In addition, the majority of studies was devoted to children's production rather than to their comprehension of speech. This was attributed to the unresolved methodological issues surrounding the study of comprehension. Until the ICP (Imitation, Comprehension and Production) Test (Fraser, Bellugi and Brown, 1963) was generally adopted, the lack of methodological clarification limited the empirical information describing the comprehension of speech.

The third aspect concerns methodology which subsequently has been employed in language development research. Three methods appear in the literature: 1) naturalistic observation (the sampling of the child's speech in households (Brown, 1969), 2) traditional experimental situations employing standardized techniques, such as the ICP Test or modifications thereof (Menyuk, 1963; Slobin, 1966a), and 3) Paiget's clinical method (Kessel, 1970).

Fourthly, the apparently increasing interest in relating linguistic development to intellectual development (Sinclair-deZwart, 1967; Slobin, 1966) has become a controversial issue.

With regard to the first aspect, research, such as that by Chomsky (1969) and many others, demonstrated a certain number of sentence patterns which children do not master until the age of eight or beyond. Sentences that depart from the actor-action-object pattern and sentences in which

the description of events does not follow their actual temporal succession, continue to be incorrectly understood and avoided in production. Though contentives have acquired a stable meaning and operator-like words have been introduced, the child's speech still seems to resemble the relationship between the linguistic representational model and reality. In particular, the child seems to equate order properties of the linguistic model with properties of the events and objects described. Beyond the age of eight or nine, children no longer exhibit this general tendency. Confirmation of these findings was obtained by Kessel (1970) and Cromer (1970). Kessel, using the "clinical method" of Piaget, obtained similar age norms for the easy/eager distinction. For example, in "John is eager to please," it is apparent that the perceived subject and the logical subject coincide, i.e., John is the actor. But in "John is easy to please," the perceived subject is not the logical subject, i.e., someone other than John does the pleasing. Cromer (1970) investigaged the sentence "John is easy to see" and found that only children with a maturational age of almost seven years were able to recognize the grammatical structure of the apparent subject, "John".

In respect to the second aspect, observational study and empirical research have reaffirmed the notion of the child's comprehension of linguistic features preceding spontaneous production (Flavell, 1963; McNeil, 1966; Piaget, 1953; Sinclair-deZwart, 1969; Turner and Rommetveit, 1967). Sentence structure is one linguistic feature in which the child's comprehension can be observed to precede production. An example is the

expression of active as opposed to passive voice, which involves a distinctly different sentence order.

Investigations of spontaneous speech (Leopold, 1953) report the late appearance of the passive voice sentence in language development. Harwood's (1959) observational study of preschool children found no occurrence of the syntactical passive voice-sentence in spontaneous speech of children with an average age of five years, eight months. (A sample of 12,700 spontaneous utterances were analyzed.) The past-participle form was used, that is, "It's broken," or "It's hurt." Additional observational studies (Kahane, Kahane & Saporta, 1958; and Slobin, 1966b) suggested that the passive voice sentence structure has not been observed until after seven to eight years of age. Correspondingly, Menyuk (1963) found that 14 out of 14 nursery school children could repeat the passive, while only 5 of these spontaneously produced passive voice forms. Fraser, Bellugi, and Brown (1963) using imitation, comprehension and production tasks, found that three-year-old children were correct only one-half of the time on their imitations of reversible passive-voice sentences. On tasks of comprehension and production very few subjects responded correctly to the passive voice sentences. Apparently, imitation of the passive voice sentence precedes its comprehension, which in turn, precedes its production in the tasks employed.

Another study employing the ICP Test (Turner and Rommetveit, 1967) investigated 48 children at five age levels (nursery school, 4.32 years; kindergarten, 5.87 years; first grade, 7.00 years; second grade, 8.11 years; and third grade, 9.00 years) for their ability to imitate,

comprehend and produce active and passive voice sentences which were reversible and nonreversible. Three relevant points emerged from this study. First, on ICP tasks, significantly more errors were made in the processing of the passive voice than the active voice sentences and in the processing of reversible than in the nonreversible sentences. Second, errors frequently involved the inversion of actor and acted-upon elements in both reversible and nonreversible sentences. Third, a developmental trend was apparent for the experimental tasks. The imitation task was relatively easy for even the youngest subjects. The comprehension task presented difficulties for the nursery school and kindergarten children, and the production task was the most difficult for the nursery school, kindergarten and grade one subjects. The difference in the degree of difficulty in these experimental tasks coincided with that reported by Fraser et al (1963). The fatigue factor would seem to have been rather unlikely as the experimental session lasted only about seven minutes. In addition, any effect of practice from the first to the last task would have tended to make the final task easier, which was not the case. In another study, Brown et al (1969) controlled for order of presentation and still found a marked effect due to tasks. An alternative explanation must be sought to explain the order of difficulty of these experimental tasks. Furthermore, it has been reported (Bem, 1970; Hayhurst, 1967; Huttenlocker, 1964; Slobin, 1964, 1966) that, among five- to seven-year-olds, the younger subjects comprehended the passive voice sentence in identification- or imitation-type tasks, but found it more difficult to produce the passive voice sentence either verbally or in action. It

appears that the type of task and the age of the child are variables in the comprehension and production of the passive voice sentence.

The third aspect noted earlier involved a discussion of the methodology prevalent in language development research. A review of the literature indicated that the ICP Test has been acknowledged as one of the acceptable methods for studying the emergence of linguistic features. In this test comprehension is operationalized as the correct identification of pictures named by contrasting sentences. For example, the experimenter says, "Here are two pictures, one of a boy pushing a girl, and the other of a girl pushing a boy," with care being taken not to show which picture goes with which sentence. The child is then asked to point to the picture that illustrates one of the sentences: "Show me the picture of... 'The girl is pushed by the boy'." The test of production begins in the same way, but instead of asking the child to point to the picture corresponding to a sentence, he is asked to furnish a sentence for a picture. Production was operationalized, therefore, in two ways: (a) the correct imitation of contrasting features in sentences without evidence of understanding and (b) the correct production of contrasting features in sentences applied appropriately to pictures. Production, in the second sense, proved to be less advanced than comprehension in the 12 three-year-old subjects in the study of Fraser et al (1963). Production in the sense of imitation was more advanced than comprehension. The subjects processed each passive voice sentence as though it were in the active voice. For example, in the sentences, "The girl is pushed by the boy," and "The boy is pushed by the girl," the subjects gave an

incorrect response that perfectly preserved the form of the sentence, but exactly reversed the correct patterns of application to the pictures.

Slobin (1966) performed an experiment with subjects aged six, eight, ten, twelve and twenty years in which the truth of sentences had to be judged against pictured scenes. The pictures presented situations which were either reversible in that the object of the action could also serve as the subject, or nonreversible in that the object could not normally serve as the subject. A picture of a dog chasing a cat or a boy pushing a girl depicted a reversible action, whereas a nonreversible action was depicted in such pictures as "a girl watering flowers" or "a boy raking leaves." Slobin expected and found that verifications were less accurate and took longer with passive than with active voice sentences. The problem of verification was simplified in the nonreversible picture in which the subject could be only the logical performer of the action, and the object, the logical recipient of the action. Aside from the fact that errors considerably diminished with age, differences between age groups were not significant. It appears necessary, therefore, to work with still younger subjects if age differences are to be demonstrated.

Hayhurst (1967) studied the efforts of three groups of subjects, aged five, six and nine years, to produce true passive and passive-negative sentences as descriptions of pictures. Production was measured by an imitation-type task in which the subject first repeated model sentences describing the set of pictures. The subjects were then required to "Make up a sentence about this picture which is exactly like these ones we did together." The sentences were passive and passive-negative,

with or without expressed actors; the subject and object in the former being either reversible or nonreversible. The results indicated that errors in construction declined with increasing age and were fewest in sentences without expressed actors. The most common error was to change the passive sentence into its active form. The younger subjects tended to have problems with both comprehension and production, whereas among the older subjects problems were primarily with production. Comprehension tasks, therefore, tended to take the form of picture-sentence recognition tasks and/or imitation-type tasks requiring verbal repetition. Production tasks usually involved the use of visual prompters to elicit a verbal response. Furthermore the assertion that understanding precedes production was taken to mean that some utterances were ordinarily comprehended before any utterances were produced. There is strong empirical support for this contention if production of an appropriate response is accepted as evidence that an utterance has been understood. Fraser et al (1963) suggested there were only two kinds of appropriate response reported common for children: (a) when an utterance made a reference, the child sometimes identified the referent and (b) when an utterance was intended to be an imperative, the child sometimes performed the designated action. In both cases the stimuli are verbal with the response being either verbal or physical. In the studies discussed, there were no tasks in which the child described a physical action, or performed a physical action other than pointing.

The techniques introduced by Huttenlocher, Eisenberg, and Strauss (1968) for the study of comprehension required the placement of one object relative to another stationary one. The comprehension of active and passive statements by 48 fourth grade boys and girls was assessed with this technique. One situation involved the manipulation of a moveable truck relative to one in a fixed position. Comprehension was assessed by the correctness of the subject's response to a statement such as, "The red truck was pushed by the green truck." Analysis of the results indicated the occurrence of longer reaction times and more errors in situations requiring the subject to place the moveable truck in response to a passive voice statement. Apparently, comprehension was easiest when a correspondence existed between the perceived actor in the situation and the logical subject of the experimenter's statement. This was consistent with previous studies showing that passive voice statements tended to be more difficult to comprehend than active voice statements (e.g., Slobin, 1966).

Finally, the fourth aspect in which apparent interest in relating linguistic development to cognitive development was considered, the research indicated that at approximately age five, a change in the young child's problem-solving behavior becomes apparent (Bem, 1970; Huttenlocher, Eisenberg & Strauss, 1968; Weir, 1964). This change was reflected in his ability to understand and use certain linguistic structures in task-oriented situations. Huttenlocher and Strauss (1968) indicated that the child's ability to use complex sentence patterns appropriately coincided with his ability to deal logically with events in his environment. Thus, the research by

Huttenlocher and Strauss (1968) suggested that the young child did not understand a relational statement unless the grammatical subject of the instruction corresponded to the logical actor in the external situation. For example, when the block that the child was asked to place was the grammatical subject of the sentence, the two corresponded, and the task presented no problem. However when the block that the child was asked to place was the grammatical object of the sentence, this correspondence was absent, and the child seemed unable to comprehend the meaning of the instruction. Once again, the results indicated that nursery school children, aged 4½ years, were less proficient than first graders, aged 6½ to 7 years, when confronted with tasks assessing the comprehension of the passive voice sentence.

In summary, the following four points are relevant to the perspective of the present study. First, sentences that depart from the actor-action-recipient pattern, and sentences in which the description of events does not coincide with their actual temporal succession, continue to be misunderstood and avoided in production until the age of eight or beyond. Second, the notion that comprehension of the passive voice precedes its production has been reaffirmed from observational studies, as well as in experimental research. Third, the age-related patterns of response which have emerged from the tasks of imitation, comprehension and production are suggestive of the development of an underlying cognitive operation. Fourth, the occurrence of the young child's ability to use complex sentence patterns appropriately, coinciding with his ability to deal logically with events in his environment, is reflected by a change in his

problem-solving behavior. Therefore, within the context of these four points, it is suggested that the emergence of the passive voice structure in terms of semi-reversible and reversible operations coincides with the development of conservation concepts.

Statement of the Problem

On the basis of the literature reviewed there appears to be a correspondence between the development of cognitive operations and the development of the syntax for use of the passive voice.

Whether it be in the comprehension or production of the passive voice, the child must be aware of two factors: sentence pattern and sentence meaning. Hence, to process the sentence form correctly, the child must simultaneously attend to the relationship between the grammatical structure and semantic content. Though the meaning of the active and passive voice is identical, their structure is different.

The pattern of the active sentence is actor-action-recipient, whereas that of the passive sentence is recipient-action-actor. To change an active voice sentence to the passive voice structure, while maintaining its meaning, suggests the child is using the same type of ability as is needed for the conservation tasks. Specifically, the transformation of an active voice sentence to a passive voice sentence requires that an irrelevant perceptual cue, namely, the reversed word order, be ignored. It was argued, therefore, that the ability to decenter and to maintain the identity element amidst a transformation affects performance on both conservation and language tasks.

As discussed previously, Piaget (1959) pointed out that the attainment of completely reversible structures proceeds by a succession of stages referred to as operational mobility. The acquisition of these stages is attested to by the appearance of reversibility arguments. It can be expected, therefore, that the degree of operational mobility achieved by the child limits the complexity of the linguistic task that he can handle appropriately. The research cited previously, in which the five-year-old child generally gave evidence of understanding the passive voice sentence before he could produce this sentence form, suggested the operation of semi-reversible structures. In the present investigation, it was expected that children who demonstrate semi-reversible operations in conservation tasks adequately comprehend passive voice sentences but are unable to verbally produce such sentence forms. On the other hand, children who demonstrate complete reversible operations on the conservation tasks are able to comprehend and produce appropriate passive voice sentences.

The major hypothesis of this study was: reversibility of operational schemes is necessary for the production of the passive voice sentence.

The following supportive hypotheses were also investigated:

1. Reversibility of operational schemes is not necessary for the comprehension of the passive voice sentence.

2. Reversibility of operational schemes is not necessary for either the comprehension nor the production of the active voice sentence.

3. Comprehension of passive and active voice sentences do not differ in identification-type tasks.

CHAPTER 2

Method

Experimental Design

The experimental design was a 3 x 2 factorial which included three levels of conservation (nonconservers, transitional conservers, and conservers) and sex. This design applied to production, comprehension and identification responses.

Tasks

Piagetian Tasks. Cognitive level, the independent variable, was assessed by means of three conservation tasks administered in the following order: elementary number conservation, quantity of matter, and length (Appendix A). Elementary number conservation required the child to place the same number of counters on the table as the experimenter. Once the child acknowledged that there were ten counters in each row, one row was made shorter such that the end points did not coincide. The subject was asked the conservation questions concerning the equality of the two rows of counters.

For the conservation of matter the child was given a ball of clay and asked to make another exactly like it "just as big and just as heavy." One of the balls was retained as a "standard of comparison," and the other was transformed into a sausage. The child was asked the conventional conservation questions regarding the two balls of clay.

The conservation of length task required the child to construct a straight road the same length as the experimenter's. Upon completion of the task he was asked the conventional qualifying questions regarding

the equality he established. One line was then made shorter and the child was again asked the conservation questions.

Linguistic Tasks. Linguistic tasks were of two general types: comprehension and production. For the comprehension tasks, the child was asked to act out sentences presented verbally by the experimenter in active and passive voice forms. For the production tasks, the child was asked to describe verbally actions produced by the experimenter. Comprehension, one of the dependent variables, was operationalized as an act or process of understanding the meaning of a verbal unit, namely, a sentence. Production, the other dependent variable, was operationalized as the verbal description of the occurrence of a simple event. Comprehension tasks included ten sentences, five in the active voice and five in the passive voice (Appendix A). Production tasks included ten action sequences, performed by the experimenter, which the subject was asked to describe in two ways (Appendix A).

Previous investigations of active-passive voice sentence comprehension used an identification procedure (Fraser et al., 1963; Slobin, 1966a). To allow for comparison of the results of comprehension demonstrated by the action sequences proposed for this study, a series of identification items were presented to all children at the end of the session. This involved presenting five sets of cartoons, each depicting reversible action sequences, that is, the actor and recipient of the action could be reversed. For example, one cartoon depicted a dog chasing a cat and the other, a cat chasing a dog. The subject was asked to point to the cartoon which was described verbally by either an active or passive

voice sentence. The order of presentation of the five sets of cartoons and the ten sentences was counterbalanced across the subjects (Appendix A).

Pilot Study

The pilot study was conducted with nine children ranging in age from 4 years to 7 years, 9 months. Two procedures were indicated by the pilot study. First, a short pause involving standing and stretching was introduced midway in the 25-35 minute test session to facilitate the subjects' interest and alertness by minimizing the effects of restlessness, fatigue, and boredom. Second, additional probes were included in the comprehension instructions, for example, "Tell me about it in a different way." The pilot study also reaffirmed the probability of finding subjects whose behavior characterized each of the three desired levels (nonconservers, transitional conservers, conservers) within the age range found in Kindergarten and Grade I.

Procedure

The principal from the Oakenwald Elementary School was contacted and an interview was obtained. Permission to conduct the study was granted by the principal under four conditions: 1) submission of a written proposal to the principal; 2) completion of all data collection within seven days; 3) testing of subjects only within school hours; and 4) submission of a written report upon completion of the project.

The necessary procedures for obtaining parental permission for the children's participation in the experiment was conducted by the principal (Appendix B for sample letter received by parents). Prior to the test week, the descriptive data involving names, ages, birthdates and sex of the subjects were obtained by the experimenter. With this information, a testing schedule was established which necessitated counterbalancing of age and sex with linguistic testing procedures.

Because of the seven day testing limit, the following plan was adopted to insure a sample size within the age range specified. Kindergarten subjects were tested in order of descending age, alternating male and female subjects. All kindergarten subjects were tested between 9:05 a.m. and 12:00 noon, and all Grade I subjects were tested between 1:45 p.m. and 4:00 p.m. This procedure facilitated cooperation with the teachers in that it minimized classroom disturbance and interference. It enabled the teacher to coordinate the child's classroom activities with the scheduled interview.

The testing took place in one of two specified rooms in the school during school hours. Each subject was tested individually during one

session of 25-35 minutes. After establishing rapport, the Piagetian tasks were presented in the following order: (a) elementary number conservation; (b) conservation of quantity of matter (clay); (c) tube rotation[1]; and (d) conservation of length. Administration of these tasks followed the procedures described in Inhelder, Sinclair and Bovet (1974). (Appendix A.) The two types of linguistic tasks (comprehension and production) were then presented in a counterbalanced order across subjects. Finally, the identification items were administered.

For the comprehension tasks, the experimenter placed the test materials (for example, a toy car and truck) on the table before the child. The experimenter named the objects and asked the child to identify and name each in turn. When the child understood the identity of the objects, the experimenter verbally presented either a passive or active voice sentence. The child was asked to act out the meaning of the sentence with the test materials presented. Prior to presenting the test items as described above, two training items using materials not included for the test items, were given to ensure the understanding of the task procedures. Active and passive voice sentences and task materials were presented in a counterbalanced order (Appendix A).

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[1]The tube rotation task results were not included for the calculation of the total conservation scores for the following two reasons: (a) the manner of scoring the tube rotation task differed from the other three conservation tasks due to the fact that the task itself precludes the possibility of obtaining justifications, and (b) sufficient differentiation of subjects was obtained with the other three conservation tasks.

For the production tasks, the experimenter placed the task materials on the table and similarly ensured the child understood their identity. The experimenter then performed an action sequence with the task materials, for example, driving the car into the truck, and asked the child to describe the event. Whether the response was in the active or passive voice, the child was asked, "Tell me about it in a different way. The truck....". Again, training trials were given prior to the ten production items and the order of presentation was counterbalanced across subjects (Appendix A).

Five pairs of cartoons were used for the identification task. A pair of cartoons each of which represented a reversible action (a dog chasing a cat, and a cat chasing a dog) was placed on the table before the child. The experimenter verbally presented either an active or passive voice sentence describing one of the two cartoons in the pair. The child was asked to point to the cartoon described. The order of presentation of cartoons and the order of active or passive voice sentences were counterbalanced across subjects (Appendix A).

Each testing session was tape recorded in its entirety to ensure accurate recording of verbal behavior. The responses of the children were coded by two experienced coders in terms of the qualitative criteria described by Inhelder, Sinclair and Bovet (1974). In discussing a discrepancy, consensus on coding was achieved by reviewing a child's protocol. On this basis four levels of conservation ability were delineated. Level I children displayed the concept of quotity in the elementary number conservation task, accompanied by nonconservation responses in the other two

tasks. Level II children characteristically displayed slightly more advanced behavior. Responses indicated complete conservation for the elementary number conservation task, transitional conservation responses for the quantity task and non-conservation responses for the length task. Level III children demonstrated conservation on the number task and transitional conservation responses for the quantity and length tasks. Level IV children displayed complete conservation responses on at least two or three tasks, accompanied by a transistional-type response on the third task.

For the purposes of obtaining quantitative data, numerical scores were ascribed to each of the four groups. Thus, children classified in Level I were those scoring from 0 to 1 points, Level II, those scoring from 2 to 3 points, Level III, those scoring from 3 to 4 points, and Level IV, those scoring from 5 to 6 points. As suggested by Inhelder, Sinclair and Bovet (1974), Level II and III were collapsed to form the Transitional Group.

In summary, the resulting three groups can be described qualitatively and quantitatively as follows: Group I consisted of nonconserving children with a total score range over all three tasks of 0 to 1 points; Group II consisted of transitional conserving children with a total score range of 2 to 4 points, and Group III consisted of conserving children with a score range of 5 to 6 points.

For the comprehension tasks a child's manipulative responses were recorded by the experimenter during the session. After the session, these responses were scored as correct or incorrect, yielding a score ranging

from 0 to 20. Responses to the production tasks were tape recorded and scored as active or passive voice forms after the session was completed. A total of ten active and ten passive sentences could be produced. Two trained colleagues independently coded the production responses and arrived at consensus on discrepant codes.

Subjects

Forty-eight children ranging in age from five years, four months to seven years, two months were tested. Twenty-four of these children (11 boys and 13 girls) were from kindergarten, and twenty-four (14 boys and 10 girls) were from Grade I. (Appendix B.) The children were all from the Oakenwald Primary School. Observations of the school and surrounding residential area suggested relatively honogeneous economic circumstances.

To ensure a large enough sample to form the three conservation groups the total number of children in each Kindergarten and Grade I classroom was tested. On the basis of the score obtained across three Piagetian conservation tasks, eighteen children with a mean age of 73.05 months (10 boys, 8 girls) were at the nonconserver level, sixteen children with a mean age of 76.00 months (8 boys and 8 girls) at the transitional level, and fourteen children with a mean age of 79.79 months (7 boys and 7 girls) were conservers (Appendix B). The mean conservation scores of boys and girls at each of the three cognitive levels are given in Appendix B, Table 3.

CHAPTER 3

Results

The language scores of boys and girls at the three cognitive levels are compared in two-way analysis of variance. Qualitative differences in production of the passive voice sentence form are described first.

Passive Voice Sentence Form

Production. A qualitative analysis of the production task data indicate the presence of two forms of the passive voice sentence: Conceptual Passive Voice and Syntactical Passive Voice. The Conceptual Passive Voice Form is characterized by the words "got" or "by" or a combination of the two. For example, "The rabbit got chased.", "The rabbit chased by the dog." The Syntactical Passive Voice Form is the grammatical passive voice employing the word "was." For example, "The rabbit was chased by the dog."

The frequency of production of the two types of passive forms presented in Table 1 illustrates the differences among the responses of the children in the three cognitive levels. Among the 18 nonconservers only six produce the Conceptual Passive Voice Form and none the Syntactical Passive Voice Form. The majority of the transitional conservers produce the Conceptual Passive Voice Form but only five of the 16 respond in the Syntactical Passive Voice Form. The conservers produce the Conceptual Passive Voice Forms more frequently, but, similar to the transitional conservers, only four of the 14 children respond in the Syntactical Voice Forms.

TABLE 1

Mean number of Conceptual Passives and Syntactical Passives Produced by Nonconservers, Transitional Conservers, and Conservers

Level of Passive Form	Cognitive Levels		
	N C	T C	C
N	18	16	14
Conceptual	.50	2.63	5.64
Syntactical	0.0	.56	.36

A two-way analysis of variance of the Conceptual Passive Voice Scores (Table 2) demonstrates differences across cognitive levels, $F(2,42) = 8.19$, $p < .01$. Follow-up t-tests indicate production of more Conceptual Passive Voice Forms by the conservers than the transitional conservers, $t\ (28) = 2.55$, $p < .05$, and the nonconservers, $t(30) = 4.02$, $p < .001$.

Comprehension. Means and the two-way analysis of variance of comprehension task scores shown in Table 3 indicate only a tendency for differences between cognitive levels in comprehension of the passive

TABLE 2

Means and Analysis of Variance of Production Scores for Conceptual Passive Voice Sentences of Boys and Girls at the Nonconserver, Transitional Conserver and Conserver Levels

	Cognitive Level							
	N C		T C		C		Total	
Sex	N	Mean	N	Mean	N	Mean	N	Mean
Boys	10	.50	8	2.75	7	7.28	25	3.12
Girls	8	1.63	8	2.50	7	4.00	23	2.65
Total	18	1.0	16	2.62	14	5.64	48	2.90

Source	*df*	*SS*	*MS*	*F*-ratio
Cognitive Level	2	171.51	85.75	8.19**
Sex	1	2.62	2.62	.25
Cognitive Level x Sex	2	41.045	20.52	1.96
Error	42	439.305	10.45	
Total	47	1057		

** $p < .01$

TABLE 3

Means and Analysis of Variance of Comprehension Scores for Passive Voice Forms of Boys and Girls at the Nonconserver, Transitional Conserver and Conserver Levels

	Cognitive Level							
	N C		T C		C		Total	
Sex	N	mean	N	mean	N	mean	N	mean
Boys	10	4.1	8	4.50	7	4.57	25	4.36
Girls	8	4.13	8	3.38	7	4.57	23	4.00
Total	18	4.11	16	3.94	14	4.57	48	4.19

Source	*df*	*SS*	*MS*	*F*-ratio
Cognitive Level	2	3.17	1.58	2.46*
Sex	1	1.55	1.55	2.41
Cognitive Level x Sex	2	3.51	1.76	2.72*
Error	42	27.08	.64	
Total	47			

*$p < .10$

voice, $F(2,42) = 2.46$, $p < .10$. The conservers comprehend more syntactical passive voice sentences than either the transitional conservers, $t(28) = 4.25$, $p < .001$, or the nonconservers, $t(30) = 3.21$, $p < .01$. The suggestion of a Cognitive Level x Sex interaction, $F(2,42) = 2.72$, $p < .10$, results from transitional conserving girls scoring lower than transitional boys, $t(14) = 2.80$, $p < .05$, and lower than the conserving girls, $t(13) = 2.98$, $p < .05$.

Active Voice Sentence Form

Production. Analysis of the active voice scores in production tasks indicate no differences among cognitive levels nor between boys and girls (Table 4).

Comprehension. Similarly, no differences in comprehension of the active voice sentences is indicated among cognitive levels (Table 5). However, there is a general tendency for the boys to comprehend more active voice sentences, $F(1,42) = 3.08$, $p < .10$, which t-tests indicate are not associated with cognitive levels.

Comparison of Active to Passive Voice Sentence Forms

To examine whether a greater proficiency was shown with respect to active voice sentences than to passive voice sentences, the difference in the frequency of responses to active and passive voice sentences was contrasted. For this comparison the number of syntactical passive voice sentences was subtracted from the number of active voice sentences produced or comprehended. The difference scores were then compared across cognitive levels for boys and girls in two-way analyses of variance.

TABLE 4

Means and Analysis of Variance of Production Scores for Active Voice Sentences of Boys and Girls at the Nonconserver, Transitional Conserver, and Conserver Levels

	Cognitive Level							
	N C		T C		C		Total	
Sex	N	Mean	N	Mean	N	Mean	N	Mean
Boys	10	10.0	8	9.75	7	9.86	25	9.88
Girls	8	9.86	8	8.63	7	10.00	23	9.48
Total	18	9.94	16	9.19	14	9.93	48	9.69

Source	*df*	*SS*	*MS*	*F*-ratio
Cognitive Level	2	6.00	1.00	0.22
Sex	1	1.93	1.93	0.43
Cognitive Level x Sex	2	3.67	1.63	0.36
Error	42	189.11	4.50	
Total	47	200.31		

TABLE 5

Means and Analysis of Variance of Comprehension Scores for Active Voice Sentences of Boys and Girls at the Nonconserver, Transitional Conserver, and Conserver Levels

	Cognitive Level							
	N C		T C		C		Total	
Sex	N	Mean	N	Mean	N	Mean	N	Mean
Boys	10	4.4	8	4.62	7	5.0	25	4.64
Girls	8	4.0	8	4.25	7	4.57	23	4.26
Total	18	4.22	16	4.43	14	4.79	48	4.46

Source	*df*	*SS*	*MS*	*F*-ratio
Cognitive Level	2	2.51	1.26	2.24
Sex	1	1.72	1.72	3.08*
Cognitive Level x Sex	2	0.19	0.09	0.17
Error	42	23.49	0.56	
Total	47			

*$p < .10$

Production. The means of the difference scores (Table 6) are significant across cognitive levels, $F(2,42) = 9.10$, $p < .01$. The non-conservers tend to produce proportionately more active than passive voice sentences relative to the transitional conservers, $t(32) = 1.85$, $p < .10$. Similarly, but more markedly, the proportion of active to passive voice sentences produced by transitional conservers exceeds that of the conservers, $t(28) = 2.41$, $p < .05$.

TABLE 6

Means and Analysis of Variance of the Difference Scores for the Production Tasks of the Boys and Girls at the Nonconserver, Transitional Conserver, and Conserver Levels

	Cognitive Level							
	N C		T C		C		Total	
Sex	N	Mean	N	Mean	N	Mean	N	Mean
Boys	10	19.0	8	13.75	7	4.27	25	13.20
Girls	8	16.75	8	13.25	7	10.29	23	13.57
Total	18	18.00	16	13.50	14	7.29	48	13.38

Source	df	SS	MS	F-ratio
Cognitive Level	2	904.39	452.19	9.10**
Sex	1	1.59	1.59	0.03
Cognitive Level x Sex	2	147.90	73.95	1.49
Error	42	2087.35	49.69	
Total	47			

** $p < .01$

Comprehension. The comparable analysis of difference scores for comprehension of active to passive voice sentences indicates no difference among cognitive levels nor between boys and girls (Table 7).

TABLE 7

Means and Analysis of Variance of the Difference Scores for the Comprehension Tasks of the Boys and Girls at the Nonconserver, Transitional Conserver, and Conserver Levels

	Cognitive Level							
	N C		T C		C		Total	
Sex	N	Mean	N	Mean	N	Mean	N	Mean
Boys	10	5.4	8	5.13	7	5.43	25	5.32
Girls	8	4.89	8	5.38	7	7.86	23	5.09
Total	18	5.17	16	5.25	14	5.21	48	5.21

Source	*df*	*SS*	*MS*	*F*-ratio
Cognitive Level	2	0.06	.03	0.03
Sex	1	0.65	.65	0.57
Cognitive Level x Sex	2	1.47	.73	0.64
Error	42	47.74	1.14	
Total	47	49.92		

Identification Tasks

To examine whether active voice sentences are more frequently comprehended than passive voice sentences when the child's response to a spoken sentence consisted merely of pointing to the picture, difference

scores were derived. The number of correctly identified passive voice sentences were subtracted from the number of correctly identified active voice sentences. A two-way analysis of these difference scores indicate, as expected, no differences among children across cognitive levels nor between boys and girls (Table 8).

TABLE 8

Means and Analysis of Variance of the Difference Scores for the Identification Tasks of the Boys and Girls at the Nonconserver, Transitional Conserver, and Conserver Levels

	Cognitive Level							
	N C		T C		C		Total	
Sex	N	Mean	N	Mean	N	Mean	N	Mean
Boys	10	10.4	8	10.63	7	10.43	25	10.48
Girls	8	10.63	8	10.38	7	10.43	23	10.48
Total	18	10.50	16	10.50	14	10.43	48	10.48

Source	*d f*	*S S*	*M S*	*F*-ratio
Cognitive Level	2	.05	.03	0.01
Sex	1	0	0	0
Cognitive Level x Sex	2	.53	.26	0.15
Error	42	75.45	1.79	
Total	47			

CHAPTER 4

Discussion and Conclusion

The results from this study support the major hypothesis that reversible operations are necessary for the production of the passive voice sentence. The most striking observation is the success of only those subjects demonstrating semireversible and reversible operational schemes in the production of the passive voice sentence. This confirms the idea of Inhelder et al (1974) that a close relationship exists between the child's level of cognitive development and the type of reasoning exhibited in language development.

The forms of reasoning described by Piaget as characteristic of preoperational, transitional operational and concrete operational thought which he inferred from behavior on conservation tasks were also observed in the production of passive voice forms. Two forms of passive voice emerged in this study: the conceptual passive and the syntactical passive voice.

The nonconserver who produced few conceptual and no syntactical passive voice form responsed with a sentence pattern, in which the recipient of the action was focused upon and ascribed ongoing action. This pattern is similar to what Piaget calls transductive reasoning. Transductive reasoning, characteristic of the preoperational child, proceeds from the particular to the particular (Flavell, 1963). For example, "The red ball hit the green ball and the green ball ran away." As is evident in both transductive reasoning and in the production of this sentence pattern, one element of the event is centered upon and the perceptually

oriented conclusion is irreversibly drawn from this event. In addition, this sentence pattern demonstrates the child's juxtaposing, i.e., there is the presence of associative "and connections" rather than true implicative and causal relations between the two objects in the action sequence. In this type of sentence it is apparent that the actor and the recipient of the action are not connected through logical necessity or physical causality. Furthermore, this production response suggests the notion that almost anything can be "causally" related to anything else. For example, when the child described the action of the dog chasing the rabbit as "The rabbit chased the dog," a direct inverse of the action sequence is provided. Though he could readily describe the event in the active voice, when pressed through probing to describe it in another form, both examples discussed suggest a lack of reversible thinking. The fact that he could produce the active voice correctly suggests understanding of the meaning of the event (deep structure) but his inability to produce the passive voice suggests the inability to reverse the word order (surface structure) while preserving the meaning.

The conceptual passive voice form begins to show evidence of reversible thought with the use of words such as "got" or "by." For example, "The red car got hit by the blue car," or "The stick hit by the ball." It is apparent from this sentence structure that the child not only understands the meaning of the event but also shows an ability to transform the surface structure of the sentence to recipient-action-actor pattern without essentially distorting the meaning (deep structure).

Hence, in contrast to the nonconserver, this child transforms the total reality of the event rather than centering on only one element. This manner of producing the passive voice was characteristic of the children functioning at the transitional and conserver levels.

Despite the fact that the experimenter modeled syntactical passive voice sentences for alternate items, the nonconservers failed to be influenced in their production responses. However, some of the transitional conservers did alter their sentence form from conceptual to syntactical during the latter half of a test session. This reaffirms the contention in Inhelder et al (1974) that observable features are assimilated only if the child is able to incorporate them into the operational schemes he already has developed.

As was expected, the hypothesis that reversible operations are not necessary for the comprehension of the passive voice sentence is supported. The fact that the children at all three cognitive levels correctly carried out an action described in the passive voice suggests that reversible operational schemes are not generally necessary for comprehension. Some preoperational children did not correctly carry out the meaning of the passive voice sentence, which suggests these children may have been functioning at lower cognitive levels.

The contrast between the levels of performance on production and comprehension tasks may be a function inherent to the differences in difficulty of these tasks. For the comprehension task the child is required to recognize the correspondence between a verbal statement and the concrete event which involves a matching of the elements of meaning

to elements in the event. The task, therefore, would appear to require an ability similar to that involved in Piaget's concept of class inclusion. A child who demonstrates class inclusion ability recognizes that all the beads are wooden, some of which are yellow and some of which are red. The child who comprehends the passive voice sentence appears to recognize the total meaning of the sentence, part of which lies in one element of the event and part of which exists in another element. For this recognition, reversible operational schemes of the level required for production of a passive voice sentence do not appear to be needed.

If this explanation holds true then the nonsignificant differences in comphrehension of the active and passive voice sentences obtained on the Identification Tasks could be expected. The pointing procedure limits the task to recognition ability.

Some incidental observations of the children while performing the action sequence described by a passive voice sentence further illustrate the functioning of irreversible operational schemes. Whether the experimenter presents an active or passive voice sentence, some nonconservers and most of the transitional conservers tended to place the first named referent onto the table, and to pick up the second named referent and carry out the action. Regardless of active or passive voice, it was the temporal sequence of the words in the sentence that appeared to indicate for them the direction of the action. These same children were also observed to pick up a referent in each hand and simultaneously moved both toward each other. This involvement of both the subject and the object in the action suggests the beginning of decentered thought.

Furthermore, the nonconservers and transitional conservers tended to hesitate more in carrying out the passive voice sentence in comprehension and identification tasks. While carrying out the passive voice sentence these children were often observed to repeat in a whisper the passive voice sentence presented by the experimenter.

In conclusion the responses of the children in this study indicate that reversible operational schemes are necessary for the production of the passive voice sentence but not the active voice sentence and not for the comprehension of either the active or passive voice sentence. Therefore, the correspondence between cognitive levels and levels of production of the passive voice tends to suggest that the functioning of operational schemes precedes their appearance in language development.

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APPENDIX A

ELEMENTARY NUMBER CONSERVATION

(SMALL COLLECTIONS)

1. METHOD*

Materials: 10 red counters;

10 blue counters.

Task Description

First situation. The experimenter lays out one row of about seven blue counters and asks the child to put out the same number of red counters: "Put out as many of your red counters ... exactly the same number as I've put blue ones ... just as many, no more, no less."

The child's response is recorded in his protocol and then, if necessary, the experimenter pairs off the red and blue counters (one-to-one correspondence) and makes sure that the child appreciates the numerical equivalence of the two rows.

The experimenter then modifies the lay-out by spacing out the counters in one of the rows, or by moving them together, so that they form either a longer or a shorter row: "Are there as many ... the same number ... of blue ones as red ones or aren't there? Or are there more? How do you know?"

Counter-Arguments

If the child has given a correct conservation answer, the experimenter draws his attention to the lay-out: "Look how long this line is,

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*From the descriptions in this appendix, the interviews might appear rather standardized. In fact, each is adapted to the particular subject, especially with regard to the latter's understanding of the terms used in quantification.

aren't there any more counters?" If the child's answer was wrong, the experimenter reminds him of the initial equivalence: "But don't you remember, before, we put one red counter in front of each blue one, and someone else said that there are the same number of red and blue ones now; what do you think?" In addition, the experimenter asks him a quotity question: "Count the blue ones (the experimenter hides the red ones). How many red ones are there, can you guess without counting them? How do you know?"

The children determine the right number of counters to put on the table by pairing off the blue and red counters (one-to-one correspondence).

The following responses are noted when the experimenter asks these children the conservation questions:

a. Some children give correct answers in only one of the situations.

b. Other children hesitate and/or keep changing their minds in both situations: "There are more blue ones ... no, red ones ... they're both the same ..." etc.

Even when these children give correct answers, they cannot explain and justify them adequately.

They give correct answers to the quotity problem, e.g.: "There are seven red ones ... so I should think there are seven blue ones as well."

Conservation (from Five Years)

These children give correct answers to all the questions, are not swayed by anything the experimenter says to try to make them change their

minds and give one or several of the following arguments:

"There are just as many blue ones as red ones because it was right before and we haven't taken anything away, they've just been squashed up" ("identity" argument).

"We could put the others in a heap as well, or put one by the other so there aren't more blue ones or red ones" ("reversibility" argument).

"Here the red ones are in a long row, but there's space in between the counters, so that makes it the same" (compensation" argument).

2. RESPONSES

Nonconservation (up to Four to Five Years)*

When they are asked to put out red counters on the table in the two situations, some children may try to count how many blue ones there are, some may just put some counters down in a haphazard way, while others roughly estimate the number required or pair off the blue and red counters.

In both situations, the conservation questions are answered incorrectly: "There are more red ones because the blue ones are all squashed together," etc.

Only some of the children give a correct answer to the quotity questions.

CONSERVATION OF QUANTITY OF MATTER

1. METHOD

Materials: two balls of play dough (diameter approximately 4 cm) of different colors.

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*Ages mentioned indicate approximately the start of the corresponding stage, but those may vary with the cultural and educational setting of the subjects.

Presentation. The experimenter asks the child to make sure that the two balls are made of the same amount of play dough. "You see these two balls. I want there to be the same amount of dough in each ... Let's pretend they are made of pastry. Make it so that if we each ate one of them, we would both have the same amount to eat. Make sure that there's exactly the same amount of pastry in each (no more, no less)."

Task Description

First situation. The experimenter (or the child) molds one of the balls into the shape of a sausage (about 12 cm long). "Now, is there the same amount to eat in the ball and in the sausage, or is there more in the ball or, perhaps, more in the sausage (more to eat ...) ... How do you know? ... Show me."

Counter-Arguments

If the child has given a correct conservation answer, the experimenter draws his attention to one particular aspect: e.g., "Look at this (sausage), it's very long, don't you think there's more to eat here than there (ball)?" or "Someone else told me ... "

If the child has given a nonconservation answer (e.g., "More to eat in the sausage) based on one aspect, e.g., length, the experimenter reminds him of the initial equal quantities: "How did we make the balls before?" Or he draws his attention to the other aspect (e.g., don't you think there's more pastry here (ball) than there (sausage)?" He encourages the child to explain his ideas before asking him: "If I now make the sausage back into a ball, will there be the same to eat or not?" If the child does not answer this "empirical return" question correctly, the

experimenter remolds the sausage into a ball, if necessary, adjusting the size of the two balls until the child judges that they are exactly the same.

2. RESPONSES

Nonconservation (up to Five to Six Years)

Each time one of the balls is remodeled, the child judges one of the amounts greater: e.g., "It's got more (in the sausage) because it's long." When the experimenter draws his attention to another dimension (e.g., the thinness of the sausage), the child either sticks to his incorrect answer, or else changes his mind and says that the other quantity (the ball) is greater. Being reminded of their initial equal quantities has no effect on the child.

At this developmental level, the "empirical return" problem is only sometimes correctly solved.

Intermediate

Three different main types of intermediate responses occur:

Faced with the same situation, the children change their minds as to whether the two quantities are equal: "There's more in the sausage ... no, more in the ball ... no, there's the same to eat in them both ..." etc.

Sometimes the children answer correctly or incorrectly in the case of, for instance, the sausage.

Sometimes the children are influenced by what the experimenter says and, for instance, answer correctly when the latter reminds them of the equality of the initial quantities, or else change their minds after

giving a correct answer, when, for instance, the latter stresses the difference in the shapes.

At this level, even when they manage to give correct answers, the children generally give unclear and incomplete reasons for them. However, they can solve the "empirical return" problem correctly.

Conservation (from about Seven Years)

In each situation, the quantities are judged equal. The child is capable of giving one or several of the following explanations:

"There's the same to eat, because we didn't take anything away or add anything" ("identity" argument).

"There's still the same, because if we made it back into a ball, it would be the same as before" ("reversibility" argument).

"Here (sausage) it's big, but it's thinner (than the ball), so there's the same to eat" ("compensation" argument).

Furthermore, these children stick to their correct answers even when the experimenter tries to make them change their minds.

CONSERVATION OF LENGTH

1. METHOD (VARIATION OF THE ORIGINAL METHOD)

Materials: two flexible wires (e.g., electrical cables) of different lengths (approximately 15 and 10 cm), the longer one designated A, the shorter one, B.

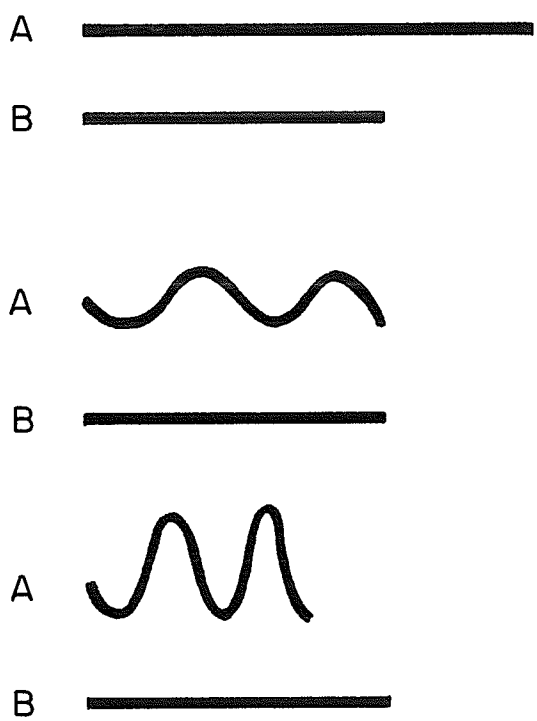
Presentation. "Let us pretend that these two wires are roads. Now, on this road (A) is there just as far to walk as on this one (B) or is there perhaps farther to walk here (A) or there (B) ... ?" "This

road (A), is it the same length as that one (B), or longer, or not so long as this one (B)?"

The child thus notices the inequality and correctly judges A to be longer than B.

Task Description

First situation. The experimenter bends A so that its ends coincide with those of B: "And now, is there as far to walk on this road A as on this road B? ... If two ants are walking, one on this road (A) and



the other on this road (B), would they both walk just as far? ... Would they both be just as tired or would one be more tired than the other? ... How do you know? ... Show me how you can find out ..." etc.

If the child has given a correct answer, the experimenter stresses the fact that the end points of A and B coincide: "But look where this road (A) stops, right where the other one does (B); perhaps they're the same length, don't you think so? Tell me why you think so?"

If a child has answered incorrectly, the experimenter reminds him of how A and B looked initially when they were both laid out straight. "When this wire (A) was straight, how was it? Were they both the same length, at the beginning?" Finally, the experimenter draws his attention to the detours of A by running his finger along them: "Look what this one's like (A) and that one (B) is quite straight."

The experimenter then straightens A as it has been originally.

Second situation. The experimenter twists A such that when the two wires are laid out one below the other, A stops short of B.

The interview is conducted as for the first situation.

2. RESPONSES

Nonconservation (below Six to Seven Years)

These children give wrong answers to the conservation questions in both situations. In the first, they judge the two wires of equal length and in the second they think that A is shorter than B because it "doesn't go as far." Reminding them of the longer length of A, which they had observed in the presentation, does not lead them to change their answers.

Intermediate

Children at a first intermediate level give the correct answer in the first situation but not in the second. At a slightly higher level,

children can give some correct answers in the second situation, but they are not convinced and cannot give a full explanation for any correct answers.

Conservation (from Eight Years)

These children give correct answers in both situations and give one or more of the following reasons:

"It's as far to walk, you've just bent the wire" ("identity" argument).

"If you put this road straight like it was before, it's longer than the other one, so now, even if it stops where the other one stops, it's longer" ("reversibility" argument).

"It's this wire (A) which is longer, it stops before the other one, but it's got bumps and zigzags" ("compensation" argument).

Furthermore, these children stick to their correct answers even when the experimenter tries to make them change their minds.

Tube Rotation Task

Materials: Place hollow tube and the yellow, red, and green candies on the table.

Task Description

"Here is a hollow tube (look through it) and there are three candies (point) ... What colors are the candies? ... I am going to put the candies into the tube, and then I will ask you which one will come out first. Let's try it." (Insert candies through side A.)

"First, I put in the yellow one. Second, I put in the red one. And last, I put in the green one." (Do not rotate the tube, but tip it and make the candies slide down to the other side.)

"Now, which one will come out of this end first (point to side B)? ... Which one second? ... Which one last?"

"Let's try it again. This time I will do something different." (Insert candies through side A.)

"First, I put in the yellow one. Second, I put in the red one. And last, I put in the green one. Now watch carefully." (Rotate the tube 180 degrees.)

"Which one will come out first? ... Which one second? ... Which one last?"

Task Instructions for the Production Tests

Materials:

1. One ball, attached to a stick with a string.
2. One red ball, one yellow ball, and an inclined trough ten inches long.
3. One miniature toy dog and one miniature toy rabbit.
4. One miniature toy blue car and one miniature toy red car.
5. One girl puppet and one boy puppet.

10 action sequences as listed on page 13.

The experimenter places the task materials on the table and names them in the following manner, for example,

"Here is a ball, attached to a stick, with this string.

Now, it's your turn, what would you call this" and the experimenter points out the ball and then the stick.

The experimenter waits for the subject to identify the objects appropriately.

The experimenter then says, "Now I would like you to watch closely because I am going to do something with the ball and the stick, then I would like you to tell me about it."

The experimenter performs one of the action sequences appropriate to the task materials, and then says, "Tell me about it."

If the subject responds in the active voice, the following probe will be employed "Tell me about it in a different way - for example, tell me about the ____ ." (The experimenter refers to the <u>recipient</u> object of the subject's sentence.)

Prior to the actual testing, the experimenter will employ this procedure in a training trial with unrelated items to ensure that the subject understands the task directions. For example, "The hammer hit the peg."

Production Tasks

A. A ball hitting a stick.

B. A stick hitting a ball.

C. A red ball bumping a yellow ball.

D. A yellow ball bumping a yellow ball.

E. A cat chasing a dog.

F. A dog chasing a cat.

G. A red car smashing into a yellow car.

H. A yellow car smashing into a red car.

I. A girl puppet pushing a boy puppet.

J. A boy puppet pushing a girl puppet.

Counterbalancing Production Tasks

S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
A	B	C	D	E	F	G	H	I	J
B	C	D	E	F	G	H	I	J	A
C	C	E	F	G	H	I	J	A	B
D	E	F	G	H	I	J	A	B	C
E	F	G	H	I	J	A	B	C	D
F	G	H	I	J	A	B	C	D	E
G	H	E	J	A	B	C	D	E	F
H	E	J	A	B	C	D	E	F	G
I	J	A	B	C	D	E	F	G	H
J	A	B	C	D	E	F	G	H	I

Task Instructions for the Comprehension Tests

Materials:

1. One ball attached to a stick with a string.
2. One red ball, one yellow ball, and an inclined trough 10 inches in length.
3. One miniature toy rabbit and one miniature toy dog.
4. One miniature toy red car and one miniature toy blue car.
5. One boy puppet and one girl puppet.

20 stimulus sentences (10 active and 10 passive)

The experimenter places the task material on the table and names them in the following manner, for example, "Here is a ball, attached to a stick, with this string. Now, it's your turn, what would you call this," and the experimenter points out each item individually and waits for the subject to identify each object appropriately.

The experimenter then says, "Now you are going to do something with the ball and the stick.

I am going to say a sentence, then you are going to do what the sentence says.

Now, listen carefully, ..." (The experimenter says either an active or passive sentence as prescribed in the counterbalancing.)

Prior to the actual testing, the experimenter will employ the identical procedure with unrelated task items until the subject understands the task. For example, "The hammer hit the peg."

20 Comprehension Sentences

		Voice	Stimulus Sentence
A	1	Active	The ball hit the stick.
		Passive	The ball was hit by the stick.
	2	Active	The stick hit the ball.
		Passive	The stick was hit by the ball.
B	3	Active	The red ball hits the green ball.
		Passive	The red ball was hit by the green ball.
	4	Active	The green ball hit the red ball.
		Passive	The green ball was hit by the red ball.
C	5	Active	The cat chases the dog.
		Passive	The cat was chased by the dog.
	6	Active	The dog chases the cat.
		Passive	The dog was chased by the cat.
D	7	Active	The red car bumps the blue car.
		Passive	The red car was bumped by the blue car.
	8	Active	The blue car bumps the red car.
		Passive	The blue car was bumped by the red car.
E	9	Active	The girl puppet pushes the boy puppet.
		Passive	The girl puppet was pushed by the boy puppet.
	10	Active	The boy puppet pushes the girl puppet.
		Passive	The boy puppet was pushed by the girl puppet.

Counterbalancing Comprehension

1 - 10 - 10 situations with 2 sentences (1 active and 1 passive)

A - E (5 sets of reversible apparatus)

A -	1	-	A P
	2	-	A P
B -	3	-	P A
	4	-	P A
C -	5	-	A P
	6	-	P A
D -	7	-	P A
	8	-	P A
E -	9	-	A P
	10	-	A P

Order of Presentation of Counterbalanced

Comprehension Sentences

Subjects

S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
1	3	5	7	9	2	4	6	8	10
3	5	7	9	2	4	6	8	10	1
5	7	9	2	4	6	8	10	1	3
7	9	2	4	6	8	10	1	3	5
9	2	4	6	8	10	1	3	5	7
2	4	6	8	10	1	3	5	7	9
4	6	8	10	1	3	5	7	9	2
6	8	10	1	3	5	7	9	2	4
8	10	1	3	5	7	9	2	4	6
10	1	3	5	7	9	2	4	6	8

Task Instructions for the Identification Task

Materials:

5 sets of cartoons depicting reversible action sequences.[1]

20 stimulus sentences (10 active and 10 passive voice sentences)

The experimenter places one set of the cartoons on the table in front of the child.

The experimenter says "Here are two pictures that I would like you to look at. In this picture there is ..." (the experimenter names and identifies each object in each picture).

The experimenter then says "Now, it's your turn, what would you call this ..." (and points to each object in the pictures).

After the subject has correctly named and identified the objects in each picture, the experimenter will say,

"Now, I am going to say a sentence and you will pick out and give me the picture that this sentence talks about."

Prior to the actual testing itself, the experimenter will employ this procedure in a training trial, with unrelated task items to ensure that the subject understands the task directions.

---

[1] For purposes of counterbalancing, each cartoon pair was duplicated, with one set mounted on red paper and the other set mounted on black paper. The resulting ten pairs of cartoons were then counterbalanced across subjects such that the presentation of active and passive voice sentences of each pair were not in close proximity. The presentation of each cartoon's active and passive voice sentence was determined randomly on the scoring sheets prior to the interview.

Identification Tasks

	Cartoons		Verbal Stimulus	Sentence Voice
I.	The boy hit the ball. The ball hit the boy.	1.	The boy hit the ball.	Active
		2.	The boy was hit by the ball.	Passive
		3.	The ball hit the boy.	Active
		4.	The ball was hit by the boy.	Passive
II.	The dog chased the cat. The cat chased the dog.	1.	The dog chased the cat.	Active
		2.	The dog was chased by the cat.	Passive
		3.	The cat chased the dog.	Active
		4.	The cat was chased by the dog.	Passive
III.	The boy pushed the girl on the swing. The girl pushed the boy on the swing.	1.	The boy pushed the girl on the swing.	Active
		2.	The boy was pushed by the girl on the swing.	Passive
		3.	The girl pushed the boy on the swing.	Active
		4.	The girl was pushed by the boy on the swing.	Passive
IV.	The truck pulled the car. The car pulled the truck.	1.	The truck pulled the car.	Active
		2.	The truck was pulled by the car.	Passive
		3.	The car pulled the truck.	Active
		4.	The car was pulled by the truck.	Passive
V.	The girl splashed the boy.	1.	The girl splashed the boy.	Active
		2.	The girl was splashed by the boy.	Passive
		3.	The boy splashed the girl.	Active
		4.	The boy was splashed by the girl.	Passive

Oakenwald School
666 OAKENWALD AVE.
WINNIPEG, MANITOBA R3T 1M4
Principal
R. D. WILSON
Phone
452-8761

March 26, 1975.

Dear Parents:

Mrs. Margaret Malis, a graduate student at the University of Manitoba, has requested the opportunity to work with a random sample of thirty of our fifty-two students in Kindergarten and Grade One.

The thirty individual sessions, involving fifteen students from each room, will last approximately fifteen minutes each and will be administered on Monday, April 14 and Tuesday, April 15.

I have talked to Mrs. Malis and feel that her thesis work is well based and will be in no way an unpleasant experience for the children.

If you desire more information on this project, or would prefer your child not participate in the interview, please contact the office at your convenience.

Yours truly,

D. Wilson

D. Wilson,
Principal.

APPENDIX B

TABLE B.1

Number of Boys and Girls in Nonconserver,

Transitional Conserver, and Conserver Levels

COGNITIVE LEVEL

	N C		T C		C	
SEX	Kindergarten	Grade I	Kindergarten	Grade I	Kindergarten	Grade I
Boys	7	3	3	5	1	6
Girls	6	2	5	3	2	5
Total	13	5	8	8	3	11

TABLE B.2

Mean Ages of Boys and Girls at Nonconserver,

Transitional Conserver, and Conserver Levels

COGNITIVE LEVEL

	N C		T C		C		Total	
SEX	N	Mean Age (years)	N	Mean Age (years)	N	Mean Age (years)	N	Mean Age (years)
Boys	10	6.13	8	6.5	7	6.68	25	6.40
Girls	8	6.03	8	6.17	7	6.62	23	6.26
Total	18	6.09	16	6.33	14	6.65	48	6.34

TABLE B.3

Mean Conservation Scores of Boys and Girls at the Nonconserver, Transitional Conserver and Conserver Levels

COGNITIVE LEVEL

	N C		T C		C		Total	
SEX	N	Mean	N	Mean	N	Mean	N	Mean
Boys	10	0.3	8	3.50	7	5.71	25	2.84
Girls	8	0.25	8	2.75	7	5.26	23	2.65
Total	18	0.28	16	3.13	14	5.50	48	2.75

APPENDIX C

M. Malis Language Study: Active-Passive Voice

Subject _____ M F Birthdate _____ Date _____

1 Time _____

Task	Item	Response
C	The stick was hit by the ball. (T)	_____
P	(A boy puppet pushing a girl puppet.)	1. Tell _____ 2. Say _____ 3. "The girl puppet... _____
C	The red ball hit the green ball.	_____
P	(A ball is hitting a stick.)	1. Tell _____ 2. Say _____ 3. "The stick... _____
C	The rabbit was chased by the dog.	_____
P	(A stick is hitting a ball.)	1. Tell _____ 2. Say _____ 3. "The ball... _____
C	The red car bumps the blue car.	_____
P	(A red ball is bumping a green ball.)	1. Tell _____ 2. Say _____ 3. "The green ball... _____
C	The girl puppet was pushed by the boy puppet.	_____
P	(A green ball is bumping a red ball.)	1. Tell _____ 2. Say _____ 3. "The red ball... _____
C	The ball hit the stick. (T)	_____
P	(A rabbit is chasing a dog.)	1. Tell _____ 2. Say _____ 3. "The dog... _____
C	The green ball was hit by the red ball.	_____
P	(A dog is chasing a rabbit.)	1. Tell _____ 2. Say _____ 3. "The rabbit... _____
C	The dog chases the rabbit.	_____
P	(A red car is smashing into a blue car.)	1. Tell _____ 2. Say _____ 3. "The blue car... _____
C	The blue car was bumped by the red car.	_____
P	(A blue car is smashing into a red car.)	1. Tell _____ 2. Say _____ 3. "The red car... _____
C	The boy puppet pushes the girl puppet.	_____
P	(A girl puppet is pushing a boy puppet.)	1. Tell _____ 2. Say _____ 3. "The boy puppet... _____

M. Malis

Language Study: Active-Passive Voice

Identification Tasks

Subject _____ M F Birthdate _____ Date _____

Time _____

Set	L	R	Sentence	Response
D_1			The car was pulled by the truck.	_____
			The truck pulled the car.	_____
A			The boy hit the ball.	_____
			The ball was hit by the boy.	_____
B_1			The cat was chased by the dog.	_____
			The dog chased the cat.	_____
C_1			The boy (on the swing) was pushed by the girl.	_____
			The girl pushed the boy (on the swing).	_____
C			The boy pushed the girl (on the swing).	_____
			The girl (on the swing) was pushed by the boy.	_____
B			The cat chased the dog.	_____
			The dog was chased by the cat.	_____
E_1			The boy splashed the girl.	_____
			The girl splashed the boy.	_____
A_1			The boy was hit by the ball.	_____
			The ball hit the boy.	_____
D			The truck was pulled by the car.	_____
			The car pulled the truck.	_____
E			The girl was splashed by the boy.	_____
			The boy was splashed by the girl.	_____

Total Number Correct _____

Total Number Incorrect _____

APPENDIX D

Raw Data for Boys and Girls at the Conserver Level

Subjects N = 14	Age (months)	Total Piagetian Score = 6	Tube Rotation	Comprehension = 10		Production = 10				Identification = 20	
				Active Voice = 5	Passive Voice = 5	Active Voice	Sentence Pattern	C P	S P	Active Voice	Passive Voice
K M 6	74	6	C	5	5	9	0	0	1	7	9
I M 5	83	5	IN	5	4	2	0	8	0	10	10
I M 6	81	6	IN	5	5	2	2	8	0	8	5
I M 8	78	6	C	5	4	1	1	9	0	10	8
I M 9	76	5	C	5	5	0	0	10	0	9	9
I M 11	84	6	IN	5	4	0	0	8	2	10	10
I M 13	85	6	C	5	5	1	0	8	1	10	10
K F 5	68	6	C	4	5	9	2	1	0	10	10
K F 6	71	6	C	5	5	10	0	0	0	10	10
I F 1	85	6	C	4	4	3	1	6	1	10	9
I F 2	85	4	IN	5	4	3	0	7	0	9	10
I F 3	84	4	C	4	4	6	0	4	0	10	9
I F 5	86	6	IN	5	5	0	0	10	0	10	10
I F 8	79	5	C	5	5	10	0	0	0	10	8

I = Grade I

K = Kindergarten

M = Male

F = Female

The numbers used in the subject description indicates subjects' score sheet number which was derived from the counterbalancing.

C - indicates subject correctly carried out the tube rotation task, i.e., demonstrated reversible operations.

IN - indicates subject incorrectly carried out the tube rotation task, i.e., demonstrated nonreversible operations.

Sentence Pattern - refers to subjects' response discussed in the discussion and referred to as "sentence pattern."

C P - conceptual passive voice sentence.

S P - syntactical passive voice sentence.

Raw Data for Boys and Girls at the Transitional Conservation Level

Subjects	Age	Total Piagetian	Tube	Comprehension = 10		Production = 10				Identification = 20	
N = 16	(months)	Score = 6	Rotation	Active Voice = 5	Passive Voice = 5	Active Voice	Sentence Pattern	C P	S P	Active Voice	Passive Voice
K M 10	70	3	C	5	5	7	0	4	0	10	10
I M 2	85	3	IN	5	4	7	0	2	1	7	6
I M 4	76	3	IN	5	3	10	0	0	0	10	10
I M 12	75	3	IN	5	5	0	0	10	0	10	9
K M 9	75	4	IN	4	4	5	3	3	0	10	10
K M 11	73	4	IN	5	5	10	0	0	0	9	8
I M 1	86	4	IN	5	5	6	1	3	1	10	10
I M 3	84	4	IN	3	5	10	2	0	0	7	5
K F 2	65	2	IN	4	2	10	0	0	0	9	9
K F 3	65	3	IN	5	2	3	0	1	5	9	9
K F 7	69	3	IN	4	5	1	1	9	0	10	9
K F 8	70	2	IN	5	2	10	1	0	0	7	7
K F 12	69	2	IN	5	4	9	3	1	0	9	8
I F 10	85	2	IN	3	4	0	0	9	1	10	10
I F 4	86	4	C	3	3	10	8	0	0	9	9
I F 6	83	4	IN	5	5	10	3	0	1	10	9

Raw Data for Boys and Girls at the Nonconserver Level

Subjects N = 16	Age (months)	Total Piagetian Score = 6	Tube Rotation	Comprehension = 10		Production = 10				Identification = 20	
				Active Voice = 5	Passive Voice = 5	Active Voice	Sentence Pattern	C P	S P	Active Voice	Passive Voice
K M 2	71	1	IN	5	5	10	0	0	0	9	8
K M 3	71	0	IN	5	5	10	0	0	0	9	8
K M 4	68	0	IN	3	4	9	0	1	0	8	9
K M 5	71	0	IN	4	3	8	0	2	0	10	8
K M 7	74	0	IN	3	4	10	0	0	0	6	9
K M 8	73	0	IN	5	4	10	0	0	0	7	8
K M 12	68	0	IN	5	5	10	0	0	0	10	9
I M 7	79	1	C	5	4	9	3	1	0	10	6
I M 10	78	1	IN	4	3	9	1	1	0	8	8
I M 14	83	0	IN	5	4	10	1	0	0	10	10
K F 1	64	0	IN	4	4	10	0	0	0	8	8
K F 4	67	1	C	3	3	7	0	3	0	10	9
K F 9	74	0	IN	4	4	10	3	0	0	8	10
K F 10	72	0	IN	3	4	10	5	0	0	9	6
K F 11	71	0	IN	3	5	10	0	0	0	10	8
K F 13	68	0	IN	5	4	0	0	10	0	9	9
I F 7	79	1	C	5	4	10	0	0	0	9	9
I F 9	84	0	IN	5	5	10	0	0	0	10	9