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LANGUAGE AND COGNITION IN THE YOUNG CHILD.

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THE LITERATURE ON INTELLECTUAL DEVELOPMENT APPEARS TO ATTRIBUTE TO THE YOUNG CHILD A HIGH LEVEL OF LINGUISTIC DEVELOPMENT AND A RELATIVELY LOW LEVEL OF DEVELOPMENT IN OTHER COGNITIVE SPHERES. IN AN ATTEMPT TO RESOLVE THIS DISCREPANCY, THE AUTHOR ADVANCED THE HYPOTHESIS THAT THE DESCRIPTIONS OF LANGUAGE DEVELOPMENT ARE BASED ON AN ANALYSIS OF THE CHILD'S COMPETENCE AS IT IS REFLECTED IN OPTIMAL PERFORMANCE CONDITIONS, WHILE THE UNFAVORABLE DESCRIPTIONS OF HIS COGNITIVE DEVELOPMENT ARISE FROM EXPERIMENTS THAT PLACE OBSTACLES IN THE WAY OF THE ACTUALIZATION OF HIS COMPETENCE. IN GENERAL, IT WAS POSTULATED THAT IMMEDIATE STIMULI COMPETE FORCEFULLY WITH IDEATIONAL PROCESSES IN GUIDING THE CHILD'S BEHAVIOR. TWO EXPERIMENTS INVOLVING THE SINGULARITY-PLURALITY DICHOTOMY WERE CONDUCTED TO EXPLORE THE POSSIBILITY OF DEALING EXPERIMENTALLY WITH THIS PROBLEM. IN THE FIRST EXPERIMENT KINDERGARTEN CHILDREN HAD TO SORT OBJECTS ACCORDING TO THIS DICHOTOMY. THE CHILDREN PERFORMED BETTER ON A TASK WHERE SINGULARITY-PLURALITY WAS EXPRESSED IN TERMS OF SINGLE OR MULTIPLE OBJECTS THAN IN A TASK WHERE IT WAS EXPRESSED IN TERMS OF DUPLICATE FEATURES EMBEDDED IN AN OBJECT. THIS FINDING SUGGESTED THAT THE IMPOSING PRESENCE OF THE OBJECT AS A WHOLE INTERFERES WITH RESPONSES BASED ON THE CHARACTERISTICS OF ITS PARTS. THE SECOND EXPERIMENT TESTED THE PLURALIZATION RULES OF KINDERGARTEN CHILDREN USING NONSENSE SYLLABLES AS NAMES FOR CARTOON ANIMALS. (SEE RELATED DOCUMENTS ED 011 653 AND AL 000 829.) THE RESULTS INDICATED THAT RECOGNITION PROCEDURES CANNOT BE CONSIDERED AS MERELY MORE SENSITIVE TESTS OF THE SAME UNDERLYING COMPETENCE AS IS MEASURED BY PRODUCTION PROCEDURES, BUT MUST BE RECOGNIZED AS TAPPING DIFFERENT ASPECTS OF COMPETENCE. THIS PAPER WAS PRESENTED AT THE SYMPOSIUM ON THE PSYCHOLINGUISTIC NATURE OF THE READING PROCESS, WAYNE STATE UNIVERSITY, MAY 3-5, 1965. (DO)

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Language and Cognition in the Young Child

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This paper is concerned with a disparity between descriptions of linguistic and of cognitive functioning found in the developmental literature. Investigators agree that the young child has mastered a complex and highly abstract system of rules underlying language behavior. In contrast, descriptions of his other cognitive capabilities leave the impression of a rather limited and primitive level of development. It is hoped that an experimental attempt to resolve this "cognitive lag" can contribute to the understanding of the level of mental development of the child whom we teach to read.

Related Literature

An analysis of the lawfulness of language behavior has frequently led observers to conclusions similar to that reached by Whorf (1956, p.258) when he said:

> ... The higher mind deals in symbols that have no fixed reference to anything, but are like blank checks, to be filled in as required, that stand for "any value" of a given variable, like the x, y, z of algebra.

1/ The research reported herein was performed pursuant to a contract with the U.S. Department of Health, Education and Welfare, Office of Education.

Students of language who subscribed to the Watsonian behaviorist position (Watson, 1913) were reluctant, in explaining language, to ascribe to the "higher mind" any characteristics of function not found in the "lower mind." They attempted to explain phenomena of grammar in terms of the specific words that make up utterances, thus avoiding the postulation of abstract categories of the sort referred to by Whorf. According to the strict behaviorist view, the construction of a sentence can be understood as a chain of associations where the nth word is determined by the (n-1) word in the sequence. While it is true that associative processes play a role in the selection of words in speech, it is equally true that such processes have no hope of accounting for the phenomena of syntax. An expert speaker of English will perceive as grammatical the utterance "Colorless green ideas sleep furiously" even though its individual words are not likely to have been linked with each other in his past experience with the language (Chomsky, 1957). Any given word can occur in immediate temporal contiguity with more than one other word, which directly leads to the conclusion that words "can" have no intrinsic temporal 'valence' " (Lashley, 1951, p. 183). In speech grammatical order "must therefore be imposed upon the motor elements by some organization other than direct associative connections between them" (Lashley, 1951, p. 183).

It is clear now that any theory which endeavours to explain the generative aspect of language, i.e., the speaker's creative ability to produce and understand novel sentences, cannot operate on the level of words, or other elementary units of speech, but must postulate abstract

symbols or categories. The most elementary theories with serious claims of generative power are phrase structure grammars (Chomsky, 1957, ch. 4). In these grammars, sentences are described in terms of a hierarchical system of superordinate and subordinate categories. Such a system for a small fraction of English sentences might have the form depicted in Figure 1. On the top of the structure of categories is the Sentence

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Insert Figure 1 about here

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which branches out into a Noun Phrase and a Verb Phrase. The Noun Phrase in turn splits into an Article, an Adjective, and a Noun, and the Verb Phrase into a Verb and a Noun Phrase, and so on down to the word level. The defining criteria of these grammatical categories are by no means simple or immediately given in observed speech. Membership in the noun category, for instance, is not determined by commonality of sounds or by physical similarity of referents but rather by such extraneous features as "having plural and possessive inflections," "being preceded by articles," and by other privileges of occurrence (Francis, 1958, pp. 237-244). Examining the nature and complexity of these concepts, it must be acknowledged that anyone who has acquired grammatical categories has attained an intellectual achievement of the highest order. This achievement, however, is not restricted to an intellectual elite, but must be considered the minimum one has to grant any person, including the young child, who is able to produce and comprehend sentences he has not heard before. This is a minimum, because the transformational theory of language, originated by Chomsky (1957, 1965; for a nontechnical exposition, see

Postal, 1964), increases the degree of abstractness of mental operations required of the language user. In transformational theory, grammatical categories have the status of scientific hypothetical constructs; they are set up to facilitate the development of a generative system of rules. Individual words are assigned membership in the categories by consideration of the totality of their functions and behavior in the language rather than solely on the basis of environments of occurrence. The increased complexity introduced by transformational theory is not limited to linguistic categories; it is even more apparent in the transformational system of generative rules. These rules go far beyond the statements of prescribed order of grammatical categories for different types of sentences ordinarily found in grammar books. It can readily be shown that the order of categories in a sentence is not directly relevant to its interpretation. Active and passive sentences manifest different orders but are interpreted similarly. On the other hand two sentences may have the same order of grammatical categories and not necessarily be interpreted in parallel fashion. For instance, the phrases the growling of lions and the raising of flowers have an identical sequence of grammatical categories (article, verb, preposition, noun) but in one the noun is the agent of the action described by the verb (lions growl) and in the other it is the object (somebody raises flowers). To account for such divergent interpretations of seemingly similar utterances, transformational grammer postulates two levels of representation of sentences: a surface level which is close to, although not identical with, the sentence as it is heard or produced, and a deep level which contains an analysis of sentences into their component propositional content. For instance, the sentence the little boy hit the big ball, contains the propositions expressed by

(a) the boy was little (X), (b) the tall was big (Y), and (c) X hit Y. The combination of these three separate propositions into one sentence is accomplished by rules of transformation.

These few remarks about transformational theory should suffice to convey the level of mental operations entailed in language use. In view of the enormous intricacy and abstractness of the linguistic system revealed by transformational analysis, it is not surprising that workers in this framework have been tremendously impressed by the linguistic achievement of children. Lees (1960, p. xvi), for instance, has stated:

> Perhaps the most astounding aspect of human behavior... is the young child's ability to acquire in a short time, and with no special tuition, complete mastery of an immensely complex apparatus for constructing and understanding grammatical sentences.

Psychological work carried out in the spirit of uncovering children's generative rules of grammar (e.g., Braine, 1963; Brown and Fraser, 1963; Miller and Ervin, 1964; Menyuk, 1963) has generally supported the notion that the child's acquisition of language cannot be understood solely in terms of imitation and retention of utterances heard, for these processes could not account for the child's creative ability to use new but grammatically correct utterances. One has to assume that the child utilizes the linguistic data he receives from his speech community to abstract rules and regularities which in turn guide his productive use of language. Some writers have been so fascinated by the child's mastery of rules as to assert that "by the age of four a child's

grammatical rules differ negligibly from those of adults" (Ervin, 1963, p. 9). Others have applied similar assertions to an even lower age, as in the statement:

> ...almost all the basic syntactic structures used by adults that we have thus far been able to describe are found in the grammar of children as young as 2 years 10 months (Menyuk, 1963, p. 429).

The phenomenal achievements of the child in the linguistic sphere lead one to expect comparable achievements in other mental spheres. But the picture that emerges from descriptions of the child's cognitive capabilities is so primitive in comparison, that it seems hard to believe that the same child is being referred to in both cases. While the recent literature on child language is replete with positive statements relating to what the child can do, the literature describing child problem solving and concept formation is characterized by negative statements of what he cannot do. An insightful reviewer (Wallach, 1963) of the work of Piaget and his collaborators reaches the conclusion that the cognitive development of the child is slow and far from the adult level even at the age of seven. This conclusion can perhaps be best demonstrated by reference to the "conservation" experiments of the Geneva school. Conservation refers to a perception of invariance of object qualities in face of irrelevant transformations. The conservation studies revealed the difficulties children face in conserving quantity, weight, volume, length, area, number, and other properties. In a typical study of conservation of quantity, a child would be shown two equal-sized beakers filled with water to the same

level. The water of one beaker would then be poured, in the sight of the child, into another, narrower or wider, container. In this situation the preschool child will usually say that the amount of water to drink in the new beaker is not equal to that in the one that remained filled.

A similar view of the crude level of intellectual development of the preschool child arises from Vigotsky's (1962) reports of children's modes of categorizing. He found that in object grouping tasks, young children tended to form complexes and pseudo-concepts rather than genuine analytic concepts. Overall similarity and momentary impressions played a greater role in their performance than commonalities of features. And yet the same child can form and manipulate the high-level analytic categories of language.

Another example of the uneveness in the child's cognitive functioning appears when his skills in the use of his natural language are compared with his behavior in experimental situations involving language. While the preschool child uses language in a way that implies categorization of words with respect to part of speech and he can learn quite readily the class membership of new words (Brown, 1957), he does not frequently employ these grammatical categories in free association tasks. When a child is presented with a stimulus word and asked to respond with the first other word that comes to his mind, he will characteristically produce a response that bears a sequential relation to the stimulus (e.g., nice-doll) in contrast to adults who frequently give responses that belong to the same grammatical category as the stimuli (Brown and Berko, 1960; Ervin, 1961).

The discrepancy between what the child can do and what he actually

does in the free association task points to the possibility that certain experimentally induced behaviors underestimate the child's capabilities. If all we knew about the child's language was based on his responses in free association tasks, we would have no reason to assume that he possessed grammatical categories. But since his normal use of natural language makes the postulation of such categories unavoidable, the reasons for failure to exhibit them in the free association task must be sought in the child's interpretation of the instructions or in the interfering effects of other factors. The general lesson to be gained from this is that when a child does not do something it is not always safe to infer that he cannot do it. The importance of distinguishing between observed performance and inferred mental competence was only recently brought to the fore (Chomsky, 1964) with regard to the study of language, but it parallels the standard psychological distinction between performance and learning (e.g., Hilgard, 1956, pp. 4-5). It thus appears that any experimental manipulation of the child's behavior that does not provide optimal conditions for the manifestation of the particular conceptual abilities searched for should be suspected of underestimating the child's cognitive competence.

This guideline leads one to question interpretations of the Piaget studies that deprive the child of the possession of the logical rule of conservation. In fact, a variation on the Geneva procedure (Bruner, 1964) suggests an interpretation more favorable to the child. In the procedure reported by Bruner, the new beaker was covered from the child's view while he watched the pouring operation. When this design was employed preschool children rarely failed to state that the two beakers contained the same

amount of water "because you just poured." But if following this the screen were removed, many five year old children would change their minds and insist that the two beakers could not contain the same amount of water because the water came to different levels. It thus appears that the child does have the relevant logical rules, but when their dictates conflict with the tendencies induced by momentary stimuli, the latter win out. Piaget (1965) himself also believes that preschool children do possess the logical concept of invariance and attributes the observed nonconservation to the children's inability to reconcile the logical rule with the contradictory perceptual evidence. Only when the child can coordinate height and diameter and recognizes that an increase in one dimension compensates for a decrease in the other will he be guided by the logic of invariance and ignore the seemingly contradictory appearance. Thus it is the child's difficulty in explaining the facts of appearance rather than lack of logic that is responsible for his nonconservation responses.

Vigotsky's studies can be interpreted in a similar fashion. In what Vigotsky called a chain complex the child puts together a green triangle with a blue triangle and then adds to it a circular blue block. This manner of grouping does not necessarily reflect an inability on the part of the child to group according to features abstracted from the whole, but may rather be due to his difficulty in staying under the control of a constant basis of classification in the face of varying constellations of stimuli. Thus, in the example mentioned, the child first classifies by shape (triangles together) and then switches to another attribute momentarily more prominent, but in both cases he uses abstracted features as bases for grouping.

More evidence can be adduced, especially from the work reported

by Luria (1961), to support the general proposition that, in guiding the child's behavior, ideational processes (rules, plans, sets, etc.) have to contend with heavy competition from immediate internal and external stimuli, which continually change and demand the child's attention and response.

Objectives for Research

Our general hypothesis then asserts that the behavior of the young child is governed more intensely by immediate sensory input than by ideational processes such as sets, plans, and rules. With the aid of this hypothesis, it is possible to grant the child the possession of the necessary competence for successful performance on such tasks as conservation and object grouping, and to attribute his failure to fully manifest this competence to the power of momentary stimuli.

Assuming this interpretation to be valid, the question arises whether the child's linguistic competence is subject to similar limitations. Could linguistic rules withstand interfering effects from immediate stimuli or would they also give in?

In order to answer this question, it is necessary to examine the realization of linguistic and other cognitive rules in a wide range of situations including some with minimal interference from environmental stimuli and some with more interference, and to observe how different rules react to the various situations. Such research would provide evidence relevant to our general hypothesis and yield suggestions for resolving the observed discrepancy between linguistic and cognitive development. This discrepancy can be resolved in one of two ways: (a) by assuming that the discrepancy is only apparent and due to an underestimation

of the level of cognitive development of young children and/or to an overestimation of their linguistic development, (b) or by granting that there is a real difference and providing a justification for it. Although we favor the first alternative as a working hypothesis, the latter can not be completely discounted. For if linguistic development turns out to be truly ahead of other cognitive functions, this could be explained by assuming either that language is relatively autogenous and not as dependent on environmental nourishment as other systems, or that a greater supply of environmental input is available for linguistic growth, since children are exposed to language for a large portion of their waking hours.

Let me now sketch briefly two experiments inspired by these considerations. These experiments do not answer the questions raised here, but I believe that they provide the kind of information about the child's mental capacities that is needed before such answers are attempted.

It was decided to start the program with an investigation of the concept of singularity-plurality, since tasks for studying both the linguistic aspect and the conceptual aspect of this dichotomy could be quite readily designed. Our interest lies in assessing whether preschool children have the concept of "one vs. more than one" and in the nature of their morphological rules for distinguishing between singular and plural nouns.

Our procedure for testing concept formation departed from the standard design used in such tasks. In standard concept formation experiments, the child is required to find out through trial and error what differences among the stimulus items were chosen by the experimenter as relevant for the particular task at hand. To put it crudely, the child has to guess

what the experimenter has in mind. In contrast to this method, we tried to make it clear to the child what the relevant distinguishing feature was and then tested his ability to be guided by this feature in his responses to new instances.

The concept formation experiments, carried out by Eileen Studd for her honor's thesis, were designed to explore the validity of our theoretical and methodological approach. They were only preliminary in nature, and one experiment will suffice to convey the flavor of the method and results. Twenty-four kindergarten pupils ranging in age from 5 years 3 months to 6 years 6 months from an English speaking public school in Montreal participated in the experiemnt. The subjects' task was to sort pictures of everyday-life objects, drawn on cards, according to the singularity-plurality dichotomy. There were 20 pairs of cards. One member of each pair was a singular item and the other a plural item. In 10 pairs, to be referred to as the Non-Embedded stimuli, the singular card depicted a single object and the plural card two or more exemplars of the same object. For instance, in one pair the singular card depicted one tree and the plural card four trees, in another pair, one card showed a single car and the other two cars. Size of objects was varied so that within any pair the space occupied by the singular picture would sometimes be equal to or larger than that of the plural picture. This was done to avoid confounding number with mass. In the other 10 pairs, to be referred to as the Embedded stimuli, plurality was represented by number of features in an object rather than by number of objects. Examples: (a) a singular picture showed an ice-cream cone with one scoop of ice-cream and its plural counterpart

an ice-cream cone with two scoops, (b) another pair contrasted a one-pane window with a 16-pane window, (c) in a third pair the singular card depicted three rings with one stone each and the plural card three rings with two stones each. Thus, in the Embedded pictures the relevant and varying attribute was the number of multiple features rather than number of objects; the number of objects was the same for both the singular and the plural cards. Five of the Embedded pairs had a single object on both the singular and the plural cards and the other five pairs had more than one object on both cards.

By way of introducing the child to the task, the experimenter showed him a pair of cards and placed the singular card on one side of the table and the plural card on the other side. After several examples, the child was asked to take over. He was informed after each sorting whether his response was correct or not and the next pair was handed to him. The subject proceeded in this way through all 20 pairs, arranged in random order.

There was virtually no difference between the five one-object pairs and the five more-than-one object pairs. Both kinds of Embedded stimuli were therefore pooled for the comparison with the Non-Embedded stimuli. This comparison revealed that the mean number of correct responses for the Non-Embedded stimuli was 7.38 and for the Embedded stimuli 5.92. The t value (2.58) for the difference between these two means is significant beyond the .02 level. Classification by a feature constituting part of an object thus appears to be harder than by the object as a whole. Although this finding can perhaps bear alternative interpretations, it seems to be

favorable to the stimulus-binding hypothesis. When a card depicts one object, the unity of the object seems to cause the child difficulty in classifying by the multiplicity of its features. Similarly, the presence of several objects on a card seems to impress plurality on the child and interferes with its classification as singular on the basis of the oneness of the feature. In other words, it is assumed that the total configuration of a familiar object competes with its classification on the basis of partial characteristics.

Results are also available concerning the linguistic aspects of singularity-plurality from studies conducted by Dick Tucker for his master's thesis. The standard rules of English provide three allomorphs for plurality: /s/ for words ending in unvoiced phonemes, /z/ for words ending in voiced phonemes, and /iz/ for words ending in sibilants and affricates, both voiced and unvoiced. Berko (1958) studied these rules in preschool children by assigning a nonsense name to a singular animal-drawing and asking the child to provide the plural form for two instances of the same referent. She found that while the percentage of errors did not exceed 42 for names requiring a /z/ ending, it went as high as 86 for those requiring /iz/. Tucker replicated Berko's production task and added to it a recognition task in the hope that the two together might reveal more about the child's competence than either one alone. (Actually, each child had either three production or three recognition tasks, but only one of each type will be discussed here.) In all, 36 kindergarten pupils from an English speaking school in Montreal participated in the experiment. Their mean age was 5 years 11 months. Half of the Ss were tested on a Production task and half

on a Recognition task. The Production task followed Berko's procedure, in main outline. It employed 12 nonsense syllables of the CVC shape as names for animals. In half of the items, the experimenter assigned a name to a single animal and requested the child to name several animals, and in the other half of the items, the child was provided with the name for several animals and requested to name a single animal. In the Recognition task, the child was shown 12 pictures, six depicting a single animal and six a plural number of animals. For each picture the child was asked to choose the best of two names suggested by the experimenter, one singular (e.g., Pesh) and the other plural (e.g., Peshes). The nonsense names for both the Production and Recognition tasks were so chosen that four required an /s/ for pluralization, four a /z/, and four a /ɨz/. The Ss had therefore an equal opportunity to err with each of the allomorphs on each task. The distribution of the errors they actually made on the average is as follows:

	/s/	/z/	/ɨz/	Total
Production	.61	.44	1.51	2.56
Recognition	.78	.34	.66	1.78

On each row, the values joined by lines differ from each other beyond the .01 level of confidence; the other comparisons are not significant. The total Recognition score does not differ significantly from the total Production score (t = 1.29), but, as can be seen in the table, the patterns of errors for the two tasks do differ. In Production, /s/ and /z/ are easier than /ɨz/, but in Recognition, /z/ is easier than the other two. The greater difficulty of /ɨz/ in Production is in accord with Berko's findings and can readily be explained by the smaller frequency of this form in the child's

everyday experience with English. The ease of /z/ in Recognition, however, seems to reflect an aspect of the child's competence not expressible in Production. English appears to have very few words ending in /consonant + z/ which are not plurals. Also, /z/ is more frequently used to mark plurality than the other suffixes. It is suggested that in the Recognition task, children drew on these characteristics of English and therefore performed better in the choice involving /z/ than in the other choices.

Summary

The literature on intellectual development appears to attribute to the child a high level of linguistic development and relatively low level of development in other cognitive spheres. Even the preschool child is credited with a very abstract and complex linguistic system which is not essentially different from that of the adult. Yet on such tasks as conservation and object grouping, he is thought to function at a considerably lower and qualitatively different level than the adult.

In an attempt to resolve this discrepancy, a hypothesis was advanced that the descriptions of language development are based on an analysis of the child's competence as it is reflected in optimal performance conditions, while the unfavorable descriptions of his cognitive development arise from experiments that place obstacles in the way of the actualization of his competence. The immediate stimuli the child has to deal with were hypothesized to constitute the major factor interfering with the child's manifestation of his competence. In general, it was postulated that immediate stimuli compete forcefully with ideational processes in guiding the child's behavior.

To explore the possibility of dealing experimentally with this problem, we conducted two experiments involving the singularity-plurality dichotomy. In the first experiment children had to sort objects according to this dichotomy. The children performed better on a task where singularity-plurality was expressed in terms of objects than in a task where it was expressed in terms of number of duplicate features embedded in an object. This finding suggested that the imposing presence of the object as a whole interferes with responses based on the characteristics of its parts.

Another experiment tested the pluralization rules of kindergarten pupils using nonsense CVC syllables as names for cartoon animals. It was found that in a Production task where they were given either a singular name and requested to produce its plural counterpart or vice versa, the children made significantly more errors with names pluralized by addition of /ɨz/ than with names having /s/ and /z/ as plural suffixes. But in a Recognition task where the task was to decide which of two names was singular and which was plural, Ss made fewer errors in choosing as plurals the names ending in /z/ than the names ending in /s/ or in /ɨz/. This was taken as an indication that the children abstracted the generalization that in English a noun ending in /consonant + z/ is much more likely to be plural than singular. This is so: (a) because there are very few singular nouns having this ending, and (b) because /z/ is the most common allomorph of plurality. There is no way children could reveal this knowledge in the Production task. In this case therefore, Recognition procedures cannot be considered as merely more sensitive tests of the same underlying competence as is measured by Production procedures, but must be recognized as tapping different aspects of competence.

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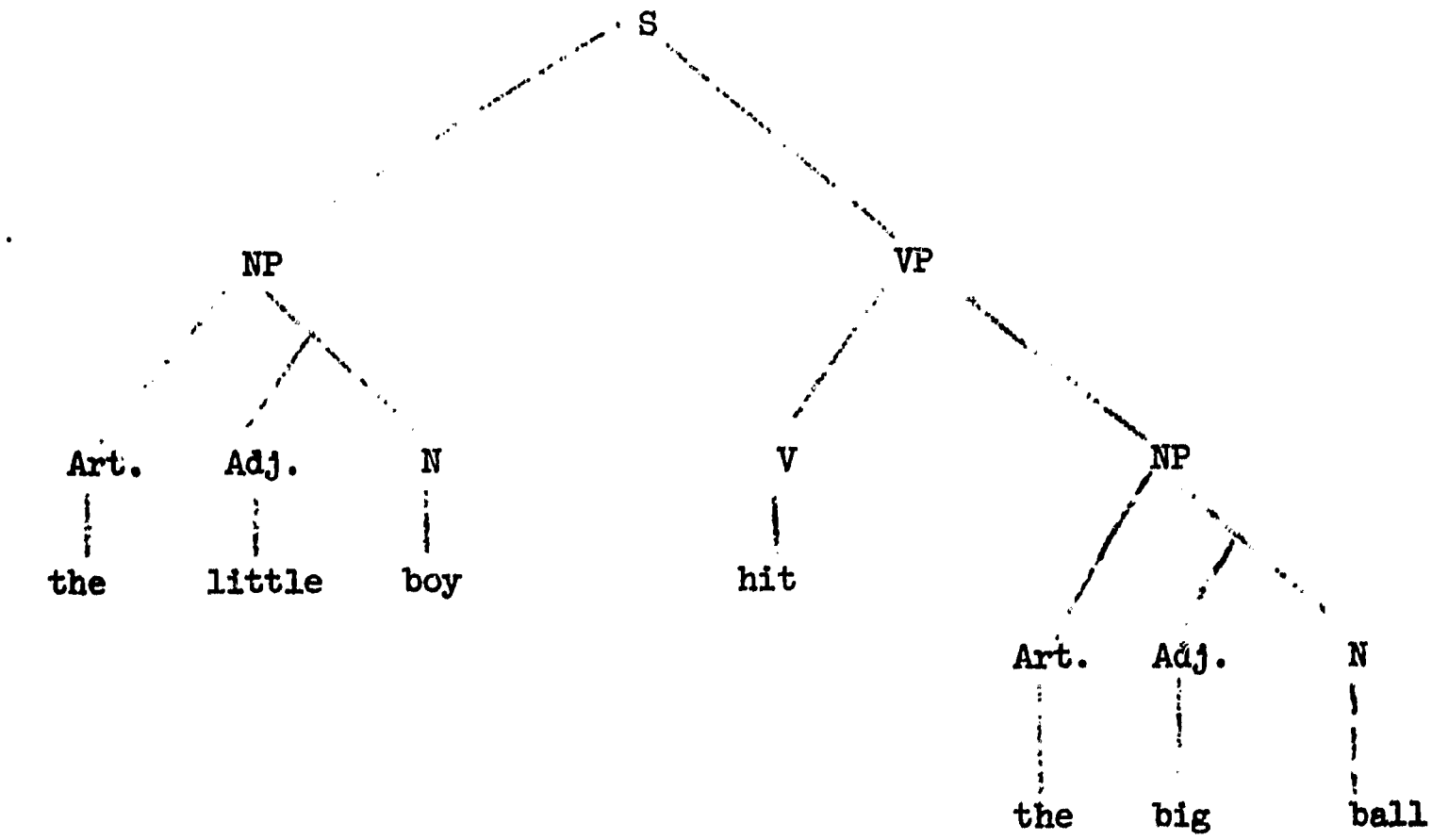

Figure 1. Tree diagram of the sentence: The little boy hit the big ball.