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ABSTRACT

This paper examines whether language development can be understood epigenetically in the same manner and based on the same principles with which Piaget has analyzed intellectual-cognitive development generally. The study is subdivided into four parts: (1) some principles in Piaget's system (the epigenetic principle, the genetic circle, and the decalage concept) are discussed in relation to language development; (2) the basic psychological functions of Piaget's theory are briefly summarized in their relationship to both cognitive and linguistic development; (3) the concept of structures or schemes as described by Piaget are examined with regard to their relevance to linguistic structures; and (4) the preverbal development of several classes of contents or concepts and their early verbal equivalents are explored. Close parallels are demonstrated between aspects of cognitive development theory and the independently established principles of language development. Since the phenomena of cognitive development appears prior to language acquisition, and since close analogies between both developments are evident, it is concluded that the prior cognitive acquisitions form the bases and molds for later linguistic advances. (Author/CS)

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Piaget's Research as Applied to the Explanation of Language Development[1]

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Abstract

Four aspects of Piaget's theory are discussed in their relevance to first language acquisition. They are: His most general principles, the primordial and at the same time invariant functions, the early established structures or schemes, and the preverbal development of concepts. Close parallels between these aspects of cognitive development and the independently established principles of language development are demonstrated. Since the phenomena of cognitive development appear prior to language acquisition, and since close analogies between both developments are evident, it is concluded, that the prior cognitive acquisitions form the bases and molds for the later appearing linguistic advances.

Piaget's Research as Applied to the
Explanation of Language Development

The Goal of the Study

The goal of this paper is to examine whether language development can be understood epigenetically in the same manner and based upon the same principles with which Piaget has analyzed intellectual-cognitive development generally. Certain aspects of Piaget's description of cognitive development will be compared with those facts and theoretical interpretations of language development to which his theory appears relevant. It is not implied that only Piaget's system could serve as a basis for the explanation of language development or that his theory can account for all facets of it. Since language is dependent upon and involved in so many psychological functions, almost all of the established physiological-psychological knowledge will have to be applied to account for it fully. A more encompassing eclectic account of language acquisition, including behavior genetic and learning theoretical perspectives, has been provided by Moerk (in preparation). Since Piaget's theory combines a pervasive epigenetic outlook with a detailed and encompassing description of behavioral evidence, it appears to supply a very promising basis for a causal-genetic explanation of language development.

The antecedents that were chosen for discussion were described by Piaget as the most profound ones, underlying all cognitive behavior and therefore also language behavior. Three rules guided the inclusion of specific cognitive principles as possible antecedents of language forms or functions. 1. The cognitive principle had to appear prior to the linguistic phenomenon. 2. The entire structure as well as its elmements had to be analogous in both domains. 3. The antecedent principle had to fulfill either the same or a closely related function.

Two similar endeavors can be found in the literature (Sinclair-de-Zwart, 1969; Sinclair, 1971). The present analysis overlaps only in very few of its basic points with these two papers. It is, therefore, advisable to compare the latter with the present article as well as a previous paper of Moerk (1973), in order to get a broader perspective of the complex problem of language and cognition.

The study is subdivided into four parts: First, some basic principles in Piaget's system will be discussed in their relation to language development. Next, it will be analyzed how the functions underlying general cognitive development could also serve as tools for language development. Then, the concept of structures or schemes as described by Piaget will be examined with regard to its relevance to linguistic structures. Finally, the preverbal development of several classes of contents or concepts and their early verbal equivalents will be explored.

Basic Principles in Piaget's System which are Relevant for Language Development

Piaget (1963, 1970) has expressed several times that he believes language to develop epigenetically from early cognitive bases, but he has never spelled out in detail the connections between early cognition and later language. The general derivation of language from cognition can best be demonstrated by means of a brief discussion of the epigenetic principle, as expounded by Piaget.

The Epigenetic Principle

One formulation (Piaget, 1957) as translated by Flavell (1963, p. 83) contains the most important points of this principle: "In short no structure is ever radically new, but each one is limited to generalizing this or that form of action abstracted from the preceding one." Three main axioms are expressed with this formulation. They have a profound bearing on the understanding of language structures: 1. If "no structure is radically new" then it has to be possible to find antecedents for linguistic structures too. 2. Abstraction leads from early primitive to later advanced structures. With this formulation a mechanism for the translation from non-linguistic to linguistic structures as well as from primitive linguistic structures to advanced structures is postulated. 3. Because of its abstract quality, the form or structure can be generalized to new contents. Productivity or generativity of behavior is a consequence of this principle of generalization. A specification of the types of underlying structures is provided in another statement of Piaget (1954, p. 141): "Operations are nothing but interiorized actions . . ." Accordingly the development of cognitive as well as verbal structures proceeds from motor behavior.

With these statements Piaget has described the development of cognitive operations generally. Similar principles have been independently postulated by other authors (Braine, 1963, 1971; Jenkins and Palermo, 1964; Werner and Kaplan, 1963) as bases of language acquisition. By means of distancing, through generalization, or by abstracting from concrete instances, the child establishes classes of 'signs' or 'symbols', as well as a variety of abstract 'sentence frames' or 'deep structures'. However, Braine (1963) with his principle of 'contextual generalization' and similarly Jenkins and Palermo (1964) remain restricted to the linguistic channel. In contrast, Piaget's approach makes it possible to trace the evolution of sentence structures from nonverbal behavioral and meaningful foundations. This stress upon the developmental continuity of meaningful structures across different channels of expression introduces a new perspective into psycholinguistic research. It far surpasses in explanatory power theories which rely solely upon linguistic 'position learning' or the establishment of 'verbal equivalence classes.' Piaget's approach, consequently, suggests that the principle of productivity transcends language and that even the first linguistic forms are a product of this productivity. The dilemma, how base structures, to which the child is never exposed, could be learned (Bever, Fodor, and Weksel, 1965; Braine, 1965), is avoided with this postulate, since linguistic base structures are derived directly from or identical with nonverbal base structures.

Several other overall developmental principles in Piaget's theory will be touched upon briefly because of their general significance, although all their implications cannot yet be analyzed.

The Genetic Circle

This concept indicates how assimilation leads to schemes and how schemes in their turn lead to renewed assimilation which again results in new schemes. When applied to language acquisition, preverbal schemes would form the bases for the establishment of verbal schemes, and early incorporated verbal schemes would then again lead to the assimilation of new and more complex linguistic and perhaps even cognitive schemes.

Horizontal and Vertical Décalage

The concept of décalage refers to the fact that functions or structures are not immediately applied to all tasks, i.e., horizontal decalage, or that formally similar structures emerge at varying levels of development, i.e., vertical decalage. The appearance of the symbolic function first in preverbal behavior and only later in verbal behavior, the recognition of the arbitrary connection between signifier and significate first in the symbolic play of pretending and only much later in the realm of language, or the fact that structures are formed first preverbally and then verbally, would be instances of vertical decalage. Even when the symbolic function is established in the realm of verbal behavior, not all messages are encoded immediately and completely in verbal forms. Objects, actions, and a few qualifying characteristics, i.e., perceptually distinct aspects of experience, are encoded earlier than relational and continuous aspects, though the latter are incorporated behaviorally. Seen from a grammatical perspective, contentives are generally encoded before functors. These two phenomena are examples of horizontal decalage in the applications of a cognitive structure that leads to digital encoding.

Functional Antecedents of Verbal Behavior

One of the most basic functions of all living organisms is that of information exchange with the environment. Piaget has stressed both aspects of this exchange for all periods of life: The intake of information, leading to accomodation; and the application of stored information, the schemes, when the child tries to assimilate new experiences. He refers to these two aspects as 'functional invariants', i.e., they remain constant in spite of the child's progress through the stages of development. These principles consequently also operate during the periods of language acquisition and language use. Exactly how they function will be sketched out in the sections to follow.

Assimilation

Piaget defines assimilation as the tendency of the organism to incorporate environmental givens into his system of established schemas. Four specific subtypes of this general principle of assimilation are differentiated: Generalizing, Reciprocal, Reproductive, and Recognitory Assimilation. It will be attempted to demonstrate how each of these processes is involved in language acquisition and language behavior.

Generalizing assimilation. Piaget (1952, p. 13) calls generalizing assimilation "an instrument for incorporating reality 'aliments'." A potentially infinite number of environmental phenomena is handled with a restricted set of schemes.

In early language behavior, infants overgeneralize their established sound patterns and substitute their babbling sounds in words which they imitate from adult models. A similar tendency to overgeneralize the first 'words', i.e. to overexpand their meaning has been repeatedly described by developmental psychologists (Lewis, 1951; Piaget, 1951, Valentine, 1942). Moerk and Wong (in press) have attempted to demonstrate how even the very first sentences result from an assimilation of the linguistic medium to preverbal structures. The same phenomenon, i.e., the application of a few syntactic frames to a wide variety of contents, has been especially stressed in the writings of developmental psycholinguists. In the two- and three-word stages, children often use the same syntactical constructions to express various contents. Bloom's (1970) discussion of the various meanings 'Mommy sock' can have, is probably the best-known example of this principle.

Reciprocal assimilation. Reciprocal assimilation is of great importance for language in the form of crossmodal associations between various sensory modalities. The combination and integration of various sensory systems has of necessity to lead to the abstraction from specific sensory modalities in the establishment of concepts.

This principle of crossmodal association has been stressed in the discussion of the roots of language and it has been asserted (Gerschwind, 1965) that a high ability to associate crossmodally may be species specific for mankind and it may be the decisive characteristic which leads to language in man. Generally, the development of 'meaning' and 'reference' is based upon, though not fully explained by, crossmodal associations. The integration of features leads to concepts and the association of concepts and labels is the basis of reference.

Reproductive assimilation. With the process of reproductive assimilation the progressive aspect of assimilation is stressed, since it leads to the secure mastery of adventitious new acquisitions. Piaget describes herewith the fact that a newly performed act is repeated over many trials.

This reproductive assimilation has been excellently exemplified, albeit with different labels, in connection with the babbling and the early monologic language games of the preschool child (Weir, 1962). Repetitiveness as an 'outstanding characteristic of child talk' has recently again been stressed by Nelson (1973). The preschool child's 'compulsion' to hear nursery rhymes over and over again and even the grade-school child's pleasure in the repetition of verbal games and rhymes have been commonly observed and reported.

Recognitory assimilation. Piaget has extensively discussed the principle of recognitory assimilation and its relation to the development of 'meaning' (Piaget, 1952, 185-194). The first instances of this phenomenon can already be observed in the reflex stage: Sound patterns are soon recognized in their function as signifiers of events. Yet only in stage 3 (4-8 mos.), with the appearance of abbreviated acts of 'motor recognition', does recognitory assimilation bring about a change from a primitive stimulus-response fit to a stimulus-contemplation relationship. Through an intervening process of distancing the signifier is not a "signal" anymore but gradually becomes a "symbol" and later a "sign."

It is no coincidence that the infant at almost the same age becomes able to use gestures and to respond to them in intentional communication. While Buhler and Hetzer (1935) recorded gestural communication from six months on, Cattell (1940) has stressed that it appears latest at the age of nine months. According to these findings, gestural communication begins during the middle or end of the third sensori-motor stage. The extensive literature on gesture language suggests that the gestures of 'abbreviated motor acts' and those of gestural communication are related not only in time of appearance but also functionally and developmentally.

It is commonly reported that the infant begins comprehending not only communicative gestures but also verbal communications at the age of seven to nine months (Menyuk, 1971). Even if it is not yet proven, it is probable that the understanding of verbal messages is closely related to the earlier appearing interpretation of sound complexes as signals of interesting events. In his exploration of recognitory assimilation, Piaget has, consequently, made two important contributions: He has demonstrated how comprehension and production of gestural messages develops and he has analyzed, even if somewhat implicitly, how both forms of language, gestural and vocal language, evolve from more primitive roots.

Accomodation

While the more conservative, stable aspect of functioning is expressed with the concept of 'assimilation', 'accommodation' represents the progressive environment-adjusted aspect. It is, therefore, closely related to the concept of learning, although it is not identical with learning, as Piaget has repeatedly stressed. By means of the function of accomodation, mental structures, i.e., the child's own contribution to an experience, are adjusted to the structures of reality, i.e., to influences from the environment. Normally a delicate balance or equilibrium between both processes, assimilation and accomodation, is approximated through gradual equilibration. Many contributions of accommodation to language development will, therefore, more conveniently be discussed in the section on equilibration and equilibrium.

The function of the more extreme form of accommodation, i.e., imitation, will be briefly touched upon here. Accommodation as imitation supplies the child with his first conventional signifiers, such as intonation patterns, gestures, and words. Three aspects of this imitative accommodation appear to be relevant for language acquisition. First and most important of all, is its contribution to the development of the symbolizing function. Besides the above discussed phenomenon of recognitory assimilation, deferred imitation is involved in the earliest recorded examples of symbolizing. Secondly, the infant relies heavily upon imitation in the acquisition of language-specific intonation features and vocabularly items. Finally, it is evident that the child gradually adapts his word and sentence schemes to those of the model language. That these and other achievements are attained only gradually, in a continuous interplay between assimilation and accommodation, is stressed by Piaget in his notion of equilibration and equilibrium. Developmental psycholinguists (Leopold, 1939; Slobin, 1968) have demonstrated that language acquisition too is not a simple process of imitation, but that the child often applies rules he has abstracted to new instances. This can result in the production of utterances he has never heard before.

Equilibration and Equilibrium

Equilibration and its end-state equilibrium are perhaps the most innovative and far-ranging principles in Piaget's system. Especially the differentiation of the equilibration process from the learning process may be helpful in clarifying old controversies in the field of developmental psycholinguistics. The complex concepts of equilibration have been extensively discussed by Piaget, Flavell (1963), and Furth (1969): Learning is passive and merely receptive; equilibration presupposes an active organism that contributes its own structures. Learning refers to the acquisition of specific contents; equilibration leads to generalizable forms which are applicable to a multitude of specific contents. Piaget (1959) as translated by Furth (1969, p. 237) tries to clarify this distinction with the following statement: "In fact if everything in the acquisition of logical structures is not 'learned' (in the strict sense), that which is acquired but not learned in these structures (in which the innate seems to play only a negligible role) can only derive from a process of equilibration." This differentiation between form and content or between equilibration and learning, may be one pertinent answer to the contestations of Chomsky, McNeill and others, that the 'deep structures' of language cannot be learned from the models which the child observes. According to the thinking of Piaget, one would agree: Since they are abstract structures, they are not learned but constructed by the child who integrates his own structures with new input; i.e., they are acquired by means of the equilibration process. They would then, however, not be innate either; contrary to the speculations of Chomsky and his followers.

Specific equilibration processes can be observed on all levels of language acquisition. On the phonetic level, a creative tension between the monotonous repetition of specific, probably innate sound patterns and the attempts to imitate the models provided by adults leads gradually to an equilibrium. This is expressed in the attainment of the sound system of the model language, while idiosyncrasies of enunciation are retained. On the semantic level, the progressive oscillations of children in their delimitation of specific concepts has often been demonstrated. One of the best recorded instances is found in Lewis (1963, p. 51) and concerns the differentiation of the concept "dog" from that of other quadrupeds. On the grammatical level, the initially almost complete omission of functors, the subsequent overgeneralization of rules to irregular forms, and finally the attainment of the correct grammatical system again betoken that equilibration processes lead slowly to an equilibrium. The overgeneralizations as well as the differential speed with which various facets of languages are learned (Slobin, 1973) suggest that acquisition proceeds quickly, whenever it can be based upon equilibration, leading to broad rules. By comparison, it proceeds slowly if it is only based upon rote learning. Base structures, being fully formed through equilibration, are, therefore, acquired and produced most rapidly (Bowerman, 1973; McNeill, 1966). Rules which are language specific but based upon logical structures, such as the singular-plural distinction or some spatial differentiations, are mastered next. Irregular exceptions to rules or other arbitrary phenomena have to be learned by rote and are mastered only slowly. The latter phenomena can probably best be accounted for by classical learning theory.

Transformations

Piaget strongly emphasizes the basic contribution of transformation to all cognitive functioning. In his recent book, Genetic Epistemology (1970), he asserts that even the most elementary knowledge is based upon transformations. In the course of cognitive development, the infant transforms variable surface structures into more stable and universal base structures or schemes. These schemes, once established, provide the basis for a potentially infinite number of external acts. Transformations, consequently, proceed in two directions: From the surface to the deep structure, as well as from the deep to the surface structure. While transformational grammarians only use the first type of transformation to explain the understanding of language, Piaget relies on it to explain the formation of base structures. Transformations of nonverbal reality are already encountered from the sensori-motor stage on. Transformations of language input are demonstrated by the child's understanding of messages, by formation of linguistic rules in two- and more-word sentences, and by his ability to interact efficiently in question-answer games, assertions, denials, etc.

The basic similarities between the transformations that Piaget has discussed and those of the transformational grammarians can now be spelled out: The relations between 'scheme' and the structure of the external act parallel those between 'deep structure' and 'surface structure'. While a gross-motor component relates the structure of an act with observable behavior, so the 'phonological component' relates the linguistic surface structure with the observable utterance. The deep structures for both gross-motor and linguistic acts are seen as relatively stable and, possibly, as cognitive and linguistic 'universals' respectively. Transformational rules, the derived surface structures, and especially the external acts differ, however, subject to culture-specific, act-specific, and idiosyncratic variables.

This difference between Piaget's theoretical approach and that of the transformational linguists is essential: Piaget spells out how the child abstracts schemes from his encounters with surface structures and how these schemes pass through various stages of temporary equilibria before attaining the final, permanent equilibrium. By contrast, Chomsky and his followers remain puzzled by the appearance of the linguistic base structures, they feel unable to explain them genetically and consequently have recourse to a postulate of inherited structures. The ontogenetic roots for some linguistic base structures will be outlined in the third main section of this essay.

Abstraction and Classification

The function of abstraction and the related principle of classification are also viewed by Piaget as universal and as having profound influences upon cognition, including language. When the infant applies his schemes to many new objects and events in the process of generalizing assimilation, he develops the first equivalents of classes and relations. Since these schemes are applied to a large variety of objects, often encompassing several sensory modalities, their general form becomes increasingly dissociated, i.e., abstracted from the specific contents. By means of the same process, actions are gradually interiorized and become logical operations. A second source of abstraction comes from schematic imitation and especially from deferred imitation. Both require the child to abstract the main schemes of the modeled behavior.

The activities of the sensori-motor period lead to the establishment of a general class of 'objects' with many subclasses of specific objects. They also lead to the schematization of a considerable number of acts, and to the first awareness of qualities and relations. In the linguistic realm, it is generally acknowledged and was forcefully argued by Brown (1956) that most words are also used as labels for classes of objects and not for unique objects. The same applies to labels for acts, qualities, and relationships. Representation generally and linguistic labels specifically further the dissociation of particular contents from the abstracted concept. Since labels can be used for an infinite number of members of a class, all unique features pertaining to single members have to be abolished. The 'substitution classes' established by the child in the course of his attainment of syntactic skills are, consequently, classes of classes. A hierarchy of classification is herewith also established in the linguistic realm in the same manner, as it was in the behavioral-perceptual sphere.

Representation

Piaget wrote an entire book on the formation of symbols (Piaget, 1951). He has also often touched upon this topic in his description of the development of intelligence generally (Piaget, 1952) and he has provided many behavioral examples in both publications. The anticipatory sucking movements of the infant (1-4 mos.), recognition of sound- or other patterns (4-8 mos.), and abbreviated motor acts (4-8 mos.) exemplify the earliest behavioral evidence of representation. These abbreviated movements are related to the later appearing acts of 'pretending', which were observed by Piaget around the beginning of the second year of life. Pretending is, however, intentional representation.

Other roots of representation are encountered in connection with the development of the object concept. The searching for missing objects and the visual following of the trajectory of a disappearing object evince mental representation. Symbol production with the help of objects is also encountered early (18 mos.), when the child uses one object to represent another one. In the case of symbolic play the child seems to be already aware of the arbitrariness of signification. He feels free to choose a variety of symbols for the representation of the intended significate. This awareness of the arbitrary connection between signifier and significate seems to develop on the linguistic level only many years later.

Conclusion

The most basic psychological functions of Piaget's theory have been briefly summarized in their relationship to both cognitive and linguistic development. It has also been repeatedly pointed out how these functions lead to structures or schemes. Structures or schemes are important paradigms both in Piaget's cognitive theory as well as in the linguistic domain. Since much emphasis has been justifiably placed upon structures, they are discussed in more detail in the next section.

Structural Antecedents of Verbal Behavior

Schemes[2]

Piaget (1952, 385-386) describes schemes as 'mobile frames' which are successively applied to a wide variety of contents. They refer, consequently, to classes of actions and not to specific acts. The scheme-concept attains its greatest importance for Piaget in the realm of ontogenetically established cognitive behavior. A defining statement provided by Flavell (1963, p. 52/3) excellently renders the main characteristics of all schemes: "A schema[3] is a cognitive structure which has reference to a class of similar action sequences, these sequences of necessity being strong, bounded totalities in which the constituent behavioral elements are tightly interrelated." Schemas do contain component actions which are governed by a core meaning (p. 54). By replacing 'action sequences' with 'sequences of words' and 'behavioral elements' with 'verbal elements', exactly the same definition could describe sentence structures: Sentences are bounded, their constituents are tightly related to each other, and they have of course the characteristic of productivity, viz., they refer to classes of structurally similar messages. The components of a sentence are also governed by a 'core meaning'. In addition, the constituents of sensorimotor and linguistic structures are highly similar. Piaget has demonstrated that the young child learns to differentiate agents from actions, and actions from objects. The infant engages in object-directed as well as in locomotory actions, and in many instances his actions incorporate spatial and temporal facts. Actions of other persons affecting objects are observed and comprehended, leading to schemes containing all three basic elements of acts: The actor, action and recipient. The infant has also established schemas of individual objects and for classes of objects, leading to recognition ("This is the . . .") and to classification ("This is a . . .") respectively.

The findings of general developmental psycholinguistics, especially those derived from the semantic oriented approaches (Brown, 1973; Chafe, 1970; Fillmore, 1968) have proven that the same constituents and their combinations are encountered in early verbal behavior. Children verbally express only those structures and contents, which they have already mastered previously on the nonverbal level (Bloom, 1970; Brown, 1973; Slobin, 1973). Although it cannot be verified without extensive experimental analysis, it is highly probable from these findings that the nonverbal structures are not only antecedents in a temporal sense, but that they also causally affect the later verbal structures (cf. Moerk and Wong, in press).

Schemes do not remain unchanged in the course of cognitive development.

Piaget has shown how they become differentiated, undergo internal reorganizations, and integrate with other schemes into larger units.

Coordination of schemes

Two ways of coordinating schemes exist according to Piaget: One is a coordination by means of reciprocal assimilation; it can proceed intra- and crossmodally. Evidence for the fact that crossmodal associations of schemes and the establishment of functional equivalences are of greatest importance in language acquisition is relatively clear cut: The child has to associate acoustic patterns with motor coordinations in a complex way and he needs to recognize the equivalences of signifiers and significates across a wide variety of sensory modalities. Two or more schemes are associated in all these cases. An important type of crossmodal functioning is also encountered in the multichannel communication of infants and young children. It has been generally reported and it was recently analyzed in detail (Moerk, 1974), that children often combine situational clues, gestures, and words in their communicative behavior, i.e., they combine schemes on a crossmodal basis in order to communicate effectively.

The second type of coordination, intramodal association of schemes, consists more of an addition or a temporal integration of two or more of them. Well-known examples for such integrations from the sensorimotor realm are the incorporation of objects, actions, and spatio-temporal variables in an act, as well as means-ends sequences, or the anticipation of events. This type of coordination of schemes is also common in language: A sequential combination of individual schemes, the phonemes, which influence each other mutually, is encountered in the single word. Scheme-coordinations are again found in the more-word sentence and especially in the coordination, subordination, and embedding of clauses.

In contrast to the early appearing coordinations of acts on the preverbal level, coordinations and even more subordinations of sentences appear relatively late. When they first appear, they simply represent concatenations of sentences without any deletion of redundant elements (Brown, 1973); i.e., the child follows the same rules in his sentence coordinations that he follows in his act coordinations. Besides this parallel in the form of the early coordinations, a complete parallel of the content exists: The child now concatenates verbally what he has combined already long before nonverbally. The fact that the verbal coordination of schemes appears later would correspond to the principle of vertical decalage.

Conclusion

Piaget has made three important contributions to the study of cognitive and language structures: (a) He has demonstrated that cognitive schemes develop early. (b) He has explored in detail the development of these schemes and has demonstrated that schemes derive from innate bases as does every kind of behavior, but that they are not innate in a nativistic sense. (c) Finally, he has investigated several important characteristics of schemes, such as their productivity, their transformational as well as their combinatorial character. Characteristics, which are parallel in form and content, have also been described in recent linguistic analyses of language structures. Two facts make it again highly probable that the more basic nonverbal structures influence the later appearing verbal ones: (a) The temporal priority of the nonverbal structures, and (b) the high similarity or even basic identity of both types of structures.

Conceptual Antecedents of Verbal Behavior

The main function of verbal behavior is, of course, the transmission of messages from a sender to a receiver. Messages express concepts and relations between concepts. Since language is only a code, the problem of meaning or information content has to be solved on a level which is more profound than this code and which appears before it. While psycholinguists have only devoted little attention to the preverbal conceptual antecedents of verbal behavior, Piaget's research has provided rich evidence for the elucidation of this issue. His approach is especially informative because it concentrates upon both aspects of information exchange from the beginning of the individual's life. The concepts 'aliment and accommodation' refer mainly to the aspect of information intake, while in the case of 'assimilation' the child contributes information, stored as schemes, to his experiences. Such schemes are first evident, i.e., communicated, in cross-motor behavior and later in hypotheses and theories. In order to account for the wide variety of evolving concepts, both types of functions have naturally to be considered. Piaget has also followed in detail the development of various concepts during infancy and early childhood. The establishment of these specific concepts and their parallels in early language will be briefly summarized.

The object concept

Piaget has explored the coordination of the schemes of prehension and vision which lead to the object concept, beginning with the second stage of sensorimotor development, and he has defined stage 5 (12-18 mos.) as 'primarily the stage of the elaboration of the object concept.' The infant distinguishes a considerable variety of objects and he especially differentiates objects which can be a cause for an action and/or can act from those which can not. In the words of Fillmore (1968) or Chafe (1970), he has differentiated objects into potential agents and into those which rarely or never become agents.

The linguistic parallels to this prelinguistic development are obvious. Nouns, referring to objects, together with their pronouns, are subdivided, as evident by their functional differentiation, into animate and inanimate nouns. Whenever children begin to build sentences containing several words, animate nouns are predominately used in the role of agent, beneficiary, or experiencer; while inanimate nouns are encountered as objects or instruments of actions. It appears even from Bever's (1970) results that young children, when they have difficulties comprehending a full sentence, follow a strategy of interpreting animate nouns as the subjects of sentences without analyzing the complete grammatical structure. 'Agent' was also equated with 'subject of sentence' by Sinclair-de-Zwart's (1969) subjects.

The action concept

In the earliest stages of development, actions are predominant and the object of the action is, according to Piaget, not yet fully differentiated from the infant's own actions. With progressive differentiation, the infant strenuously tries to accommodate his actions to the objects. The main progress in the development of the action concept is seen in stage 4 (8-12 mos.) when the infant learns means-ends sequences. He uses two types of actions: Locomotion to approach his goal and actions having the function to affect an object. Schematic imitations of movements of others and attempts to instigate others towards specific actions provide evidence of a well-established action concept.

In the linguistic realm, verbs and a few particles that are used instead of separable verbs represent one of the most frequently used early word classes in infant speech. At least two types of verbs are established: Those referring to locomotion and those referring to activities which affect objects. This differentiation is already evident in the early two-word sentences, since intransitive verbs are never used with objects, while the 'transitive verb - object' structure as well as the 'subject-intransitive verb' structure appear early (Brown, 1973).

Qualifiers

The concept "qualifier " is used here to describe the differentiations that are made by the perceiving organism in regard to the specific characteristics of perceived objects, acts, or events. Piaget did not specifically analyze the establishment of qualifiers. However, he intensively studied the establishment and differentiation of schemes, leading to recognition and classification (Piaget and Inhelder, 1959) and the child's adaption to novelty. All these achievements require close attention to qualifying characteristics of objects. During the first year of his life, when the child learns to modify his own acts according to situational givens, he again demonstrates a keen awareness for distinguishing features in the environment.

These qualifying characteristics are expressed in early speech mostly in the form of adjectives and adverbs. A good description of the linguistic expression of such modification has already been provided by Stern and Stern (1907); part-aspects of this topic are often treated in the literature (Brown, 1973; Leopold, 1949). Modifiers appear relatively early in language, but generally less frequently and less universally than nouns and verbs. The early qualifications often serve to express a personal-emotional ("hot", "good", "pretty") or a dynamic-motivational ("more", "'nother") reaction of the child. But descriptions of object-characteristics, especially colors and sizes, are also encountered. Again the establishment of qualifications in the nonverbal realm considerably antedates their verbal formulation.

Relations

The concept of relations is broad and, therefore, also difficult to specify. Only the basic distinction between relations of persons to objects and of relations between several objects will be considered in this paper.

Relations between persons and objects. Piaget has described many actions of the child, that express these relations: Directive nonverbal communication, i.e., requests or rejections, represent one form. Relations in space are mainly expressed by reaching, grasping, and locomotion. Means-ends coordinations demonstrate the understanding of quite complex relations between the infant and several objects.

In the linguistic realm, the early verb-object, subject-object, and subject-verb constructions are evidence for one type of relations. Possessive pronouns used to communicate requests, or some early imperatives express the directive tendency. "No" as a verbal rejection also appears early. Spatial prepositions and adverbs or baby-talk phrases such as "bye-bye" serve to express the relations between the child and objects in space.

Relations between objects and events. Two relations between objects are psychologically salient: Spatial and causal ones. The predominantly perceived relations between events are temporal and causal. Piaget (1954) has dedicated an entire book to the exploration of the development of the concepts of space, causality, and time. He has demonstrated that these concepts become better defined around stages 4 and 5 (8-18 mos.) of the sensorimotor period. Causal relations, however, are most often interpreted animistically and resemble therefore relations between persons and objects.

In child speech, prepositions and adverbs express spatial relations between objects. Temporal relations are expressed only later by means of specific vocabulary items. They are, however, communciated relatively early through the temporal arrangement of verbal elements: What happened first is mentioned first (Clark, 1970). Although the word "because" appears early in the vocabulary of many children, it remains difficult for them to master causal explanations until they reach school age.

Conclusion

These four groups of conceptual classes, consisting of the class of objects, actions, qualifiers, and relations probably do not encompass all the concepts that are developed by infants in various social and cultural environments. Piaget's research has always been centered upon the general laws of development and the more universal acquisitions. He has established that the above conceptual classes, which are rendered linguistically in various forms in all presently known languages, are established and expressed before the beginning of verbal comprehension or production. This proves that they are cognitive and not specifically linguistic universals. Being so basic, they also become the main elements of verbal communication.

General Conclusion

Piaget has attempted to establish the bases of all cognitive development from an ontogenetic perspective. Such a system has necessarily to implicate language development, since language fulfills important functions in cognitive behavior and since it is one of the most conspicuous products of cognition.

Although neither Piaget nor his school have ever explored language development in detail, Piaget has contributed to developmental psycholinguistics in three important aspects: 1. He has explored and formulated the functional principles which lead to cognitive acquisitions. 2. He has described the resulting structures as well as the effects these structures have upon further cognitive development. 3. Finally, he has investigated some of the basic concepts and classes of concepts that are established during infancy.

The science of linguistics has heretofore dealt mainly with only one of these three topics extensively: The exploration of linguistic structures. The other two topics have been less successfully promoted. Although semantics has been discussed repeatedly (Chafe, 1970; Katz and Fodor, 1963; Ogden and Richards, 1923; Weinreich, 1963), no generally accepted theory has been established. The reason underlying this impasse will probably be found in the fact that meaning or semantics is an eminently psychological problem. This argument applies even more to the third topic, i.e., the functions involved in language acquisition and language behavior. Functions fall fully into the domain of the neurological and psychological sciences and they have, therefore, been neglected by linguists inspite of Peirce's (1932) and Morris' (1946) stress on the pragmatic aspect of language.

Psycholinguistics as a new science has been searching for models and has thereby relied too heavily and closely upon the established science of linguistics with its one-sided syntactic orientation. Only recently have meaning and functions come more to the attention of this new discipline. The cognitive-functional approach of Bever (1970), or Slobin (1973), the special consideration of meaning by Brown (1973), and the sociologically oriented analyses of Labov (1970) are examples of this new trend.

Piaget, in his independent and innovative approach to the science of epistemology, has concentrated from the beginning upon these most primordial aspects, since only meaningful functioning can lead to complex structures and concepts. It will remain the task of the present generation of developmental psycholinguists to incorporate this fruitful and promising system more into their own scientific endeavors.

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Footnotes

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1. The author wants to thank two anonymous reviewers whose critical suggestions proved very valuable for the final elaboration of this article.
2. In the present discussion the term "scheme" is used whenever applicable instead of the term "schema." The reason for this decision lies in the recent differentiation of "scheme" and "schema" by Piaget himself. The term "scheme" applies according to this differentiation to operative structures, while the term "schema" is reserved for figurative structures.
3. Flavell does not make the distinction between "schemes" and "schemas" that was explained in footnote 2.