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CHAPTER 4

The Piagetian Concept of Representation and the Soviet-Inspired View of Self-Regulation

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Luria's conception (1961) of language as a regulator of motor activity brings out the more general problem of the relationships between language and thought or, more precisely, the problem of the relationship between language and cognition. In order to analyze this conception in detail, it seems useful to place it in the broader context of Vygotsky's developmental theory (1934/1962), and then to compare it with Piaget's ideas on the relation between thought and language. The aim of this chapter will be therefore twofold: (1) to analyze in depth the theoretical and experimental foundations underlying these two positions and (2) to use this analysis to formulate certain hypotheses about the significance of both Luria's findings and the data of those who have repeated his experiments concerning the effect of vocal rhythm on the control of motor behavior. More attention will be paid to the analysis of the Piagetian position than to Vygotsky's. This disproportion has nothing to do with any theoretical choice on our part, but simply reflects the availability of the writings of each author: whereas Piaget has written and published a great deal, Vygotsky's works are scarce and difficult to find.

The intervention of language as a behavior-regulator can only be conceived once speech has been acquired or is in the process of being acquired by the child, that is at about age two. However, the problem of the interaction of speech with cognition is already evident at an earlier phase in the child's development, the phase of prespeech. The questions pertinent at each period are of a different nature: the prespeech period of development raises the problem of the origin of language and in what way it is different from other behavioral forms; the later period poses the question of the role language (once learned) plays in cognitive development.

1Not a single text by Vygotsky has been translated into French. Also note: the authors of this chapter have translated into English the specific Piagetian citations, page numbers are to the original works written in French.
THE CHILD'S ACQUISITION OF LANGUAGE

Piaget’s Position

The problem of the genesis of language was first treated in what is one of Piaget’s most remarkable books, La Formation du Symbole Chez l’Enfant (1946/1951). The ideas set forth in this work have been frequently defended by Piaget himself in a number of articles and popular works (especially 1963, 1964/1967, 1967/1971), but particularly by his followers, among whom H. Sinclair figures prominently (1971, 1973, 1974). The Piagetian position on language is often stated by a number of principles, which can sometimes seem like recipes. They cover three main themes:

1. Speech, only one of several manifestations of the symbolic function, is elaborated by man in the context of his interactions with his surroundings:

   Since Saussure and others, we know that verbal signs are only one of the aspects of the semiotic function ... in addition to speech, this function extends to imitation in its representational forms, gesticual mimicry, symbolic play, mental images, etc., and too often we forget that the development of representation and thought ... is linked to all of this semiotic function and not only to speech. [Piaget, 1968 pp. 78-79].

2. The appearance of speech, at the end of the second year, is linked to the emergence of the symbolic function, which in turn appears at the end of the sensorimotor evolution. This second theme demands further development. In Piaget’s works the appearance of the first words seems to depend on the concept of object permanence and on the mechanism of imitation.

   As far as object permanence in children is concerned, it is not considered present if a child can find an object only partially hidden from his view or if he can reproduce a movement made by the experimenter; he must be able to find an object which is hidden in different places before his eyes (cf. Sinclair, 1974, p. 2). Object permanence refers to what Bronckart calls “a structural condition for content stability.” Children are not able to produce these signs, that is to find a correspondence between a sound sequence and a content, unless the content has a certain stability. It must be noted however that those who have emphasized the role of object permanence in the acquisition of language are Piaget’s successors (e.g., Inhelder, et al., 1971). Piaget is often satisfied simply to call attention to the fact that permanence coincides with the acquisition of speech (1937/1954, 1946/1951, 1967/1971).

3. Language always comes behind cognition or intelligence, as much on the level of children’s acquisition as in its emergence in the human race:

   Intelligence precedes language, not only ontogenetically ... but phylogenetically, as numerous experiments dealing with intelligence in the higher orders of monkeys have proven. [Piaget, 1968, p. 79]

   Surely for Piaget verbal behavior is a characteristic particular to the human species; but he also holds against most philosophers and linguists that language is not the cause of the emergence of thought but rather one of its consequences. In the Piagetian perspective what characterizes the human species is a sort of superior cognitive power, made possible by a special neurobiological apparatus,

   The operations of thought and logico-mathematical structures, in the broadest sense, are due to the general coordinations of actions ... and not to language or to specifically social transmissions; these general coordinations of actions themselves come from the nervous and organic coordinations which have nothing to do with social interactions. [Piaget, 1970, p. 177]

   This theme has been frequently picked up by Sinclair,

   [This quotation brings out the difference between the notions of an innate structure as proposed by Chomsky (1965) and Piaget’s innate function (to be discussed later).]
In a certain sense, something like a basic schema of human language does exist, and so does a set of basic assumptions permitting an oriented approach to the input. Both derive from fundamental properties of the human mind and therefore, in a sense, from neurological coordinations. [1974a, p. 40]3

To appreciate the full significance of these three affirmations, it is necessary to analyze the Piagetian explanation of language acquisition in greater detail and discover its epistemological and psychological implications.

In the various works concerning the symbolic (or semiotic) function, the central concept for Piaget seems to be that of representation. This term can have two different meanings: (1) in the broad sense, representation is thought, “all intelligence which no longer depends simply on perceptions and movements... but rather on a system of concepts and mental schemes” (1946, p. 68); (2) in the more limited sense used by Piaget—and thus ours as well—representation is conceived as a function, which connects a given content (an object or a concept) with something that becomes its substitute or representative. In voluntarily keeping this discussion on an elementary level (which Piaget himself is sometimes obliged to do to simplify certain demonstrations) we can say that representation is, in reality, the psychological mechanism that permits the setting up of sign or signal systems as described by semioticians.4 Thus between a landscape drawing and the real landscape, between the word “book” or “livre” and the concept of a book, between the gestures miming an act and the act itself, there is a link, a relation—that of representation. In the etymological sense of the term, it is a question of “presenting something again”—an object, a characteristic, a behavior, or a concept. Using the terms of Saussure (1916) in their most popular sense, Piaget speaks of signifier to designate the word, gesture, or painting—in other words, the substitute; and he speaks of signified to designate the content that is represented by the signifier. Whence his classical definition of representation as the association of a signifier with a signified.

In the Piagetian analysis of language acquisition, three aspects of the symbolic function are discussed: (1) the content or signified, (2) the substitute or signifier, and (3) the mechanism which acts as go-between. The references for these aspects are to be found in the classical works of Piaget (1936/1952, 1937/1954, 1946/1951, 1964/1967) and are reorganized in the more recent writings (1961/1969 and especially 1968/1970).

3For other statements of this type, see Piaget (1977, p. 42) and Sinclair (1972, p. 223; 1975, p. 318.)

4Cf. Barthes (1953). Note the hybrid character of the expression, “semiotic function,” at the same time functional and structural.

The Classical Analysis of Representation

The content of representational activity is an object or a behavior or one of their characteristics. Knowledge of objects and behavior is not however innate, that is, “given” to a child at birth; the child must come to know them through the various stages Piaget describes in most of his work on psychology (for the developmental period with which this chapter is concerned see La Naissance de l’Intelligence Chez l’Enfant (1936/1952), and La Construction du Reel Chez l’Enfant, (1937/1954). Referring to an assumption already established a good bit earlier (Baldwin, 1915), Piaget emphasizes that the newborn child is not able to distinguish between what is “given” by the outside world and his own “inner self.” This distinction begins during the sensorimotor stage; by a progressive coordination of actions a progressively increasing objectivity slowly takes place of primitive egocentricity. At the moment when representation appears, between 18 and 24 months according to Piaget, this cognitive evolution is far from being completed. In a way it never is finished even at the highest levels of formal intelligence. Object permanence, mentioned earlier, cannot be considered as a concept that works according to the law of all-or-nothing within the logical framework of the Piagetian system. There are degrees of object permanence, and the specific test developed by Piaget and his successors covers only one instance in a continuous evolution. Other psychologists (for example Klein, 1948) have mentioned that at as early as 8 months, babies recognize their mother’s face. This is undeniably a form of object permanence. Piaget himself has written of more subtle permanences using the term, conservation.

The substitutes or signifiers of representational activity have been the object of several types of classifications made by Piaget and his many collaborators. The essential hypothesis underlying the classifications, which we shall analyze later, is that of a progressive passage from representation (in its broad sense) leading to representation (in its strict sense), that is to the symbolic function. For Piaget all knowledge consists of giving a meaning, a signification to objects and events. In the broad sense of the term all knowledge is representational.

Every perception and every cognitive adaptation consists in assigning a significance (forms, ends or means, etc. . . .). [1964, p. 104]

Knowledge becomes symbolic when its general assigning function develops into a specific assigning activity that uses substitutes or differentiated signifiers. In the classical works (1936/1952, 1937/1954, 1946/1951, 1964/1967), Piaget maintains that the sensorimotor period is characterized by representation in the broad sense: it uses cues and signals that are undifferentiated signifiers. The Piagetian notion of a cue is analogous to the notion proposed by semiotists who say: smoke is a sign of fire, footprints in the
snow are a sign that someone has been there, a hiccup is a sign of drunkenness, and so on. According to Piaget sensorimotor representationational signs are internal translations (that are inside the subject) of certain characteristics of the object. These signs become organized progressively during development until they form mental images. The real symbolic stage begins when these images enable the subject to evoke (that is, to make a new presentation which necessarily is symbolic) of an object or an activity. Examples are putting a stuffed bear or doll to sleep, making believe that stones are trains, saying a word, and so on. In this new sort of activity the child uses signifiers that are differentiated, that is distinct from their signifieds. These signifiers are outside the subject (stones for trains or words for objects). These particular signifiers are symbols or signs and their presence attests to the fact that representation in its strict sense is at work. The appearance of the symbolic function is essentially characterized then not only by the use of undifferentiated signifiers (cues or signals), but also by the use of differentiated signifiers (symbols or signs).

The mechanism which determines the passage toward representation in its strict sense of evocation, that is, the possibility of making an object or event which is objectively absent, present by representing it somehow. The capacity to evoke, according to Piaget, is derived from the process of imitation. During the sensorimotor stage, imitations are made only in the presence of a model; then progressively the child becomes capable of imitating, with considerable time lapses, between the original activity he witnesses and his own imitation of that behavior. Finally imitation becomes an activity in its own right, an activity which presupposes that there is a mental trace or image of the model. It is not easy to know if, for Piaget, imitation explains the creation of images or if it merely makes the passage to representation possible.

The Modern Analysis of Representation

In the classical position representation constitutes a function that permits the evocation of a content or signified by means of substitutes or signifiers. If these signifiers are not clearly dissociated from their content, it is a question of representation in the broad sense; if they are clearly differentiated, then it is a question of representation in the strict sense. It was from about 1960 (see particularly 1961/1969 and 1968/1970) that Piaget's analysis of representation was more fully elaborated in the light of the principles and findings of genetic epistemology. As Piaget and his colleagues began to put more emphasis on the constructive, interactive character of all thinking, the notions of signifiers and signifieds, inherited from linguistics, proved to be too simple. All thinking was seen as being elaborated by an active interaction of the individual with his surroundings; the signifieds and signifiers therefore had to be redefined as the constructions of the subject.

The signified or content is known only inasmuch as the subject assimilates it which, in turn, is only possible through the schemes at the subject's disposition. Piaget maintained then that "the signifieds... [are] the schemes at all levels constituting the organism's schematization" (1968, p. 13)—or rather that signifieds are composed of schemes and their contents. To put it simply, signifieds correspond to what the subject is able to construct with his operatory structures; the individual's signifieds taken together constitute what Piaget calls the "operative" domain.

As far as signifiers are concerned, the picture is a bit more complicated since Piaget distinguishes between three levels of signifiers. The most elementary level is, according to the classical view, that of perceptual cues. A cue is not a faithful copy of an object; it is the figuration of one of its states inside the subject. In order to describe these perceptual cues, Piaget also speaks about the figurative apparatus as opposed to the operative status of the signifieds. At a more complex level words in natural languages make up a category of signifiers differentiated from their signifieds to which they also have an arbitrary relationship: there is no natural link between the words, "horse," "cheval," "Pferd," nor do they look like their content /horse/. While the figurative apparatus, which gives the perceptual cues, is clearly limited by a dependence on content (it is smoke that indicates a fire and not footprints in the snow), the verbal signifier is for its part purely a matter of convention; Piaget calls it a "real semiotic instrument." Between these two opposing levels (figurative and semiotic) there is an intermediate group of signifiers composed of nonverbal symbols, gestural language, mental images, and so on. These signifiers are distinct from their contents; they are also autonomous with respect to their signifieds, but they are not completely independent. For example when in symbolic play a child uses a book to represent a plate and some leaves to represent food, the signifiers (the book and the leaves) are not chosen arbitrarily; they have a certain resemblance (in terms of size especially) with their signifieds (the plate and the food), and in this respect they are figurative tools. Still these signifiers are not simply a part of the signified, and the subject can choose them from a relatively vast range of objects (he can take a book, an ashtray, a cloth, or even a piece of wood to represent the plate); the symbolism is in the choice. Piaget considers signifiers which are both figurative and semiotic to be in an intermediate category.

Piaget's Conception of Development

In these two versions of the Piagetian analysis of representation, the same hypotheses are formulated about the nature and origin of language. The first hypothesis is that of an absolute dependence of the figurative domain on the operational one: individual cognitive development means the development of operatory structures which, in turn, bring about the evolution of figurative structures. Piaget writes:

Whereas operatory structures, operational intelligence included, are rooted in sensori-motor activities in one long continuous developmental
process, the contrary is true of figurative structures which are always subordinate to the operatory structures, developing not by direct filiation, where one structure leads to the next, but by gradual additions from operatory structures and from interaction with the data of experience. [1961, p. 353]

The second hypothesis is but a corollary of the first. It assumes that there is functional continuity, without any particular gap, between the different sorts of signifiers. A subject, his development governed by the evolution of his operative apparatus, first of all constructs perceptual cues (that is undifferentiated and purely figurative signifiers), which he can then use to elaborate mental images and symbols, (that is differentiated signifiers), partly figurative and partly semiotic. Finally he produces the first signs of speech, which are pure semiotic instruments:

First of all, there exists a figurative apparatus which has no semiotic function. Perception, for instance, is a system of signifiers, but the cues are not differentiated from the perceptual given. Then, there are mechanisms which are both figurative and semiotic, such as mental images, symbolic play, "deferred imitation", gestural language, etc. Finally, there is a category of semiotic instruments which themselves are not figurative, but belong to systems of signs. Natural languages belong to this category. [Piaget, 1968, p. 15]

Inasmuch as they adhere to these two hypotheses, the followers of Piaget can contend that representation in the strict sense is simply the evolutionary result of representation in the broad sense. On this basis as well, they can claim that language is only one tool of symbolic function and as such is dependent on cognitive structures. This position is based on epistemological considerations which will now be briefly examined.

The Epistemological Foundations of the Piagetian Position

The principles underlying the Piagetian position on language acquisition are presented in great detail in three recent works by Piaget: Biologie et Connaissance (1967) Epistémologie des Sciences Humaines (1970), and Adaptation Vitale et Psychologie de l'Intelligence (1974). These principles are quite original and bear little resemblance to the ideas predominant in current theory; those of neo-Darwinian biological theory (for example, J. Monod) on the one hand, and those of transformational linguistics (for example, N. Chomsky) on the other.

Biology plays a major role in these theories. According to Monod the human species is the product of a succession of mutations and selections by the environment. Of all these mutations the emergence of deoxyribonucleic acid (DNA) is of capital importance. It is DNA, the species' biological code, that makes the creation of a very elaborate communicative code—language—possible; language for Monod is synonymous with thought or the "noosphere." Chomsky takes a similar stand: language competence relies upon and is explained by a specific genetic apparatus. During language acquisition, only a few stimulations are enough to enable this competence to "emerge." Roughly, the dominant view of language in Western thought is one of a phenomenon based on biological apparatus particular to the species that makes the development of thought and intelligence possible.

For Piaget the subject's structures, whether they be intellectual or linguistic, cannot be considered as already given. They must be constructed. In addition, and in opposition to Monod's and Chomsky's contentions, thought precedes language both on the ontogenetic and phylogenetic levels. However, Piaget clearly sees a direct relation between biological processes and thinking, as the title of his very important work, Biologie et Connaissance (1967) indicates, but the link between the two is made on the level of functional mechanisms. For him, at each level of living organization, the organism and surroundings are in interaction. Their relationships are defined as regulations that apply until a satisfactory equilibrium has been attained. This permanent dialogue between the organism and its surroundings seems to have two poles: (1) assimilation by which the organism makes sense of his surroundings and (2) accommodation which is a modification of the organism's structure as a result of contact with this same environment. According to Piaget, from the sea anemone to man, the same biological mechanisms are at work, and their recursive application results in the construction of more and more complex structures. Human intelligence is only the culmination, the crystallization at a given moment, of these general cognitive mechanisms, and language is merely a particular aspect of human intelligence.

Thus one can see why in order to defend this epistemological position, Piaget must treat language as one behavior among others, a result of the same cognitive mechanisms. In the same way that he analyzes the appearance of speech in children as a continuous process, he tries to demonstrate the continuity of the passage from the first signal system to the second at the level of the species (Piaget 1970, p. 343 ff.). He argues in particular that the elements of the first system, the cues that trigger certain behavior, are to be found on every level of biological life; at every level of animal behavior; and in children they are the only signifiers functioning until the age of sixteen months. (These signifiers remain at the child's disposition after that time as well). A second system of signifiers is to be found in certain superior primates and in man; it is the symbolic function that includes two types of signifiers: (1) symbols, used by both animals and human beings and (2) signs, used only by man. These language signs give man an unquestionable advantage, that is,
The sign system has an undeniably exceptional advantage because of its constructive mobility and the considerable number of meanings that it is able to transmit. [1970, pp. 345-346]

Nevertheless, for Piaget they are only the result of an underlying cognitive evolution, that of the operative apparatus which has attained a level of development in man definitely superior to that in other species. This cognitive superiority is linked to a specific neurological apparatus.

Several points should be made with respect to the Piagetian epistemology. The first, which we merely mention, concerns the opposition between innate structures and innate functions. Piaget in all his writings defends the hypothesis of functional innateness against Chomsky and the neo-Darwinians who present claims for structural innateness (cf. Piaget's Structuralism 1968/1970). However he is indeed obliged to admit that the human species is different from others. Inasmuch as he rejects language as the reason for that difference, he must de facto also uphold a structural innateness, precisely that of a particular neurological apparatus.

The second point concerns the implicit consequences of the Piagetian position. The hypothesis of a functional continuity from biological processes to intelligence leads to the reduction of language to a tool for individual representation, systematically leaving out its social and communicative aspects. It is striking to note that the entire discussion above only looks at the organism as an individual interacting with its environment, making figurative tools and then making semiotic tools, which help to represent reality. Never are social contingencies nor the necessity nor the desire to communicate mentioned as contributing to the appearance of language. The arguments made by Vygotsky and the Soviets, as well as by Western theoreticians, like Wallon (1941), differ radically from Piaget on this point; for them language is in fact considered to be a social tool for communication and representation.

The Social Origin of Language

It is in Thought and Language (1934/1962) that Vygotsky clearly takes a stand against Piagetian conceptions regarding the acquisition of thought and language. The arguments he develops are generally well known, therefore they will be treated here briefly in spite of their importance.

One of the major theses of this work is presented in the chapter, "The Genetic Roots of Thought and Speech." For Vygotsky, rational language, specific to the human species phylogenetically and ontogenetically, has two distinct roots: (1) purely intellectual and (2) purely vocal.

Using Koehler's (1921), Wundt's (1900), and Yerkes' (1916) analyses, the Soviet psychologist first of all demonstrates that higher-order monkeys possess capacities that are undeniably intellectual (according to Yerkes, a degree of ideation equivalent to that of a 3½-year-old child). He also notes that these animals use a relatively rich language, but a very affective one, and that it works in the same way as instincts do. What seems essential to him is that these two functions are independent of each other.

The similarity points once more to the independence of chimpanzee 'communication' from any intellectual activity. [Vygotsky, 1962, p. 41]

On the ontogenetic level, using the works of Buehler (1928) and Stern (1914) as references, Vygotsky argues that during the first year of life there exist intelligent, nonverbalized behaviors and vocal productions that have an unquestionably social function, but no intellectual role. At a certain point in development these two roots merge, thought becomes verbal and language becomes intellectual. It is this merging, not observable in animals, that is the essential characteristic of man. Once this meeting of functions has occurred, the child uses the words of his social environment to designate various things. At the outset however the child does not always manage to make the correct correspondences. Only progressively does the child really grasp language and internalize it.

It seems possible to state Vygotsky's position by substituting the notions representation, communication, and language for what he calls respectively thought, speech, and rational speech. By "representation" we mean an individual process by which an organism structures the knowledge he constructs in his interactions with his surroundings; this is done in the form of substitutes, either internal (cues, images) or external (symbols, signals, words). We understand "communication" as a social phenomenon of exchange between two or more members of a group in the context of those global finalities that ensure the group's survival and cohesion. As for "language," it can be defined as one system that is both communicative and representational; it is composed of representational substitutes linked by social convention as to their meanings. This conventional association is responsible for denotation, the representative aspect of language. Elaborated in a context where individuals interact and have reciprocal expectations, language functions moreover as a system of values; these values make up the communicative (intentional) aspect of language.

Given this new terminology, the differences between the positions of Vygotsky and Piaget are clearer. For Piaget language comes exclusively from representation, which is but an individual mechanism with a biological origin; for Vygotsky language results from both a representative root and a communicative root, that of social exchanges through which socio-historical determinisms manifest themselves. This first difference involves a second. Piaget insists on a functional continuity of the processes of cognitive development; Vygotsky, on the contrary, emphasizes the revolution produced when the two roots of development merge.
The nature of development itself changes, from biological to socio-historical. [1962, p. 51]

The themes essential to Vygotsky's thought present obvious analogies to those developed by the French psychologist, Wallon. In L'Evolution Psychologique de l'Enfant (1941), Wallon stresses the prolonged immaturity of human children,

A child remains virtually helpless for a long time in front of the most elementary necessities of life. [p. 46]

Because of this inability to confront the outside world directly, the child must always rely upon his family, and most of his activity is mediated by his social entourage:

Whereas the young animal, sometimes due to example and being forced by his mother, adjusts his reactions directly to the situations of his physical world, the child remains for months and years unable to satisfy his desires unless assisted by others. The only way of expressing [these desires] is by putting himself in contact with his entourage, that is with those of his reactions which arouse behaviors in others that are to his advantage, and those reactions in others which indicate his behavior should continue or change. As early as the first weeks or first days, the sequences for the first foundations of what will serve as interpersonal relationships are laid down. Expressive functions are way ahead of functions of realization. As a prelude to language, strictly speaking, they are the first to leave their mark upon man, essentially a social animal. [Wallon, 1941, pp. 46-47]

This passage seems to illustrate fairly clearly the need to postulate a communicative root as a fundamental social precedent of language.

Wallon also emphasizes the functional discontinuity of child development; he clearly indicates that,

development in children does not proceed by simple additions of progress which always work in the same direction. [1941, p. 103]

Development is seen rather in terms of fluctuations or alternations (with phases of rapid development and others of apparent regression), in which maturation of nervous and muscular support, motor activity development, and emotional interactions all have an influence.

This and the following quotations from Wallon, like those from untranslated works by Piaget, were translated by the authors.

Towards a New Conception of Language Acquisition
In this section the Piagetian and the social positions will be integrated in a conception of language acquisition that Bronckart (1976,1977) has been working on for the last several years.

What Must Be Explained in Language Acquisition
The Piagetian analysis of signs is in line with a popular conception held by a number of linguists and semiotists and usually associated with Saussure (1916). According to this conception the sign is made up of: (1) a conceptual content that is called the signified and (2) a sound substitute called the signifier. Between the two there exists a conventional or arbitrary relationship. During the last 10 years, however, some important critical works, particularly by Engler (1968) and de Mauro (1972), have brought out the superficiality of this conception. The Saussurian sign notion is much more complex than Piaget seems to believe.

One of the first tenets of the Saussurian analysis is that in order to construct a sign every speaker must deal with two areas of reality: (1) the material substance, or the meaning or content to be expressed and (2) the sound substance of the language that expresses the content. Between these two areas there exists no natural relationship of resemblance; they simply happen to be simultaneously present in a communicative context. For example the word "pipe" pronounced in the presence of the object /pipe/. Given these two material realities, the subject elaborates two images: one which Saussure (1916) calls the sound image, the other which he calls the concept, which we shall call the meaning image.

The point that we find of capital importance in the Saussurian demonstration is that the contrast between sound image and meaning image is not at all synonymous with the opposition between signifier and signified. For Saussure (1916), images are in fact individual constructions, whereas signifiers and signifieds are elaborations of a social nature. The passage from individual to social is accomplished by establishing a conventional correspondence between certain aspects or certain groups of sound images and certain aspects or certain groups of meaning images. The images or individual representations are reorganized by social convention; the results of this reorganization are called signifieds and signifiers. To take a simple example, the pair of English words "ox" and "beef" can be compared with the single French word "boeuf," if we limit ourselves to the content level. Every individual in Western

The Piagetian position is understandable; up until 1968 almost all linguists adhered to this "superficial" conception of signs (see Bronckart, 1977, Chap. 4).
society, whatever his native language, has the chance to construct for himself various representations of oxen in its different states: big or small when alive, in the form of steak or corned beef when dead. These representations are the meaning images constructed by an individual subject. The intervention of language, or rather of the social convention that is its basis, makes a restructurization (a reorganization) of these individual images necessary. For English speakers the language proposes two signifiers, "ox" and "beef." To these two words two groups of meaning images correspond—those designated by "ox" and those designated by "beef." These are the reorganizations of images that are the signifieds in English. In French, convention supplies only one word. Thus, the signified necessarily has a wider field of application than the two English signifieds to which it corresponds.

The Saussurian conception of signs implies therefore that in a first stage, subjects construct personal images of the two material substances of sound and content, and that, in a second stage, language reorganizes these images in the form of signifiers and signifieds. In the light of this analysis we would like to take a new look at the problem of the acquisition of signs in children.

When at about 18 months a child produces the utterance "allgone" each time his mother leaves, an object falls to the ground, or to accompany play in which things are made to disappear and reappear, psycholinguists refer to these utterances as word-phrases or as holophrases (see Brown, 1973). For us this sort of production constitutes a sign in every sense of the word. The child in fact has constructed a sound image ("allgone") on the basis of the sound used in adult productions like "She is gone." "The book is gone." and so on. He has also constructed a meaning image that includes various events characterized by the disappearance of something. This is the first step in the elaboration of a sign, according to Saussure (1916). Besides these two individual constructions, the child has also made the association suggested by social convention: although there is no natural connection between these two types of image, he uses one to represent the other. Thus he reproduces approximately, of course, the meaning relationship belonging to his native language, which is the second step for Saussure.

For us every interpretation of language acquisition must give a satisfactory explanation of these two steps; that is why the Piagetian conception seems insufficient. It must be remembered that for Piaget human language is a tool used for interacting with the environment, constructed by the continuous working of general, essentially biological, mechanisms. Let us briefly examine the steps of this construction again. From birth on, a baby constructs various cues. These represent certain aspects of his environment and permit him to identify certain stimulations. Later on these cues are organized into configurations or images, making deferred imitation and evocation possible. Up to this level Piaget's functional continuity seems plausible. With symbolic play something new appears: the subject represents an object (the car of a train) by another object (a stone). This new representative activity can be analyzed in the following manner: starting with an initial object \( O_1 \) (a railroad car), the subject constructs a mental image that can itself be represented by another object \( O_2 \) (a stone), on the condition that the two objects \( O_1 \) and \( O_2 \) bear a physical resemblance to each other. In this analysis symbolic play calls for the elaboration of only one mental image that takes the place of two physical objects, one of which stands for the other, on the condition that their relation is motivated, that is that they share obvious characteristics. Symbolic activity remains quite similar to the simple elaboration of mental images. Here functional continuity is therefore still likely. The case is completely different as far as verbal signs are concerned. When the first of these signs appear, the child (as has been shown) has to construct two separate mental images in radically different areas of reality, sound and meaning, and relate these images by means of the conventional rules of his mother tongue. This construction of a verbal sign is a complex process, a rupture in the single thread of development, inexplicable within the simple framework of the development of individual representation.

In short the Piagetian hypothesis of functional continuity which sees language as exclusively representational in origin, does not seem to hold under scrutiny. Development in children, on the contrary, seems characterized by breaks, reorganizations, if not revolutions, as suggested by Wallon (1941) and especially by Mounoud (1971, 1977). On the linguistic level, what remains to be explained is how one goes from the first Saussurian stage (individual images) to the social stage of signifiers and signifieds. In other words the transition from natural substitutes, requiring only a mental image (cues, images, and symbolic play), to artificial and social substitutes, which demand two images and the establishment of a relationship between them (verbal signs, mathematical symbols, highway codes, and so on), remains to be explained.

The Theoretical Bases of an Exploration

The problem of language acquisition is one of the oldest problems that has interested psychologists. It is also a very timely problem in that it continually challenges the existence of the borderline that most social science specialists
try to draw between the domains of the cognitive-psychological-individual and that of the social-relational-affective. Psychology, sociology, and psychoanalysis have the status of separate domains, since each has developed its own methods and conceptual apparatus, but each has to come to grips with the same object of study, language, the real social and individual interface. Each scientific conception of language reveals a deep epistemological position. Piaget, who with Chomsky (1968) and Monod (1970), follows the "biology is everything" tradition, reduces language to an essentially representational phenomenon, explaining its emergence as a progressive growth in complexity in the ways in which the individual interacts with his environment, physically and asocially. According to other theories, language is considered to be essentially communicative and social (see especially Sapir, 1969 and Whorf, 1964), and the need for an individual construction is not emphasized. Looking at language's hybrid status, it seems to us that these two positions need to be reconciled, and it is towards this end that we maintain a position similar to that of Vygotsky, whose hypotheses are similar to Wallon's (1941) conception of development.

In our opinion what remains to be analyzed and explained during the prelinguistic period is: (1) the preparation for the construction of mental images and (2) the preparation for the social convention which connects the two types of specific images—those formed from sound and those elaborated from content.

Image-making can be described as a process of individual construction. The best description of this process is, to our knowledge, the Piagetian one. The conventional correspondence between sound images and their content on the other hand requires something else. It is no longer a question of elaborating a knowledge of the physical world, but rather of the social and relational world. Obviously society is not introduced here abruptly as something which imposes itself brutally on the subject. Social knowledge as well must construct itself: it is the fruit of a permanent dialectic between partners.

To differentiate these two aspects of prelinguistic development, Bronckart has suggested a distinction between representational schemes—worked out on contact with the physical environment, inert and non-responsive—and communicative schemes—constructed in interaction between social partners, active and autonomous (1976, forthcoming). Representational schemes (what Vygotsky calls the "nonverbal intellectual root") having been analyzed in detail, we shall now say something about communicative schemes.

**Communicative Schemes in Children**

As indicated by the etymology of the French term, "enfant" (from the Latin "in-fari"—unable to speak), the child is a member of the species who does not share its principal means of communication, speech. More precisely, the child is confronted by his family members who, unlike him, have ways of making elaborate representations. They can also use a certain system of communication and representation—language. The study of communicative schemes is really the study of the interactions taking place between two unequal partners, the baby and the people around him. Wallon (1941) gives an admirable introduction to this study in a chapter dealing with affectivity and emotions:

... emotions, due to their psychogenetic orientation, are what create the connections which prepare the way for intention and discrimination. The attitudes which characterize them, the sound and visual effects which they produce, are for others extremely interesting stimulations, which have the power to provoke similar, complementary or reciprocal reactions, depending on the situation for which they are the effect and the cue. A kind of consonance, either of harmony or disharmony, sets in very early between emotional attitudes which coincide in the same area of perception and action. [1941, p. 133]

As we have seen, this type of cognition differs utterly from that analyzed by Piaget. Here we are dealing with interactions that are essentially anticipatory, with expectations and with intentions.

Up-to-date data on this type of scheme is scattered among the available literature. Nonetheless we shall comment on some work done in this area. Condon and Sander (1974) have shown that newborn infants move head, shoulders, legs, and feet in synchronisation with rhythmic and syntactic segments of words adults say to them. In this very early period of development, unconscious modes of interaction thus become established between the baby and his surroundings by means of the sound canal. Better known studies have revealed that at the age of about two months another type of communication appears. When the baby finds himself in a disagreeable situation, his muscular tensions increase, and his cries become high-pitched and nasal. When he is comfortable and relaxed however the noises he makes are low-pitched and not nasal because the muscles used for vocalizing are relaxed. This first differentiation in vocalizing is quickly discriminated by the people familiar with the baby, so that a rudimentary communication system operating on cries becomes established. Some months later, as the baby starts staying awake for longer stretches of time, long acoustic sequences develop, these are called vocalizations. More and more, the duration and the triggering of both these phonatory games as well as their characteristics depend on the nature of interactions with the milieu, especially with the mother. The third kind of communicative exchange—prosodic images, then phonological images and, finally, the lexical images proper to speech—structures itself progressively on these sorts of interactions.
The development of speech from vocalizations does not however exclude nonlinguistic vocalizations from the process of communication. Ricks (1975) has shown that exchanges by means of cries, far from disappearing, tend to increase. In an experiment as clever as it is simple, he asked mothers to listen to tape recordings of cries (made by babies in certain situations) and to try to identify their own child's cries as well as the context in which they were made. His results showed that the mothers had no trouble recognizing the situation in which the cries were made for all the babies. Thus, certain infant vocalizations have universal acoustic characteristics and form a system of communications with those around them. Montagner (1972) and Montagner, et al., (1974) examined another kind of communication. He showed that there is a system of communication that works on mimicry and gestures between children ranging in age from 18 months to 4 years. This type of communication uses ritualized acts, that is, behavioral sequences of postural, gestural, and mimicking elements that, in a precise context, communicate an unambiguous meaning for children of that age.

Available findings like these can be summed up in this way:

1. Starting from the moment of birth there is an initial type of communicative interaction going on between mother and child: a rhythmic exchange governed by the mother's voice, which seems to play an important role in the child's emotional development.

2. Little by little the infant develops types of behavior which the adult interprets and to which the adult reacts, either by something he does or something he says. The infant's behavior operates with signals, whether they are cries, gestures, mimicry, or vocalizations (Weir, 1962).

3. The adults around the baby, who speak to him in a certain way, usually without cries or gestures, reinforce the vocal productions he makes that seem nearest to their own productions, that is his vocalizations. Aided by this feedback infant vocalizations develop a great deal and, at the moment when imitation starts, it is with these vocalizations that the child constructs his first phonological oppositions and his first verbal signifiers.

The Appearance of Speech

Between the ages of 12 and 16 months (approximately), the number of acoustic images at the child's disposal for communicating increases, and they become associated with his needs being satisfied, as do the vocal productions of the people around him. His voice now works as a means of satisfying some of his expectations. At the same time, on a strictly representational level, the child is busy elaborating a certain way of understanding the world. He is developing the ability to stabilize contents and he can evoke absent realities by using permanent images.

Speech appears in children, as Vygotsky has said, as the result of the merging of these two evolutions: representative constructions (for example the idea of /dog/) are incorporated in communicative schemes. The child finds a correspondence between the acoustic images elaborated from adult speech and the content images (like/dog/); that is he applies to his own individual representations a sound-context correspondence that previously he had been making only on a communicative level. Adults around him reinforce the correspondences he makes, thus the child gradually leaves personal evocation behind for social evocation. He becomes aware not only that he can evoke something that is not there, but also that an adult can do it too. It is this sharing of evocations that permits the child to adopt the social conventions on which language is founded.

THE ROLE OF LANGUAGE IN THE CHILD'S LATER DEVELOPMENT

The Different Positions

The Piagetian position does not give language a privileged status. Human beings are seen as distinctive basically due to their cognitive equipment, which enables them to construct successive levels of operatory structures and systems of signifiers that correspond to them. Language is only one system of signifiers among others. For Piaget language is neither necessary nor sufficient for the development of thought. (The point commonly brought up in this respect is that in many areas the deaf have a level of cognitive development that is the same as that of those who can hear).

In the Piagetian perspective it makes no sense to talk about interactions between language and other types of behavior. More precisely, the ideas of self-regulation through one's own speech is necessarily circuitous or senseless. Constructionists maintain that language cannot influence either development or actions. The evolution of language follows that of the operatory structures; symbols and signs simply happen to be particularly good for representing the highly elaborate operations of formal thought (see especially Piaget, 1964/1967; Sinclair, 1971; and Duckworth, 1973).

For Wallon (1941) not only the intellectual aspects, but also the emotional and sociocommunicative sides of development, must be taken into consideration in order to explain language completely. Social structures act on the child, not by creating ready-made attitudes and feelings, but by gradually integrating the subject's structures of thought. As Wallon puts it, "the social amalgamates the organic" (1941, p. 134). Thus when speech appears, it is the result of both intellectual and social development, and it uses them both. Wallon continues:
The Piagetian Concept of Representation

Vygotsky-Luria position then assumes an initial state $E_1$ in which adult speech exercises (by its impulse and meaning) a control on the subject's behavior. This state is followed by two others. First $E_2$ develops from $E_1$, that is, an initially external regulation gives way to regulations made by the impulse aspect of the vocal characteristics of children's productions. This is the first transfer of regulation ($T_1$). Next, internal control ($E_3$) is replaced by a regulation made by the semantic aspects of the subject's language ($E_5$). This second transfer ($T_2$) coincides with language's internalization.

Luria put together a good amount of experimental data to support these hypotheses. In a first series of research projects, he showed that adult language exercised an influence on motor behavior in children at a very early age. From the age of about 18 months on, vocal productions made around children had the effect of reducing certain stereotyped kinds of behavior or certain perseverative actions (see Lyublinskaya's experiments in particular, 1957). A second kind of experiment has also confirmed the existence of this initial $E_1$ stage by means of a technique perfected by Ivanov-Smolenskii. A young child is given a rubber bulb that is designed to record all presses. Each time an adult tells the child to press, he is supposed to do so. The youngest subjects however press regardless of whether the order is "Press," or "Don't press." This negative understanding of certain orders lasts only up to the age of around 2½ years. At this point adult language-control on children's behavior seems to be well established. To examine the transfer from external control ($E_2$) to internal regulation ($E_3$ and $E_5$), a more complex experimental situation is necessary. Using a verbal order, like "Press when you see a light go on.", the experimenter asks the child to do something simple (one reaction for one stimulus) or complex (several reactions for a single stimulus or even one reaction for only certain subcategories of the stimulus). According to Luria a 3-year-old is incapable of doing such tasks, for even simple coordinations between stimulus and reaction break down rapidly. To maintain these coordinations the subject himself must say something. Thus if children aged 3½ years or more give the pertinent verbal orders themselves ("Press, press, and so on") each time the stimulus occurs, they manage to coordinate their motor reaction with the stimulus. It is indeed an intervention made by the child's language that insures success in performance on the task, but this intervention is not semantic. Whether the verbal reactions are positive or negative ("Press," or "Don't press."), they always provoke a motor reaction. In Luria's description, state $E_3$ is characterized by this regulation of behavior by the impulse aspect of the motor or vocal feature of language. The final stage ($E_5$) is not observed until age 5 or later. Here the verbal reactions play a semantic role. Discrimination tasks are executed perfectly (for example, pushing a green light goes on, not pushing when a blue one goes on).

Luria, like a good many other Russian psychologists, is frequently vague about his experimental techniques, his methodology, and sometimes even
about the theoretical references made in his interpretations. Analyzing and redoing his experiments is thus no easy task. The first experiments done to repeat his work (Joynt and Cambourne, 1968; Miller, Shelton, and Flavell, 1970; Wilder, 1969) led to mostly negative results. However, Wozniak (1972) questioned them on methodological and theoretical grounds. To put it briefly: the phenomenon of regulation did not belong to the area of verbal mediation as the persons who repeated the experiments thought, but rather were a kind of inhibition. At the same time other results were published (Bronckart, 1970; Rondal, 1973, 1975; and Beaudichon, Legros, and Oleron 1973), which confirmed beyond a doubt Luria's description of the existence of a regulator of the impulsive (motor or vocal) aspects of speech between the ages of 3½ and 5 years.

What Luria's Experiments Show

It seems to us that Luria's findings cannot be interpreted without checking certain elementary facts about his experiments. The analysis that Luria put forth in 1961 is based on several implicit hypotheses that need to be tested and made explicit. The most important hypothesis of Luria's implicit ones has to do with the verbal orders given to the children. Luria apparently did not see any problem in the children's understanding a sentence like "Press the bulb when you see the red light go on." As Bronckart (1973) stressed earlier, this hypothesis is, at best, open to argument. Even if one admits that a 3-year-old can understand such an order, one runs into a situation where an order is understood but not followed. Luria in his study tries to show that the successful performance does not stem from the order given by the experimenter, but from the vocal productions of the child himself. This sort of analysis, in our eyes, demands some basic experimental control: for each task a silent experiment must be made in order to see at what moment the adult order is understood and acted upon without the children saying anything.

Luria's second implicit hypothesis can be formulated as follows: between the ages of 3 and 6, the coordination of visual stimulus with verbal reaction appears before the coordination of visual stimulus and motor reaction. The children's verbal productions ("Press." "Go on." "Don't press." and so on) actually have a regulatory effect on motor reactions in that they are themselves shaped by the stimulus. This second implicit hypothesis is extremely daring and must be interpreted very carefully. A second experimental control study is then necessary to check the subject's capacities for coordinating visual stimulus and verbal reactions systematically for each experiment.

Experiments carried out between 1967 and 1969 notably used the two controls just mentioned (Bronckart, 1969, 1970, 1973). The technique developed for this series of experiments was adopted by Rondal (1973, 1975). Four important points issued from these studies:

1. Adult language (E1) definitely has a regulatory role. It can elicit a simple motor reaction from the age of 1½ on, inhibit it from the age of 2½ on, and regulate a motor reaction to a visual stimulus from the age of about 3½ on. These regulations however depend on the semantic aspects of adult speech.

2. There was no evidence that the semantic aspects of children's speech (E2) regulate their motor behavior. At the period where their verbal reactions ("I'm going to press twice." "I don't press.") are followed by the right motor reactions, the children did better under silent conditions. An order given by the adult is therefore enough to explain good performances.

3. Luria's technique, which was to ask the subject to make both a verbal reaction and a motor reaction when the stimulus appeared, complicated an already complex task. This had the general effect of worsening the motor performance (Bronckart, 1970). Between the ages of 3½ and 4½, however, in certain experimental paradigms, the coordination of the visual stimulus and the verbal reaction preceded that of the visual stimulus and the motor reaction. In this case the verbal reaction had a positive effect on motor performance.

4. The effect the verbal reaction can have on the motor reaction is particularly of a rhythmic nature (Cf. Zivin, 1976; Harris, 1976).

What can be concluded from these findings? Luria's attempts to validate his position are a failure inasmuch as the existence of the two later stages of transfer of regulations was not proved. As far as T1 is concerned, it is certain that the state E1 (regulation by nonsemantic aspects of language) exists, but Luria himself has stressed (1961, 1963) that this is not the only or the most efficient mode of nonsemantic regulation; there is also no evidence that it develops directly from external regulation. As for T2, there is no data pointing to the existence of the final state E2.

In our opinion this lack of proof does not jeopardize Vygotsky's developmental hypothesis, which is without a doubt one of the most important ones in contemporary psychology and one to which we adhere. Our reservations concern Luria's interpretation of Vygotsky's position and the choice of the technique of pressing a rubber bulb. As Luria has reformulated Vygotsky on the transfer of regulations, it seems that during its first transfer, language loses its semantic characteristics. According to Luria, when the adult exercises control on the child's motor behavior, he does so by meanings that are understood by the child (at least after the age of 2): "Press." "Press when you see the light." "Don't press." and so on. When the child takes over the regulation of his actions by himself, the meaning of the words spoken no longer plays any role. This disappearance of meaning seems quite unlikely from the theoretical point of view. It also makes us skeptical about the possibility of establishing any relation (and thus a connection) between external regulation by the
meaning and internal regulation by the impulse side of speech.

From a methodological point of view, the choice of the rubber bulb technique seems to us unfortunate. Let us cite, as an example of the problem it poses, the simplest possible experimental paradigm. The experimenter asks the child to keep his hand on the rubber bulb and to press each time the light appears. Three- and 4-year-olds manage to press on the bulb right from the first stimuli but, very quickly, perseverative pressures show up which finally completely disturb the stimulus-reaction coordination. The child’s production of verbal reactions (“I press,” or “Go on.”) at the appearance of each stimulus eliminates these perseverative reactions, and that is why we talk about regulation by speech.

The problem here is to know what the status of the intermediary reactions is. According to Wozniak, they are explained by “certain other compelling classes of non-verbal signals, such as tactile stimulation of the palm” (1972, p.17). Have we here a general characteristic of motor development? Or at least a characteristic that can be generalized? Or is it simply an incidental effect due to the type of material used? These are the questions we shall now examine.

Rhythm and Language
While Luria’s approach is open to criticism, there unquestionably exist certain phenomena of regulation by the impulsive aspects of speech. Three types of results serve to prove this point:

1. When children are asked to press twice when they receive the stimulus and are also asked to make any verbal response at all—not only “Press-press”, but also “Bam-bam”, “Sing-sing”, or “Tou-tou.” (Bronckart, 1970; Tikhomirov, 1958/1975)—their motor performance between the ages of 3 and 4 is better than when no such instructions are given.

2. In the same situation when children are asked to give a long verbal response (like “I shall press twice.”), this utterance has no regulating effect at all. The subjects either press just once or several times (Tikhomirov, 1958/1975).

3. Many times this verbal order elicited three motor reactions instead of two; in this case the verbal response was broken up into three parts (“twice/press/press” or “I/press/two.”) (Bronckart, 1970; Tikhomirov, 1958/1975).

These effects of the introduction of speech have been interpreted in different ways. Luria, from the viewpoint of neuropsychology that he develops, sometimes maintains that, “regulatory influence in our experiments proceeds ... from the direct impelling or initiating action of the speech itself” (1961, p. 95). Still he usually sees verbal stimuli rather as having an inhibitory effect, a view that is shared by Wozniak in his discussion of the disappearance of perseverating reactions.

Most western authors who have carried out replication experiments stress the correspondence between the number of verbal responses and the number of motor reactions; they maintain that vocal emissions reinforce motor behavior that has the same rhythm (Bronckart, 1970). Wozniak (1976), Zivin (1976), Harris (1976), and others emphasize this rhythmic coordination and consider it the basic mechanism involved in regulation. For them the rhythms of vocal productions have a special role as an integrator from the moment the processes of autoregulation set in, thus permitting a reinterpretation of most of Luria’s findings.

How then do these authors define rhythm? Wozniak talks about a “mechanism of structural regulation” and of “temporal organization” (1976). Harris uses the term of rhythm “for the general case to describe the organization of particular sequences or pulses or beats in ongoing activity” (1976). Martin (1972) defines rhythmic patterns as “event sequences in which some events (elements) are marked from others; for example loud, sound, versus soft, ... sound....” He calls the marked elements “accents.” The accents occur with some regularity, regardless of tempo. Zivin (1976) sees rhythm as “patterns of onsets and durations.”

A comparison of these definitions show that some speak of a mechanism while others talk about an organization, a pattern, or a series of separate events. Thus in certain cases rhythm is considered as a process, in others as a structure resulting from the working of a process. We think that it is important to know what role rhythm is considered to play in human development by psychologists not particularly interested in language, but interested in rhythm.

There is a huge literature on rhythm extending over several centuries. It includes phenomena outside the sphere of human activity, such as seasonal and diurnal rhythms. To narrow down the problem however, we shall concentrate on psychological rhythm. Philosophers were the first to examine the idea of rhythm. Plato offered an interesting definition of it as, “order in movement” (Laloy, 1904). A century ago Meumann (1894) thought of it as, “an emotion which discharges itself in ordered movements.” With the birth of experimental psychology, Wundt (1911) and Pavlov (1927) became interested in the subject. For the Gestaltists rhythm was a privileged subject of investigation, since it was considered a good form, or “Gestaltverkettung” (Werner, 1919). More recently Fraisse has done long studies on the “periodicity and structure” of rhythm, where periodicity is considered to be a succession of appearances and disappearances of a stimulation” (1956).

Psychologists have mainly studied physiological rhythm, like cardiac and respiratory rhythm. Using these models they have stressed the importance of parameters like repetition, periodicity, accent, and the regularity of separate events. It is the product or result of a rhythmic movement that has more often
held their attention, not so much the movement itself. Rhythm is necessarily related to some kind of movement. Movement implies activity, which is essential to an organism. It is also where psychological behavior begins.

In order to say whether or not rhythm is a fundamental mechanism for behavioral organization, let us first look at where the phenomenon exists outside physiological rhythms. Starting from birth, movements begin organizing themselves in children, first as reflexes. All bodily activity organizes itself according to what Piaget calls the circulatory reflex: the fact that a movement repeats itself explains why it becomes stable. In this way too, very simple structures, like seizing an object or walking, develop. In additional organizations much more complex are similarly elaborated in 4- or 5-year-olds, for example tying shoelaces. Piaget describes this development as initial sensorimotor schemes that are “made up of rhythmical structures” and are observable in all organisms as spontaneous, global movements.

If it is true that rhythm underlies all movement organized temporarily, it can also be an activity in itself which has its own development. Thus at the age of 2 children can imitate a regular pattern like ..., beating time with two sticks, at the age of 3 children can imitate this kind of rhythm: ... ... ... ; at the age of 4: ... ... ... ; and at the age of 5: y. y. y. (one strong beat and one weak one) (Leibold 1936). Making rhythm is the purpose of the activity in such imitative behavior, whereas it is the apparent byproduct or form in the spontaneous sensorimotor behavior mentioned earlier.

From a rhythmical point of view, everything related to the organs of speech at a very early stage becomes functional for language sharing. Beginning with the first cries, a rhythm basically related to that of the baby’s respiration can be observed. The first sounds, phonemes, and syllables develop by circular reaction. Very early, before the age of 2, stresses in intonation can be observed, although the same sort of variation in manual manipulation can be observed only at a much later date.

All rhythmic variations are closely related to the physiological and muscular rhythms of all the organs involved in phonation (tongue, glottis, lips, and so on). Harris (1976) distinguishes between four levels of rhythm in speech: pace, stress, intonation, and meter. But rhythmic productions at the speech level are even richer in variation. (One could also mention, for example quality of tone and duration.) Thus, at the level of speech, we are faced with a complex interweaving of different phonetic activities that have wide variations. One function of rhythm, so developed at the level of speech, is for the sake of communication. Vocal language has a great range of different rhythmic nuances.

Another common phenomenon in the regulatory role rhythm plays is its imposing the movement of one activity on another activity. Everyday examples can be found in music which makes people dance the work songs to whose rhythm slaves worked in pre-Civil-War America. This type of synchronization however is not natural and is the result of learning. Thus children of 3 cannot yet keep time to music.

It is our opinion that autoregulation can occur only between two motor systems, one of which is more developed than the other. The overdevelopment of speech might explain the effect of rhythmic regulation observed by Luria (as he implied in 1961) insofar as the more developed system (speech) took over for the less developed one (manual dexterity). There are numerous illustrations of this phenomenon in child development research.

Nevertheless the situations in which this autoregulation can take place are very rare. First of all, the rhythm must be extremely simple or else the task will be too difficult. What is more, as Zivin notes (1976), “speech can organize motor acts, not [that] it must.” Finally it must be observed that language is only one among several means of regulation. In certain of his experiments, Tikhomirov (1958/1975) replaced verbal responses by sound stimuli, serving as a kind of orienting reinforcement. He observed that the sound signals or an exteroceptive afferration, had an effect identical to impulsive speech signals. In certain other experiments he even concluded that “this kind of regulation is often more developed than that effected by means of supplementary speech impulses” (1975). The regulation of an activity by the rhythmic aspects of another activity is thus a rather universal, but infrequent, phenomenon. The intervention of language, which has the effect of doing away with perseverating responses, must be seen in the context of this general development of motor interactions. There is no way it can be used to test the validity of Vygotsky’s general developmental theory.

CONCLUSION

In this chapter we have tried first of all to compare Piaget’s and Vygotsky’s positions on the nature of language, how children acquire it, and the general role it plays in development. We have shown that the central concept underlying the Piagetian position in this area is that of representation or symbolic function. The ability to make representations is only one stage in a subject’s operatory development, a process characterized essentially by its functional continuity, that is, by the recursive working of certain cognitive mechanisms whose roots are biological. Following the unfolding of his evolution, the individual constructs mental images first, then symbols, and finally verbal signs. The creation of these signifiers cannot be separated from cognitive activity itself and thus language can have no special influence on other intellectual or motor functions. According to this view speech is basically an individual representative construction and only secondarily a social
and communicative one. It is not at all a mechanism for regulating one's own motor behavior, such regulation comes from general cognitive activity.

As Vygotsky shows in his book, *Thought and Language*, his differences from Piaget are of an epistemological nature. Like Wallon, Vygotsky refuses to see man as the result of an evolution which is primarily biological and only secondarily social. On an ontogenetic level he suggests that there are two developmental roots, one representational, the other communicative. Language then results when the two merge. In this same perspective we analyzed communicative as well as representational schemes in the period which precedes the appearance of speech. The data on communicative schemes that we cited seem to bring out the importance of rhythmic and vocal factors in the establishment of the first interpersonal relations. For Vygotsky when language appears, it immediately conveys the group's social and historical meanings; the individual child internalizes these meanings with time, and verbalizable thought comes out of this progressive internalization. We take the liberty of emphasizing that there is no place in this conception for nonsemantic speech and that the onset of speech in no way does away with the evolution of representational and communicative schemes (or to be more precise, of strictly representational and strictly communicative schemes). They continue to develop and interact with each other.

This analysis comparing Piaget's and Vygotsky's positions has shown certain things missing in the Piagetian conception, which is centered too exclusively on representation. It has also allowed us to reinterpret results found by Luria and those who have replicated his experiments in the area of verbal regulation.

As soon as the child can reproduce adult speech, a certain type of conventional exchange is established (see Figure 1) by the connection of AL and CL through CC. By developing these exchanges, the child can enlarge his processes of verbal comprehension (CR) and make sense of orders given by the experimenter. The good performances observed in the experiments made with a silent control resulted from this understanding of adult language.

The two transitions imagined by Luria consist in going from the intervention by adult language (understanding AL) first to a regulation by the child's communicative schemes (CC) and then to a regulation by the child's own speech (CL). This return to the communicative schemes, seen as a necessary transitional step between intervention by adult speech and then by children's speech, seems to us incompatible with Vygotsky's view of development, particularly with this idea that language is semantic the instant it makes its appearance in the child.

Phenomenon of self-regulation by rhythm cannot be used as proof for the general hypothesis of an evolution from adult meanings to children's meanings in the development of thought. For us the explanation for these phenomena lies in the context of one single communicative strand that evolves with time. Indeed from birth onwards vocal interactions, especially their rhythmic characteristics, play an important part in the baby's emotional and social development. First one can see that adult productions control some of the baby's behavior. Later as vocalizations develop, the baby's vocal and rhythmic productions greatly increase and diversify. It is very likely that the rhythmic structuralization of vocal productions is much more developed than that of delicate movements in young children. The noticeable difference from ages 3 to 4 between the coordination of visual stimulus and verbal reaction and that of visual stimulus and motor reaction (see particularly Bronckart 1970) argues for this likelihood. This difference would explain how, when sounds are organized rhythmically, they "bring about" rhythmically organized motor activity.

Results obtained on rhythmic activity by Luria and confirmed by Thikomirov (1958/1975), Harris (1976), Zivin (1976), and Bronckart (1970) have to be analyzed in the light of interactions among rhythmic structures on the communicative strand and rhythmic structures of certain sensorimotor
organizations. In any case, momentary effects of overdeveloped rhythmic structures of human speech on the less developed rhythmic structures of motor reactions can be considered as a phase in the process of language internalization, which we see as an essentially social, and therefore semantic, phenomenon.

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