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Mind in Society

The Development of Higher Psychological Processes

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1

Tool and Symbol in Child Development

The primary purpose of this book is to characterize the uniquely human aspects of behavior, and to offer hypotheses about the way these traits have been formed in the course of human history and the way they develop over an individual's lifetime.

This analysis will be concerned with three fundamental issues: (1) What is the relation between human beings and their environment, both physical and social? (2) What new forms of activity were responsible for establishing labor as the fundamental means of relating humans to nature and what are the psychological consequences of these forms of activity? (3) What is the nature of the relationship between the use of tools and the development of speech? None of these questions has been fully treated by scholars concerned with understanding animal and human psychology.

Karl Stumpf, a prominent German psychologist in the early years of the twentieth century, based his studies on a set of premises completely different from those I will employ here.[1] He compared the study of children to the study of botany, and stressed the botanical character of development, which he associated with maturation of the whole organism.

The fact is that maturation per se is a secondary factor in the development of the most complex, unique forms of human behavior. The development of these behaviors is characterized by complicated, qualitative transformations of one form of behavior into another (or, as Hegel would phrase it, a transformation of quantity into quality). The conception of maturation as a passive process cannot adequately describe these complex phenomena. Nevertheless, as A. Gesell has aptly

pointed out, in our approaches to development we continue to use the botanical analogy in our description of child development (for example, we say that the early education of children takes place in a "kindergarten").[2] Recently several psychologists have suggested that this botanical model must be abandoned.

In response to this kind of criticism, modern psychology has ascended the ladder of science by adopting zoological models as the basis for a new general approach to understanding the development of children. Once the captive of botany, child psychology is now mesmerized by zoology. The observations on which these newer models draw come almost entirely from the animal kingdom, and answers to questions about children are sought in experiments carried out on animals. Both the results of experiments with animals and the procedures used to obtain these results are finding their way from the animal laboratory into the nursery.

This convergence of child and animal psychology has contributed significantly to the study of the biological basis of human behavior. Many links between child and animal behavior, particularly in the study of elementary psychological processes, have been established. But a paradox has now emerged. When the botanical model was fashionable, psychologists emphasized the unique character of higher psychological functions and the difficulty of studying them by experimental means. But this zoological approach to the higher intellectual processes—those processes that are uniquely human—has led psychologists to interpret the higher intellectual functions as a direct continuation of corresponding processes in animals. This style of theorizing is particularly apparent in the analysis of practical intelligence in children, the most important aspect of which concerns the child's use of tools.

PRACTICAL INTELLIGENCE IN ANIMALS AND CHILDREN

The work of Wolfgang Köhler is particularly significant in the study of practical intelligence.[3] He conducted many experiments with apes during World War I, and occasionally compared some of his observations of chimpanzees' behavior with particular kinds of responses in children. This direct analogy between practical intelligence in the child and similar response by apes became the guiding principle of experimental work in the field.

K. Buhler's research also sought to establish similarities between child and ape.[4] He studied the way in which young children grasp objects, their ability to make detours while pursuing a goal, and the manner in which they use primitive tools. These observations, as well as his experiment in which a young child is asked to remove a ring from a stick, illustrate an approach akin to Köhler's. Buhler interpreted the manifestations of practical intelligence in children as being of exactly the same type as those we are familiar with in chimpanzees. Indeed, there is a phase in the life of the child that Buhler designated the "chimpanzee age" (p. 48). One ten-month-old infant whom he studied was able to pull a string to obtain a cookie that was attached to it. The ability to remove a ring from a post by lifting it rather than trying to pull it sideways did not appear until the middle of the second year.[5] Although these experiments were interpreted as support for the analogy between the child and apes, they also led Buhler to the important discovery, which will be explicated in later sections, that the beginnings of practical intelligence in the child (he termed it "technical thinking"), as well as the actions of the chimpanzee, are independent of speech.

Charlotte Buhler's detailed observations of infants during their first year of life gave further support to this conclusion.[6] She found the first manifestations of practical intelligence took place at the very young age of six months. However, it is not only tool use that develops at this point in a child's history but also systematic movement and perception, the brain and hands—in fact, the child's entire organism. Consequently, the child's system of activity is determined at each specific stage (*both by the child's degree of organic development and by his or her degree of mastery in the use of tools.*)

K. Buhler established the developmentally important principle that the beginnings of intelligent speech are preceded by technical thinking, and technical thinking comprises the initial phase of cognitive development. His lead in emphasizing the chimpanzee-like features of children's behavior has been followed by many others. It is in extrapolating this idea that the dangers of zoological models and analogies between human and animal behaviors find their clearest expression. The pitfalls are slight in research that focuses on the preverbal period in the child's development, as Buhler's did. However, he drew a questionable conclusion from his work with very young children when he stated, "The achievements of the chimpanzee are quite independent of language and in the case of man, even in later life, technical thinking, or thinking in terms of tools, is far less closely bound up with language and concepts than other forms of thinking."[7]

Buhler proceeded from the assumption that the relationship between practical intelligence and speech that characterizes the ten-

month-old child remains intact throughout her lifetime. This analysis postulating the independence of intelligent action from speech runs contrary to our own findings, which reveal the integration of speech and practical thinking in the course of development.

Shapiro and Gerke offer an important analysis of the development of practical thinking in children based upon experiments modeled after Köhler's problem-solving studies with chimpanzees.[8] They theorize that children's practical thinking is similar to adult thought in certain respects and different in others, and emphasize the dominant role of social experience in human development. In their view, social experience exerts its effect through imitation; when the child imitates the way adults use tools and objects, she masters the very principle involved in a particular activity. They suggest that repeated actions pile up, one upon another, as in a multi-exposure photograph; the common traits become clear and the differences become blurred. The result is a crystalized scheme, a definite principle of activity. The child, as she becomes more experienced, acquires a greater number of models that she understands. These models represent, as it were, a refined cumulative design of all similar actions; at the same time, they are also a rough blueprint for possible types of action in the future.

However, Shapiro and Gerke's notion of adaptation is too firmly linked to a mechanical conception of repetition. For them, social experience serves only to furnish the child with motor schemas; they do not take into account the changes occurring in the internal structure of the child's intellectual operations. In their descriptions of children's problem solving, the authors are forced to note the "specific role fulfilled by speech" in the practical and adaptive efforts of the growing child. But their description of this role is a strange one. "Speech," they say, "replaces and compensates for real adaptation; it does not serve as a bridge leading to past experience but to a purely social adaptation which is achieved via the experimenter." This analysis does not allow for the contribution speech makes to the development of a new structural organization of practical activity.

Guillaume and Meyerson offer a different conclusion regarding the role of speech in the inception of uniquely human forms of behavior.[9] From their extremely interesting experiments on tool use among apes, they concluded that the methods used by apes to accomplish a given task are similar in principle and coincide on certain essential points to those used by people suffering from aphasia (that is, individuals who are deprived of speech). Their findings support my assumption that

speech plays an essential role in the organization of higher psychological functions.[10]

These experimental examples bring us full circle to the beginning of our review of psychological theories regarding child development. Buhler's experiments indicate that the practical activity of the young child prior to speech development is identical to that of the ape, and Guillaume and Meyerson suggest that the ape's behavior is akin to that observed in people who are deprived of speech. Both of these lines of work focus our attention on the importance of understanding the practical activity of children at the age when they are just beginning to speak. My own work as well as that of my collaborators is directed at these same problems. But our premises differ from those of previous investigators. Our primary concern is to describe and specify the development of those forms of practical intelligence that are specifically human.

RELATION BETWEEN SPEECH AND TOOL USE

In his classic experiments with apes Köhler demonstrated the futility of attempting to develop even the most elementary sign and symbolic operations in animals. He concluded that tool use among apes is independent of symbolic activity. Further attempts to cultivate productive speech in the ape have also produced negative results. These experiments showed once more that the purposive behavior of the animal is independent of any speech or sign-using activity.

The study of tool use in isolation from sign use is common in research work on the natural history of practical intellect, and psychologists who studied the development of symbolic processes in the child have followed the same procedure. Consequently, the origin and development of speech, as well as all other sign-using activity, were treated as independent of the organization of the child's practical activity. Psychologists preferred to study the development of sign use as an example of pure intellect and not as the product of the child's developmental history. They often attributed sign use to the child's spontaneous discovery of the relation between signs and their meanings. As W. Stern stated, recognition of the fact that verbal signs have meaning constitutes "the greatest discovery in the child's life."[11] A number of authors fix this happy "moment" at the juncture of the child's first and second year, regarding it as the product of the child's mental activity. Detailed examination of the *development of* speech and other forms of sign use was assumed to be unnecessary. Instead, it has routinely been as-

sumed that the child's mind contains all stages of future intellectual development; they exist in complete form, awaiting the proper moment to emerge.

Not only were speech and practical intelligence assumed to have different origins, but their joint participation in common operations was considered to be of no basic psychological importance (as in the work of Shapiro and Gerke). Even when speech and the use of tools were closely linked in one operation, they were still studied as separate processes belonging to two completely different classes of phenomena. At best, their simultaneous occurrence was considered a consequence of accidental, external factors.

The students of practical intelligence as well as those who study speech development often fail to recognize the interweaving of these two functions. Consequently, the children's adaptive behavior and sign-using activity are treated as parallel phenomena—a view that leads to Piaget's concept of "egocentric" speech.[12] He did not attribute an important role to speech in the organization of the child's activities, nor did he stress its communicative functions, although he was obliged to admit its practical importance.

Although practical intelligence and sign use can operate independently of each other in young children, the dialectical unity of these systems in the human adult is the very essence of complex human behavior. Our analysis accords symbolic activity a specific *organizing* function that penetrates the process of tool use and produces fundamentally new forms of behavior.

SOCIAL INTERACTION AND THE TRANSFORMATION OF PRACTICAL ACTIVITY

Based on the discussion in the previous section, and illustrated by experimental work to be described later, the following conclusion may be made: *the most significant moment in the course of intellectual development, which gives birth to the purely human forms of practical and abstract intelligence, occurs when speech and practical activity, two previously completely independent lines of development, converge.* Although children's use of tools during their preverbal period is comparable to that of apes, as soon as speech and the use of signs are incorporated into any action, the action becomes transformed and organized along entirely new lines. The specifically human use of tools is thus realized, going beyond the more limited use of tools possible among the higher animals.

Prior to mastering his own behavior, the child begins to master his surroundings with the help of speech. This produces new relations with the environment in addition to the new organization of behavior itself. The creation of these uniquely human forms of behavior later produce the intellect and become the basis of productive work: the specifically human form of the use of tools.

Observations of children in an experimental situation similar to that of Köhler's apes show that the children not only *act* in attempting to achieve a goal but also *speak*. As a rule this speech arises spontaneously and continues almost without interruption throughout the experiment. It increases and is more persistent every time the situation becomes more complicated and the goal more difficult to attain. Attempts to block it (as the experiments of my collaborator R. E. Levina have shown) are either futile or lead the child to "freeze up."

Levina posed practical problems for four- and five-year-old children such as obtaining a piece of candy from a cupboard. The candy was placed out of reach so the child could not obtain it directly. As the child got more and more involved in trying to obtain the candy, "egocentric" speech began to manifest itself as part of her active striving. At first this speech consisted of a description and analysis of the situation, but it gradually took on a "planful" character, reflecting possible paths to solution of the problem. Finally, it was included as part of the solution.

For example, a four-and-a-half-year-old girl was asked to get candy from a cupboard with a stool and a stick as possible tools. Levina's description reads as follows: (Stands on a stool, quietly looking, feeling along a shelf with stick.) "On the stool." (Glances at experimenter. Puts stick in other hand.) "Is that really the candy?" (Hesitates.) "I can get it from that other stool, stand and get it." (Gets second stool.) "No, that doesn't get it. I could use the stick." (Takes stick, knocks at the candy.) "It will move now." (Knocks candy.) "It moved, I couldn't get it with the stool, but the, but the stick worked."[13]

In such circumstances it seems both natural and necessary for children to speak while they act; in our research we have found that speech not only accompanies practical activity but also plays a specific role in carrying it out. Our experiments demonstrate two important facts:

(1) A child's speech is as important as the role of action in attaining the goal. Children not only speak about what they are doing; their speech and action are part of *one and the same complex psychological function*, directed toward the solution of the problem at hand.

(2) The more complex the action demanded by the situation and

the less direct its solution, the greater the importance played by speech in the operation as a whole. Sometimes speech becomes of such vital importance that, if not permitted to use it, young children cannot accomplish the given task.

These observations lead me to the conclusion that *children solve practical tasks with the help of their speech, as well as their eyes and hands.* This unity of perception, speech, and action, which ultimately produces internalization of the visual field, constitutes the central subject matter for any analysis of the origin of uniquely human forms of behavior.

To develop the first of these two points, we must ask: What is it that really distinguishes the actions of the speaking child from the actions of an ape when solving practical problems?

The first thing that strikes the experimenter is the incomparably greater *freedom* of children's operations, their greater independence from the structure of the concrete, visual situation. Children, with the aid of speech, create greater possibilities than apes can accomplish through action. One important manifestation of this greater flexibility is that the child is able to ignore the direct line between actor and goal. Instead, he engages in a number of preliminary acts, using what we speak of as instrumental, or mediated (indirect), methods. In the process of solving a task the child is able to include stimuli that do not lie within the immediate visual field. Using words (one class of such stimuli) to create a specific plan, the child achieves a much broader range of activity, applying as *tools* not only those objects that lie near at hand, *but searching for and preparing such stimuli as can be useful in the solution of the task, and planning future actions.*

Second, the practical operations of a child who can speak become much less impulsive and spontaneous than those of the ape. The ape typically makes a series of uncontrolled attempts to solve the given problem. In contrast, the child who uses speech divides the activity into two consecutive parts. She plans how to solve the problem through speech and then carries out the prepared solution through overt activity. Direct manipulation is replaced by a complex psychological process through which inner motivation and intentions, postponed in time, stimulate their own development and realization. This new kind of psychological structure is absent in apes, even in rudimentary forms.

Finally, it is decisively important that speech not only facilitates the child's effective manipulation of objects but also controls *the child's own behavior.* Thus, with the help of speech children, unlike apes, acquire the capacity to be both the subjects and objects of their own behavior.

Experimental investigation of the egocentric speech of children engaged in various activities such as that illustrated by Levina produced the second fact of great importance demonstrated by our experiments: *the relative amount of egocentric speech,* as measured by Piaget's methods, increases in relation to the difficulty of the child's task.[14] On the basis of these experiments my collaborators and I developed the hypothesis that children's egocentric speech should be regarded as the transitional form between external and internal speech. Functionally, egocentric speech is the basis for inner speech, while in its external form it is embedded in communicative speech.

One way to increase the production of egocentric speech is to complicate a task in such a way that the child cannot make direct use of tools for its solution. When faced with such a challenge, the children's emotional use of language increases as well as their efforts to achieve a less automatic, more intelligent solution. They search verbally for a new plan, and their utterances reveal the close connection between egocentric and socialized speech. This is best seen when the experimenter leaves the room or fails to answer the children's appeals for help. Upon being deprived of the opportunity to engage in social speech, children immediately switch over to egocentric speech.

While the interrelationship of these two functions of language is apparent in this setting, it is important to remember that egocentric speech is linked to children's social speech by many transitional forms. The first significant illustration of the link between these two language functions occurs when children find that they are unable to solve a problem by themselves. They then turn to an adult, and verbally describe the method that they cannot carry out by themselves. The greatest change in children's capacity to use language as a problem-solving tool takes place somewhat later in their development, when socialized speech (which has previously been used to address an adult) *is turned inward.* Instead of appealing to the adult, children appeal to themselves; language thus takes on an *intrapersonal function* in addition to its *interpersonal use.* When children develop a method of behavior for guiding themselves that had previously been used in relation to another person, when they organize their own activities according to a social form of behavior, they succeed in applying a social attitude to themselves. The history of the process of *the internalization of social speech* is also the history of the socialization of children's practical intellect.

The relation between speech and action is a dynamic one in the course of children's development. The structural relation can shift even during an experiment. The crucial change occurs as follows: At an

early stage speech *accompanies* the child's actions and reflects the vicissitudes of problem solving in a disrupted and chaotic form. At a later stage speech moves more and more toward the starting point of the process, so that it comes to *precede* action. It functions then as an aid to a plan that has been conceived but not yet realized in behavior. An interesting analogy can be found in children's speech while drawing (see also chapter 8). Young children name their drawings only after they have completed them; they need to see them before they can decide what they are. As children get older they can decide in advance what they are going to draw. This displacement of the naming process signifies a change in the function of speech. Initially speech follows actions, is provoked by and dominated by activity. At a later stage, however, when speech is moved to the starting point of an activity, a new relation between word and action emerges. Now speech guides, determines, and dominates the course of action; *the planning function of speech* comes into being in addition to the already existing function of language to reflect the external world.[15]

Just as a mold gives shape to a substance, words can shape an activity into a structure. However, that structure may be changed or reshaped when children learn to use language in ways that allow them to go beyond previous experiences when planning future action. In contrast to the notion of sudden discovery popularized by Stern, we envisage verbal, intellectual activity as a series of stages in which the emotional and communicative functions of speech are expanded by the addition of the planning function. As a result the child acquires the ability to engage in complex operations extending over time.

Unlike the ape, which Köhler tells us is "the slave of its own visual field," children acquire an independence with respect to their concrete surroundings; they cease to act in the immediately given and evident *space*. Once children learn how to use the planning function of their language effectively, their psychological field changes radically. A view of the future is now an integral part of their approaches to their surroundings. In subsequent chapters, I will describe the developmental course of some of these central psychological functions in greater detail.

summary

To summarize what has been said thus far in this section: The specifically human capacity for language enables children to provide for auxiliary tools in the solution of difficult tasks, to overcome impulsive action, to plan a solution to a problem prior to its execution, and to master their own behavior. Signs and words serve children first and foremost as a means of social contact with other people. The cognitive and communicative functions of language then become the basis of a

new and superior form of activity in children, distinguishing them from animals.

The changes I have described do not occur in a one-dimensional, even fashion. Our research has shown that very small children solve problems using unique mixtures of processes. In contrast with adults, who react differently to objects and to people, young children are likely to fuse action and speech when responding to both objects and social beings. This fusion of activity is analagous to syncretism in perception, which has been described by many developmental psychologists.

The unevenness I am speaking of is seen quite clearly in a situation where small children, when unable to solve the task before them easily, combine direct attempts to obtain the desired end with a reliance upon emotional speech. At times speech expresses the children's desires, while at other times it serves as a substitute for actually achieving the goal. The child may attempt to solve the task through verbal formulations *and* by appeals to the experimenter for help. This mixture of diverse forms of activity was at first bewildering; but further observations drew our attention to a sequence of actions that clarify the meaning of the children's behavior in such circumstances. For example, after completing a number of intelligent and interrelated actions that should help him solve a particular problem successfully, the child suddenly, upon meeting a difficulty, ceases all attempts and turns for help to the experimenter. Any obstacle to the child's efforts at solving the problem may interrupt his activity. The child's verbal appeal to another person is an effort to fill the hiatus his activity has revealed. By asking a question, the child indicates that he has, in fact, formulated a plan to solve the task before him, but is unable to perform all the necessary operations.

Through repeated experiences of this type, children learn covertly (mentally) to plan their activities. At the same time they enlist the assistance of another person in accordance with the requirements of the problem posed for them. The child's ability to control another person's behavior becomes a necessary part of the child's practical activity.

Initially this problem solving in conjunction with another person is not differentiated with respect to the roles played by the child and his helper; it is a general, syncretic whole. We have more than once observed that in the course of solving a task, children get confused because they begin to merge the logic of what they are doing with the logic of the same problem as it has to be solved with the cooperation of another person. Sometimes syncretic action manifests itself when children realize the hopelessness of their direct efforts to solve a problem. As in the example from Levina's work, children address the objects of their atten-

tion equally with words and sticks, demonstrating the fundamental and inseparable tie between speech and action in the child's activity; this unity becomes particularly clear when compared with the separation of these processes in adults.

In summary, children confronted with a problem that is slightly too complicated for them exhibit a complex variety of responses including direct attempts at attaining the goal, the use of tools, speech directed toward the person conducting the experiment or speech that simply accompanies the action, and direct, verbal appeals to the object of attention itself.

If analyzed dynamically, this alloy of speech and action has a very specific function in the history of the child's development; it also demonstrates the logic of its own genesis. From the very first days of the child's development his activities acquire a meaning of their own in a system of social behavior and, being directed towards a definite purpose, are refracted through the prism of the child's environment. The path from object to child and from child to object passes through another person. This complex human structure is the product of a developmental process deeply rooted in the links between individual and social history.

2

The Development of Perception and Attention

The linkage between tool use and speech affects several psychological functions, in particular perception, sensory-motor operations, and attention, each of which is part of a dynamic system of behavior. Experimental-developmental research indicates that the connections and relations among functions constitute systems that change as radically in the course of a child's development as do the individual functions themselves. Considering each function in turn, I will examine how speech introduces qualitative changes in both its form and its relation to other functions.

Köhler's work emphasized the importance of the structure of the visual field in organizing the ape's practical behavior. The entire process of problem solving is essentially determined by perception. In this respect Köhler had ample grounds for believing that these animals are bound by their sensory field to a much greater extent than adult humans. They are incapable of modifying their sensory field by means of voluntary effort. Indeed, it would probably be useful to view as a general law the dependence of all natural forms of perception on the structure of the sensory field.

However, a child's perception, because it is *human*, does not develop as a direct continuation and further perfection of the forms of animal perception, not even of those animals that stand nearest to humankind. Experiments conducted to clarify this problem led us to discover some basic laws that characterize the higher human forms of perception.

The first set of experiments concerned developmental stages of picture perception in children. Similar experiments describing specific aspects of young children's perception and its dependence on higher

4

Internalization of Higher Psychological Functions

When comparing the principles regulating unconditioned and conditioned reflexes, Pavlov uses the example of a telephone call. One possibility is for the call to connect two points directly via a special line. This corresponds to an unconditioned reflex. The other possibility is for the phone call to be relayed through a special, central station with the help of temporary and limitlessly variable connections. This corresponds to a conditioned reflex. The cerebral cortex, as the organ that closes the conditioned reflex circuit, plays the role of such a central station.

The fundamental message of our analysis of the processes that underlie the creation of signs (signalization) may be expressed by a more generalized form of the same metaphor. Let us take the case of tying a knot as a reminder or drawing lots as a means of decision making. There is no doubt that in both cases a temporary conditioned connection is formed, that is, a connection of Pavlov's second type. But if we wish to grasp the essentials of what is happening here, we are forced to take into consideration not only the function of the telephone mechanism but also of the operator who plugged in and thus connected the line. In our example, the connection was established by the person who tied the knot. This feature distinguishes the higher forms of behavior from the lower.

The invention and use of signs as auxiliary means of solving a given psychological problem (to remember, compare something, report, choose, and so on) is analogous to the invention and use of tools in one psychological respect. The sign acts as an instrument of psychological activity in a manner analogous to the role of a tool in labor. But this analogy, like any other, does not imply the identity of these similar

concepts. We should not expect to find *many* similarities with tools in those means of adaptation we call signs. What's more, in addition to the similar and common feature shared by the two kinds of activity, we see very essential differences.

Here we want to be as precise as possible. Leaning for support on the term's figurative meaning, some psychologists have used the word "tool" when referring to the indirect function of an object as the means for accomplishing some activity. Expressions such as "the tongue is the tool of thought" or "aides de memoire" are usually bereft of any definite content and hardly mean more than what they really are: simple metaphors and more colorful ways of expressing the fact that certain objects or operations play an auxiliary role in psychological activity.

On the other hand, there have been many attempts to invest such expressions with a literal meaning, to equate the sign with the tool. By erasing the fundamental distinction between them, this approach loses the specific characteristics of each type of activity and leaves us with one general psychological form of determination. This is the position adopted by Dewey, one of pragmatism's representatives. He defines the tongue as the tool of tools, transposing Aristotle's definition of the human hand to speech.

I wish it to be clear that the analogy between sign and tool that I propose is different from either of the approaches just discussed. The uncertain, indistinct meaning that is usually read into the figurative use of the word "tool" in no way eases the researcher's task. His task is to uncover the real relationship, not the figurative one, that exists between behavior and its auxiliary means. Should we conceive of thought or memory as being analogous to external activity? Do the "means of activity" simply play the indefinite role of supporting the psychological process that leans on them? What is the nature of this support? What in general does it mean to be a "means" of thought or of memory? Psychologists who so enjoy using these fuzzy expressions furnish us with no answer to these questions.

But the position of those psychologists who treat such expressions literally turns out to be even fuzzier. Concepts that have a psychological aspect but do not actually belong to psychology—such as "technique"—are psychologized without any grounds whatsoever. Equating psychological and nonpsychological phenomena is possible only if one ignores the essence of each form of activity, as well as the differences between their historic roles and nature. Distinctions between tools as a means of labor, of mastering nature, and language as a means of social intercourse

become dissolved in the general concept of artifacts or artificial adaptations.

We seek to understand the behavioral role of the sign in all its uniqueness. This goal has motivated our empirical studies of how both tool and sign use are mutually linked and yet separate in the child's cultural development. We have adopted three conditions as a starting point for this work. The first pertains to the analogy and common points of the two types of activity, the second clarifies their basic differences, and the third attempts to demonstrate the real psychological link existing between the one and the other, or at least to hint at its existence.

As we have already noted, the basic analogy between sign and tool rests on the mediating function that characterizes each of them. They may, therefore, from the psychological perspective, be subsumed under the same category. We can express the logical relationship between the use of signs and of tools using the schema in figure 4, which shows each concept subsumed under the more general concept of indirect (mediated) activity.

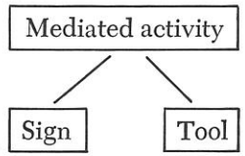

Figure 4

That concept, quite justly, was invested with the broadest general meaning by Hegel, who saw in it a characteristic feature of human reason: "Reason," he wrote, "is just as cunning as she is powerful. Her cunning consists principally in her mediating activity which, by causing objects to act and react on each other in accordance with their own nature, in this way, without any direct interference in the process, carries out reasons' intentions."[1] Marx cites that definition when speaking of working tools, to show that man "uses the mechanical, physical, and chemical properties of objects so as to make them act as forces that affect other objects in order to fulfill his personal goals."[2]

This analysis provides a sound basis for assigning the use of signs to the category of mediated activity, for the essence of sign use consists in man's affecting behavior through signs. In both cases the indirect (mediated) function comes to the forefront. I shall not define further the relation of these jointly subsumed concepts to each other, or their relation to the more generic concept of mediated activity. I should only

like to note that neither can, under any circumstance, be considered isomorphic with respect to the functions they perform, nor can they be seen as *fully* exhausting the concept of mediated activity. A host of other mediated activities might be named; cognitive activity is not limited to the use of tools or signs.

On the purely logical plane of the relation between the two concepts, our schema represents the two means of adaptation as diverging lines of mediated activity. This divergence is the basis for our second point. A most essential difference between sign and tool, and the basis for the real divergence of the two lines, is the different ways that they orient human behavior. The tool's function is to serve as the conductor of human influence on the object of activity; it is *externally* oriented; it must lead to changes in objects. It is a means by which human external activity is aimed at mastering, and triumphing over, nature. The sign, on the other hand, changes nothing in the object of a psychological operation. It is a means of internal activity aimed at mastering oneself; the sign is *internally* oriented. These activities are so different from each other that the nature of the means they use cannot be the same in both cases.

Finally, the third point pertains to the real tie between these activities and, hence, to the real tie of their development in phylo- and ontogenesis. The mastering of nature and the mastering of behavior are mutually linked, just as man's alteration of nature alters man's own nature. In phylogenesis we can reconstruct this link through fragmentary but convincing documentary evidence, while in ontogenesis we can trace it experimentally.

One thing is already certain. Just as the first use of tools refutes the notion that development represents the mere unfolding of the child's organically predetermined system of activity, so the first use of signs demonstrates that there cannot be a single organically predetermined internal system of activity that exists for each psychological function. The use of artificial means, the transition to mediated activity, fundamentally changes all psychological operations just as the use of tools limitlessly broadens the range of activities within which the new psychological functions may operate. In this context, we can use the term *higher* psychological function, or *higher behavior* as referring to the combination of tool and sign in psychological activity.

Several phases in the use of sign operations have been described thus far. In the initial phase reliance upon external signs is crucial to the child's effort. But through development these operations undergo radical changes: the entire operation of mediated activity (for example,

memorizing) begins to take place as a purely internal process. Paradoxically, late stages of the child's behavior appear to be the same as early stages of memorizing, which were characterized by a direct process. The very young child does not rely upon external means; rather he uses a "natural," "eidetic" approach. Judging only from external appearances, it seems that the older child has simply begun to memorize more and better; that she has somehow perfected and developed her old methods of memorizing. At the highest levels she appears to have abandoned any reliance upon signs. However, this appearance is only illusory. Development, as often happens, proceeds here not in a circle but in a spiral, passing through the same point at each new revolution while advancing to a higher level.

We call the internal reconstruction of an external operation *internalization*. A good example of this process may be found in the development of pointing. Initially, this gesture is nothing more than an unsuccessful attempt to grasp something, a movement aimed at a certain object which designates forthcoming activity. The child attempts to grasp an object placed beyond his reach; his hands, stretched toward that object, remain poised in the air. His fingers make grasping movements. At this initial stage pointing is represented by the child's movement, which seems to be pointing to an object—that and nothing more.

When the mother comes to the child's aid and realizes his movement indicates something, the situation changes fundamentally. Pointing becomes a gesture for others. The child's unsuccessful attempt engenders a reaction not from the object he seeks but *from another person*. Consequently, the primary meaning of that unsuccessful grasping movement is established by others. Only later, when the child can link his unsuccessful grasping movement to the objective situation as a whole, does he begin to understand this movement as pointing. At this juncture there occurs a change in that movement's function: from an object-oriented movement it becomes a movement aimed at another person, a means of establishing relations. *The grasping movement changes to the act of pointing*. As a result of this change, the movement itself is then physically simplified, and what results is the form of pointing that we may call a true gesture. It becomes a true gesture only after it objectively manifests all the functions of pointing for others and is understood by others as such a gesture. Its meaning and functions are created at first by an objective situation and then by people who surround the child.

As the above description of pointing illustrates, the process of internalization consists of a series of transformations:

(a) *An operation that initially represents an external activity is reconstructed and begins to occur internally*. Of particular importance to the development of higher mental processes is the transformation of sign-using activity, the history and characteristics of which are illustrated by the development of practical intelligence, voluntary attention, and memory.

(b) *An interpersonal process is transformed into an intrapersonal one*. Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, *between* people (*interpsychological*), and then *inside* the child (*intrapsychological*). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relations between human individuals.

(c) *The transformation of an interpersonal process into an intrapersonal one is the result of a long series of developmental events*. The process being transformed continues to exist and to change as an external form of activity for a long time before definitively turning inward. For many functions, the stage of external signs lasts forever, that is, it is their final stage of development. Other functions develop further and gradually become inner functions. However, they take on the character of inner processes only as a result of a prolonged development. Their transfer inward is linked with changes in the laws governing their activity; they are incorporated into a new system with its own laws.

The internalization of cultural forms of behavior involves the reconstruction of psychological activity on the basis of sign operations. Psychological processes as they appear in animals actually cease to exist; they are incorporated into this system of behavior and are culturally reconstituted and developed to form a new psychological entity. The use of external signs is also radically reconstructed. The developmental changes in sign operations are akin to those that occur in language. Aspects of external or communicative speech as well as egocentric speech turn "inward" to become the basis of inner speech.

The internalization of socially rooted and historically developed activities is the distinguishing feature of human psychology, the basis of the qualitative leap from animal to human psychology. As yet, the barest outline of this process is known.

6

Interaction between Learning and Development

The problems encountered in the psychological analysis of teaching cannot be correctly resolved or even formulated without addressing the relation between learning and development in school-age children. Yet it is the most unclear of all the basic issues on which the application of child development theories to educational processes depends. Needless to say, the lack of theoretical clarity does not mean that the issue is removed altogether from current research efforts into learning; not one study can avoid this central theoretical issue. But the relation between learning and development remains methodologically unclear because concrete research studies have embodied theoretically vague, critically unevaluated, and sometimes internally contradictory postulates, premises, and peculiar solutions to the problem of this fundamental relationship; and these, of course, result in a variety of errors.

Essentially, all current conceptions of the relation between development and learning in children can be reduced to three major theoretical positions.

The first centers on the assumption that processes of child development are independent of learning. Learning is considered a purely external process that is not actively involved in development. It merely utilizes the achievements of development rather than providing an impetus for modifying its course.

In experimental investigations of the development of thinking in school children, it has been assumed that processes such as deduction and understanding, evolution of notions about the world, interpretation of physical causality, and mastery of logical forms of thought and abstract logic all occur by themselves, without any influence from school

learning. An example of such a theory is Piaget's extremely complex and interesting theoretical principles, which also shape the experimental methodology he employs. The questions Piaget uses in the course of his "clinical conversations" with children clearly illustrate his approach. When a five-year-old is asked "why doesn't the sun fall?" it is assumed that the child has neither a ready answer for such a question nor the general capabilities for generating one. The point of asking questions that are so far beyond the reach of the child's intellectual skills is to eliminate the influence of previous experience and knowledge. The experimenter seeks to obtain the tendencies of children's thinking in "pure" form, entirely independent of learning.[1]

Similarly, the classics of psychological literature, such as the works by Binet and others, assume that development is always a prerequisite for learning and that if a child's mental functions (intellectual operations) have not matured to the extent that he is capable of learning a particular subject, then no instruction will prove useful. They especially feared premature instruction, the teaching of a subject before the child was ready for it. All effort was concentrated on finding the lower threshold of learning ability, the age at which a particular kind of learning first becomes possible.

Because this approach is based on the premise that learning trails behind development, that development always outruns learning, it precludes the notion that learning may play a role in the course of the development or maturation of those functions activated in the course of learning. Development or maturation is viewed as a precondition of learning but never the result of it. To summarize this position: Learning forms a superstructure over development, leaving the latter essentially unaltered.

2 The second major theoretical position is that learning *is* development. This identity is the essence of a group of theories that are quite diverse in origin.

One such theory is based on the concept of reflex, an essentially old notion that has been extensively revived recently. Whether reading, writing, or arithmetic is being considered, development is viewed as the mastery of conditioned reflexes; that is, the process of learning is completely and inseparably blended with the process of development. This notion was elaborated by James, who reduced the learning process to habit formation and identified the learning process with development.

Reflex theories have at least one thing in common with theories such as Piaget's: in both, development is conceived of as the elaboration and substitution of innate responses. As James expressed it, "Education,

in short, cannot be better described than by calling it the organization of acquired habits of conduct and tendencies to behavior."[2] Development itself is reduced primarily to the accumulation of all possible responses. Any acquired response is considered either a more complex form of or a substitute for the innate response.

But despite the similarity between the first and second theoretical positions, there is a major difference in their assumptions about the temporal relationship between learning and developmental processes. Theorists who hold the first view assert that developmental cycles precede learning cycles; maturation precedes learning and instruction must lag behind mental growth. For the second group of theorists, both processes occur simultaneously; learning and development coincide at all points in the same way that two identical geometrical figures coincide when superimposed.

The third theoretical position on the relation between learning and development attempts to overcome the extremes of the other two by simply combining them. A clear example of this approach is Koffka's theory, in which development is based on two inherently different but related processes, each of which influences the other.[3] On the one hand is maturation, which depends directly on the development of the nervous system; on the other hand is learning, which itself is also a developmental process.

Three aspects of this theory are new. First, as we already noted, is the combination of two seemingly opposite viewpoints, each of which has been encountered separately in the history of science. The very fact that these two viewpoints can be combined into one theory indicates that they are not opposing and mutually exclusive but have something essential in common. Also new is the idea that the two processes that make up development are mutually dependent and interactive. Of course, the nature of the interaction is left virtually unexplored in Koffka's work, which is limited solely to very general remarks regarding the relation between these two processes. It is clear that for Koffka the process of maturation prepares and makes possible a specific process of learning. The learning process then stimulates and pushes forward the maturation process. The third and most important new aspect of this theory is the expanded role it ascribes to learning in child development. This emphasis leads us directly to an old pedagogical problem, that of formal discipline and the problem of transfer.

Pedagogical movements that have emphasized formal discipline and urged the teaching of classical languages, ancient civilizations, and mathematics have assumed that regardless of the irrelevance of these

particular subjects for daily living, they were of the greatest value for the pupil's mental development. A variety of studies have called into question the soundness of this idea. It has been shown that learning in one area has very little influence on overall development. For example, reflex theorists Woodworth and Thorndike found that adults who, after special exercises, had achieved considerable success in determining the length of short lines, had made virtually no progress in their ability to determine the length of long lines. These same adults were successfully trained to estimate the size of a given two-dimensional figure, but this training did not make them successful in estimating the size of a series of other two-dimensional figures of various sizes and shapes.

According to Thorndike, theoreticians in psychology and education believe that every particular response acquisition directly enhances overall ability in equal measure.[4] Teachers believed and acted on the basis of the theory that the mind is a complex of abilities—powers of observation, attention, memory, thinking, and so forth—and that any improvement in any specific ability results in a general improvement in all abilities. According to this theory, if the student increased the attention he paid to Latin grammar, he would increase his abilities to focus attention on any task. The words "accuracy," "quick-wittedness," "ability to reason," "memory," "power of observation," "attention," "concentration," and so forth are said to denote actual fundamental capabilities that vary in accordance with the material with which they operate; these basic abilities are substantially modified by studying particular subjects, and they retain these modifications when they turn to other areas. Therefore, if someone learns to do any single thing well, he will also be able to do other entirely unrelated things well as a result of some secret connection. It is assumed that mental capabilities function independently of the material with which they operate, and that the development of one ability entails the development of others.

Thorndike himself opposed this point of view. Through a variety of studies he showed that particular forms of activity, such as spelling, are dependent on the mastery of specific skills and material necessary for the performance of that particular task. The development of one particular capability seldom means the development of others. Thorndike argued that specialization of abilities is even greater than superficial observation may indicate. For example, if, out of a hundred individuals we choose ten who display the ability to detect spelling errors or to measure lengths, it is unlikely that these ten will display better abilities regarding, for example, the estimation of the weight of objects. In the

same way, speed and accuracy in adding numbers are entirely unrelated to speed and accuracy in being able to think up antonyms.

This research shows that the mind is not a complex network of *general* capabilities such as observation, attention, memory, judgment, and so forth, but a set of specific capabilities, each of which is, to some extent, independent of the others and is developed independently. Learning is more than the acquisition of the ability to think; it is the acquisition of many specialized abilities for thinking about a variety of things. Learning does not alter our overall ability to focus attention but rather develops various abilities to focus attention on a variety of things. According to this view, special training affects overall development only when its elements, material, and processes are similar across specific domains; habit governs us. This leads to the conclusion that because each activity depends on the material with which it operates, the development of consciousness is the development of a set of particular, independent capabilities or of a set of particular habits. Improvement of one function of consciousness or one aspect of its activity can affect the development of another only to the extent that there are elements common to both functions or activities.

Developmental theorists such as Koffka and the Gestalt School—who hold to the third theoretical position outlined earlier—oppose Thorndike's point of view. They assert that the influence of learning is never specific. From their study of structural principles, they argue that the learning process can never be reduced simply to the formation of skills but embodies an intellectual order that makes it possible to transfer general principles discovered in solving one task to a variety of other tasks. From this point of view, the child, while learning a particular operation, acquires the ability to create structures of a certain type, regardless of the diverse materials with which she is working and regardless of the particular elements involved. Thus, Koffka does not conceive of learning as limited to a process of habit and skill acquisition. The relationship he posits between learning and development is not that of an identity but of a more complex relationship. According to Thorndike, learning and development coincide at all points, but for Koffka, development is always a larger set than learning. Schematically, the relationship between the two processes could be depicted by two concentric circles, the smaller symbolizing the learning process and the larger the developmental process evoked by learning.

Once a child has learned to perform an operation, he thus assimilates some structural principle whose sphere of application is other than just

the operations of the type on whose basis the principle was assimilated. Consequently, in making one step in learning, a child makes two steps in development, that is, learning and development do not coincide. This concept is the essential aspect of the third group of theories we have discussed.

ZONE OF PROXIMAL DEVELOPMENT: A NEW APPROACH

Although we reject all three theoretical positions discussed above, analyzing them leads us to a more adequate view of the relation between learning and development. The question to be framed in arriving at a solution to this problem is complex. It consists of two separate issues: first, the general relation between learning and development; and second, the specific features of this relationship when children reach school age.

That children's learning begins long before they attend school is the starting point of this discussion. Any learning a child encounters in school always has a previous history. For example, children begin to study arithmetic in school, but long beforehand they have had some experience with quantity—they have had to deal with operations of division, addition, subtraction, and determination of size. Consequently, children have their own preschool arithmetic, which only myopic psychologists could ignore.

It goes without saying that learning as it occurs in the preschool years differs markedly from school learning, which is concerned with the assimilation of the fundamentals of scientific knowledge. But even when, in the period of her first questions, a child assimilates the names of objects in her environment, she is learning. Indeed, can it be doubted that children learn speech from adults; or that, through asking questions and giving answers, children acquire a variety of information; or that, through imitating adults and through being instructed about how to act, children develop an entire repository of skills? Learning and development are interrelated from the child's very first day of life.

Koffka, attempting to clarify the laws of child learning and their relation to mental development, concentrates his attention on the simplest learning processes, those that occur in the preschool years. His error is that, while seeing a similarity between preschool and school learning, he fails to discern the difference—he does not see the specifically new elements that school learning introduces. He and others assume that the difference between preschool and school learning consists of non-

systematic learning in one case and systematic learning in the other. But "systematicness" is not the only issue; there is also the fact that school learning introduces something fundamentally new into the child's development. In order to elaborate the dimensions of school learning, we will describe a new and exceptionally important concept without which the issue cannot be resolved: the zone of proximal development.

A well known and empirically established fact is that learning should be matched in some manner with the child's developmental level. For example, it has been established that the teaching of reading, writing, and arithmetic should be initiated at a specific age level. Only recently, however, has attention been directed to the fact that we cannot limit ourselves merely to determining developmental levels if we wish to discover the actual relations of the developmental process to learning capabilities. We must determine at least two developmental levels.

The first level can be called the *actual developmental level*, that is, the level of development of a child's mental functions that has been established as a result of certain already *completed* developmental cycles. When we determine a child's mental age by using tests, we are almost always dealing with the actual developmental level. In studies of children's mental development it is generally assumed that only those things that children can do on their own are indicative of mental abilities. We give children a battery of tests or a variety of tasks of varying degrees of difficulty, and we judge the extent of their mental development on the basis of how they solve them and at what level of difficulty. On the other hand, if we offer leading questions or show how the problem is to be solved and the child then solves it, or if the teacher initiates the solution and the child completes it or solves it in collaboration with other children—in short, if the child barely misses an independent solution of the problem—the solution is not regarded as indicative of his mental development. This "truth" was familiar and reinforced by common sense. Over a decade even the profoundest thinkers never questioned the assumption; they never entertained the notion that what children can do with the assistance of others might be in some sense even more indicative of their mental development than what they can do alone.

Let us take a simple example. Suppose I investigate two children upon entrance into school, both of whom are ten years old chronologically and eight years old in terms of mental development. Can I say that they are the same age mentally? Of course. What does this mean? It means that they can independently deal with tasks up to the degree of difficulty that has been standardized for the eight-year-old level. If I

stop at this point, people would imagine that the subsequent course of mental development and of school learning for these children will be the same, because it depends on their intellect. Of course, there may be other factors, for example, if one child was sick for half a year while the other was never absent from school; but generally speaking, the fate of these children should be the same. Now imagine that I do not terminate my study at this point, but only begin it. These children seem to be capable of handling problems up to an eight-year-old's level, but not beyond that. Suppose that I show them various ways of dealing with the problem. Different experimenters might employ different modes of demonstration in different cases: some might run through an entire demonstration and ask the children to repeat it, others might initiate the solution and ask the child to finish it, or offer leading questions. In short, in some way or another I propose that the children solve the problem with my assistance. Under these circumstances it turns out that the first child can deal with problems up to a twelve-year-old's level, the second up to a nine-year-old's. Now, are these children mentally the same?

When it was first shown that the capability of children with equal levels of mental development to learn under a teacher's guidance varied to a high degree, it became apparent that those children were not mentally the same age and that the subsequent course of their learning would obviously be different. This difference between twelve and eight, or between nine and eight, is what we call *the zone of proximal development. It is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.*

If we naively ask what the actual developmental level is, or, to put it more simply, what more independent problem solving reveals, the most common answer would be that a child's actual developmental level defines functions that have already matured, that is, the end products of development. If a child can do such-and-such independently, it means that the functions for such-and-such have matured in her. What, then, is defined by the zone of proximal development, as determined through problems that children cannot solve independently but only with assistance? The zone of proximal development defines those functions that have not yet matured but are in the process of maturation, functions that will mature tomorrow but are currently in an embryonic state. These functions could be termed the "buds" or "flowers" of development rather than the "fruits" of development. The actual developmental level characterizes mental development retrospectively, while the zone of proximal development characterizes mental development prospectively.

The zone of proximal development furnishes psychologists and educators with a tool through which the internal course of development can be understood. By using this method we can take account of not only the cycles and maturation processes that have already been completed but also those processes that are currently in a state of formation, that are just beginning to mature and develop. Thus, the zone of proximal development permits us to delineate the child's immediate future and his dynamic developmental state, allowing not only for what already has been achieved developmentally but also for what is in the course of maturing. The two children in our example displayed the same mental age from the viewpoint of developmental cycles already completed, but the developmental dynamics of the two were entirely different. The state of a child's mental development can be determined only by clarifying its two levels: the actual developmental level and the zone of proximal development.

I will discuss one study of preschool children to demonstrate that what is in the zone of proximal development today will be the actual developmental level tomorrow—that is, what a child can do with assistance today she will be able to do by herself tomorrow.

The American researcher Dorothea McCarthy showed that among children between the ages of three and five there are two groups of functions: those the children already possess, and those they can perform under guidance, in groups, and in collaboration with one another but which they have not mastered independently. McCarthy's study demonstrated that this second group of functions is at the actual developmental level of five-to-seven-year-olds. What her subjects could do only under guidance, in collaboration, and in groups at the age of three-to-five years they could do independently when they reached the age of five-to-seven years.[5] Thus, if we were to determine only mental age—that is, only functions that have matured—we would have but a summary of completed development, while if we determine the maturing functions, we can predict what will happen to these children between five and seven, provided the same developmental conditions are maintained. The zone of proximal development can become a powerful concept in developmental research, one that can markedly enhance the effectiveness and utility of the application of diagnostics of mental development to educational problems.

A full understanding of the concept of the zone of proximal development must result in reevaluation of the role of imitation in learning. An unshakable tenet of classical psychology is that only the inde-

pendent activity of children, not their imitative activity, indicates their level of mental development. This view is expressed in all current testing systems. In evaluating mental development, consideration is given to only those solutions to test problems which the child reaches without the assistance of others, without demonstrations, and without leading questions. Imitation and learning are thought of as purely mechanical processes. But recently psychologists have shown that a person can imitate only that which is within her developmental level. For example, if a child is having difficulty with a problem in arithmetic and the teacher solves it on the blackboard, the child may grasp the solution in an instant. But if the teacher were to solve a problem in higher mathematics, the child would not be able to understand the solution no matter how many times she imitated it.

Animal psychologists, and in particular Köhler, have dealt with this question of imitation quite well.[6] Köhler's experiments sought to determine whether primates are capable of graphic thought. The principal question was whether primates solved problems independently or whether they merely imitated solutions they had seen performed earlier, for example, watching other animals or humans use sticks and other tools and then imitating them. Köhler's special experiments, designed to determine what primates could imitate, reveal that primates can use imitation to solve only those problems that are of the same degree of difficulty as those they can solve alone. However, Köhler failed to take account of an important fact, namely, that primates cannot be taught (in the human sense of the word) through imitation, nor can their intellect be developed, because they have no zone of proximal development. A primate can learn a great deal through training by using its mechanical and mental skills, but it cannot be made more intelligent, that is, it cannot be taught to solve a variety of more advanced problems independently. For this reason animals are incapable of learning in the human sense of the term: *human learning presupposes a specific social nature and a process by which children grow into the intellectual life of those around them.*

Children can imitate a variety of actions that go well beyond the limits of their own capabilities. Using imitation, children are capable of doing much more in collective activity or under the guidance of adults. This fact, which seems to be of little significance in itself, is of fundamental importance in that it demands a radical alteration of the entire doctrine concerning the relation between learning and development in children. One direct consequence is a change in conclusions that may be drawn from diagnostic tests of development.

Formerly, it was believed that by using tests, we determine the mental development level with which education should reckon and whose limits it should not exceed. This procedure oriented learning toward yesterday's development, toward developmental stages already completed. The error of this view was discovered earlier in practice than in theory. It is demonstrated most clearly in the teaching of mentally retarded children. Studies have established that mentally retarded children are not very capable of abstract thinking. From this the pedagogy of the special school drew the seemingly correct conclusion that all teaching of such children should be based on the use of concrete, look-and-do methods. And yet a considerable amount of experience with this method resulted in profound disillusionment. It turned out that a teaching system based solely on concreteness—one that eliminated from teaching everything associated with abstract thinking—not only failed to help retarded children overcome their innate handicaps but also reinforced their handicaps by accustoming children exclusively to concrete thinking and thus suppressing the rudiments of any abstract thought that such children still have. Precisely because retarded children, when left to themselves, will never achieve well-elaborated forms of abstract thought, the school should make every effort to push them in that direction and to develop in them what is intrinsically lacking in their own development. In the current practices of special schools for retarded children, we can observe a beneficial shift away from this concept of concreteness, one that restores look-and-do methods to their proper role. Concreteness is now seen as necessary and unavoidable only as a stepping stone for developing abstract thinking—as a means, not as an end in itself.

Similarly, in normal children, learning which is oriented toward developmental levels that have already been reached is ineffective from the viewpoint of a child's overall development. It does not aim for a new stage of the developmental process but rather lags behind this process. Thus, the notion of a zone of proximal development enables us to propound a new formula, namely that the only "good learning" is that which is in advance of development.

The acquisition of language can provide a paradigm for the entire problem of the relation between learning and development. Language arises initially as a means of communication between the child and the people in his environment. Only subsequently, upon conversion to internal speech, does it come to organize the child's thought, that is, become an internal mental function. Piaget and others have shown that reasoning occurs in a children's group as an argument intended

to prove one's own point of view before it occurs as an internal activity whose distinctive feature is that the child begins to perceive and check the basis of his thoughts. Such observations prompted Piaget to conclude that communication produces the need for checking and confirming thoughts, a process that is characteristic of adult thought.[7] In the same way that internal speech and reflective thought arise from the interactions between the child and persons in her environment, these interactions provide the source of development of a child's voluntary behavior. Piaget has shown that cooperation provides the basis for the development of a child's moral judgment. Earlier research established that a child first becomes able to subordinate her behavior to rules in group play and only later does voluntary self-regulation of behavior arise as an internal function.

These individual examples illustrate a general developmental law for the higher mental functions that we feel can be applied in its entirety to children's learning processes. We propose that an essential feature of learning is that it creates the zone of proximal development; that is, learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers. Once these processes are internalized, they become part of the child's independent developmental achievement.

From this point of view, learning is not development; however, properly organized learning results in mental development and sets in motion a variety of developmental processes that would be impossible apart from learning. Thus, learning is a necessary and universal aspect of the process of developing culturally organized, specifically human, psychological functions.

To summarize, the most essential feature of our hypothesis is the notion that developmental processes do not coincide with learning processes. Rather, the developmental process lags behind the learning process; this sequence then results in zones of proximal development. Our analysis alters the traditional view that at the moment a child assimilates the meaning of a word, or masters an operation such as addition or written language, her developmental processes are basically completed. In fact, they have only just begun at that moment. The major consequence of analyzing the educational process in this manner is to show that the initial mastery of, for example, the four arithmetic operations provides the basis for the subsequent development of a variety of highly complex internal processes in children's thinking.

Our hypothesis establishes the unity but not the identity of learning

processes and internal developmental processes. It presupposes that the one is converted into the other. Therefore, it becomes an important concern of psychological research to show how external knowledge and abilities in children become internalized.

Any investigation explores some sphere of reality. An aim of the psychological analysis of development is to describe the internal relations of the intellectual processes awakened by school learning. In this respect, such analysis will be directed inward and is analogous to the use of x-rays. If successful, it should reveal to the teacher how developmental processes stimulated by the course of school learning are carried through inside the head of each individual child. The revelation of this internal, subterranean developmental network of school subjects is a task of primary importance for psychological and educational analysis.

A second essential feature of our hypothesis is the notion that, although learning is directly related to the course of child development, the two are never accomplished in equal measure or in parallel. Development in children never follows school learning the way a shadow follows the object that casts it. In actuality, there are highly complex dynamic relations between developmental and learning processes that cannot be encompassed by an unchanging hypothetical formulation.

Each school subject has its own specific relation to the course of child development, a relation that varies as the child goes from one stage to another. This leads us directly to a reexamination of the problem of formal discipline, that is, to the significance of each particular subject from the viewpoint of overall mental development. Clearly, the problem cannot be solved by using any one formula; extensive and highly diverse concrete research based on the concept of the zone of proximal development is necessary to resolve the issue.