Lev Vygotsky

Mind and Society

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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. 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”). Recently several psychologists have suggested that this botanical model must be abandoned.

In response to this kind of criticism, modem 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 Koehler is particularly significant in the study of practical intelligence. 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. 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 Koehler'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. 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. 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."

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 Koehler's problem-solving studies with chimpanzees. 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 crystallized 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. 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.

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 Koehler 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." 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 assumed 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. 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 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 Koehler'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."

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. 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. 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.

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 Stem, 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 Koehler 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.

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 analogous 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 childrenÕs 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 attention 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 separations 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**.

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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 psychological mechanisms had been carried out earlier by Binet and analyzed in detail by Stern. Both authors found that the way small children describe pictures differs at successive developmental stages. A two-year-old usually limits his description to separate objects within the picture. Older

children describe actions and indicate the complex relations among the separate objects within the picture. Stern inferred from these observations that a stage when children perceive separate objects precedes the stage when they perceive actions and relations in addition to objects, that is, when they perceive the picture as a whole. However, many psychological observations suggest that the child's perceptual processes are initially fused and only later become more differentiated.

We resolved the contradiction between these two positions through an experiment replicating Stern's study of children's descriptions of pictures, in which we asked children to communicate the contents of a picture without using speech. We suggested that the description be made *in pantomime*. The two-year-old child, who according to Stern's schema is still at the separate "object" stage of development, perceived the dynamic features of the picture and reproduced them with ease through pantomime. What Stern regarded as a characteristic of the child's perceptual skills proved to be a product of the limitations of her *language development* or, in other words, a feature of her *verbalized perception.*

A series of related observations revealed that labeling is the primary function of speech used by young children. Labeling enables the child to choose a specific object, to single it out from the entire situation he is perceiving. Simultaneously, however, the child embellishes his first words with very expressive gestures, which compensate for his difficulties in communicating meaningfully through language. By means of words children single out separate elements, thereby overcoming the natural structure of the sensory field and forming new (artificially introduced and dynamic) structural centers. The child begins to perceive the world not only through his eyes but also through his speech. As a result, the immediacy of "natural" perception is supplanted by a complex mediated process; as such, speech becomes an essential part of the child's cognitive development.

Later, the intellectual mechanisms related to speech acquire a new function; verbalized perception in the child is no longer limited to labeling. At this next stage of development, speech acquires a synthesizing function, which in turn is instrumental in achieving more complex forms of cognitive perception. These

changes give human perception an entirely new character, quite distinct from the analogous processes in higher animals.

The role of language in perception is striking because of the opposing tendencies implicit in the nature of visual perception and language. The independent elements in a visual field are simultaneously perceived; in this sense, *visual perception is integral.* Speech, on the other hand, requires sequential processing. Each element is separately labeled and then connected in a sentence structure, *making speech essentially analytical.*

Our research has shown that even at very early stages of development, language and perception are linked. In the solution of nonverbal tasks, even if a problem is solved without a sound being uttered, language plays a role in the outcome. These findings substantiate the thesis of psychological linguistics as formulated many years ago by A. Potebnya, who argued for the inevitable interdependence between human thought and language.

A special feature of human perception — which arises at a very young age — is the *perception of real objects.* This is something for which there is no analogy in animal perception. By this term I mean that I do not see the world simply in color and shape but also as a world with sense and meaning. I do not merely see something round and black with two hands; I see a clock and I can distinguish one hand from the other. Some brain-injured patients say, when they see a clock, that they are seeing something round and white with two thin steel strips, but they do not know it is a clock; such people have lost their real relationship with objects. These observations suggest that all human perception consists of categorized rather than isolated perceptions.

The developmental transition to qualitatively new forms of behavior is not confined to changes in perception alone. Perception is part of a dynamic system of behavior; hence, the relation between transformations of perceptual processes and transformations in other intellectual activities is of primary importance. This point is illustrated by our studies on choice behavior, which show the changing relation

between perception and motor action in young children.

Studies of Choice Behavior in Children

We requested four- and five-year-old children to press one of five keys on a keyboard as they identified each one of a series of picture stimuli assigned to each key. Because this task exceeds the capabilities of the children, it causes serious difficulties and more intensive efforts to solve the problem. Perhaps the most remarkable result is that the entire process of selection by the child is *external,* and concentrated in the motor sphere, thus allowing the experimenter to observe the very nature of the choice process itself in the child's movements. The child does her selecting while carrying out whatever movements the choice requires.

The structure of the child's decision does not in the least resemble the adult process. Adults make a preliminary decision internally and subsequently carry out the choice in the form of a single movement that executes the plan. The child's choice resembles a somewhat delayed *selection among his own movements.* Vascillations in perception are directly reflected in the structure of movement. The child's movements are replete with diffuse gropings that interrupt and succeed one another. A mere glance at the chart tracing the child's movements is sufficient to convince one of the basic motor nature of the process.

The main difference between the choice processes in the child and in the adult is that for the child the series of tentative movements constitute the selection process. The child does not choose the *stimulus* (the necessary key) as the starting point for the consequent movement but rather selects the *movement,* using the instruction as a guide to check the results. Thus, the child resolves her choice not through a direct process of visual perception but through movement, hesitating between two stimuli, her fingers hovering above and moving from one key to another, going half-way and then coming back. When the child transfers her attention to a new location, thereby creating a new focus in the dynamic structure of perception, her hand obediently moves toward this new center, in unison with the eye. In short, movement is not

separated from perception: the processes coincide almost exactly.

In the behavior of the higher animals, visual perception forms part of a more complex whole in a similar way. The ape does not perceive the visual situation passively; a complex behavioral structure consisting of reflexive, affective, motor, and intellectual factors is directed toward acquiring the object that attracts it. The ape's movements constitute an immediate dynamic continuation of its perception. In human children, this early, diffusely structured response undergoes a fundamental change as soon as a more complex psychological function is utilized in the choice process. The natural process present in animals is then transformed into a higher psychological operation.

Subsequent to the experiment described above we attempted to simplify the task of selection by marking each key with a corresponding sign to serve as an additional stimulus that could direct and organize the choice process. The child was asked, upon the appearance of a target stimulus, to press the key marked with the corresponding sign. As early as age five or six the child is able to fulfill this task easily. The addition of this new ingredient radically changes the structure of the choice process. The elementary, "natural" operation is replaced by a new and more complicated one. The simpler task evokes a more complexly structured response. When the child attends to the auxiliary sign in order to find the key corresponding to the given stimulus, he no longer exhibits those motor impulses that arise directly from perception. There are no uncertain groping movements in the air such as we observed in the earlier choice reaction when auxiliary aids were not used.

The use of auxiliary signs breaks up the fusion of the sensory field and the motor system and thus makes new kinds of behavior possible. A "functional barrier" is created between the initial and final moments of the choice response; the direct impulse to move is shunted by preliminary circuits. The child who formerly solved the problem impulsively now solves it through an internally established connection between the stimulus and the corresponding auxiliary sign. The movement that previously had been the choice now serves only to fulfill the prepared operation. *The system of signs restructures the whole psychological process and enables the child to master her movement. It reconstructs the choice process on a totally new basis.*

Movement detaches itself from direct perception and comes under the control of sign functions included in the choice response. This development represents a fundamental break with the natural history of behavior and initiates the transition from the primitive behavior of animals to the higher intellectual activities of humans.

Attention should be given first place among the major functions in the psychological structure underlying the use of tools. Beginning with Köhler, scholars have noted that the ability or inability to direct one's attention is an essential determinant of the success or failure of any practical operation. However, the difference between the practical intelligence of children and animals is that children are capable of reconstructing their perception and thus freeing themselves from the given structure of the field. With the help of the indicative function of words, the child begins to master his attention, creating new structural centers in the perceived situation. As K. Koffka so aptly put it, the child is able to determine for herself the "center of gravity" of her perceptual field; her behavior is not regulated solely by the salience of individual elements within it. The child evaluates the relative importance of these elements, singling out new "figures" from the background and thus widening the possibilities for controlling her activities.

In addition to reorganizing the visual-spatial field, the child, with the help of speech, creates a time field that is just as perceptible and real to him as the visual one. The speaking child has the ability to direct his attention in a dynamic way. He can view changes in his immediate situation from the point of view of past activities, and he can act in the present from the viewpoint of the future.

For the ape, the task is unsolvable unless the goal and the object needed to reach it are both simultaneously in view. For the child, this gap is easily overcome by verbally controlling her attention and thereby reorganizing her perceptual field. The ape will perceive a stick one moment, but cease to pay attention to it after its visual field has changed and the goal comes into view. The ape must see his stick in order to pay attention to it; the child may pay attention in order to see.

Thus, the child's field of attention embraces not one but a whole series of potential

perceptual fields that form successive, dynamic structures over time. The transition from the simultaneous structure of the visual field to the successive structure of the dynamic field of attention is achieved through the reconstruction of the separate activities that are a part of the required operations. When this occurs, we can say that the field of attention has detached itself from the perceptual field and unfolded itself in time, as one component of a dynamic series of psychological activities.

The possibility of combining elements of the past and present visual fields (for instance, tool and goal) in one field of attention leads in turn to a basic reconstruction of another vital function, *memory.* (See chapter 3.) Through verbal formulations of past situations and activities, the child frees himself from the limitations of direct recall; he succeeds in synthesizing the past and present to suit his purposes. The changes that occur in memory are similar to those that occur in the child's perceptual field where centers of gravity are shifted and figure and ground relationship are altered. The child's memory not only makes fragments of the past more available, but also results in a *new method of uniting the elements of past experience with the present.*

Created with the help of speech, the time field for action extends both forward and backward. Future activity that can be included in an ongoing activity is represented by signs. As in the case of memory and attention, the inclusion of signs in temporal perception does not lead to a simple lengthening of the operation in time; rather, it creates the conditions for the development of a single system that includes effective elements of the past, present, and future. This emerging psychological system in the child now encompasses two new functions: *intentions and symbolic representations of purposeful action.*

This change in the structure of the child's behavior is related to basic alterations in the child's needs and motivations. When Lindner compared the methods by which deaf children solved tasks to the methods used by Köhler's ape, he noted that the motives guiding the ape and those guiding the child to achieve mastery of a goal were not the same. The "instinctive" urges predominating in the animal become secondary in the child. New motives, socially rooted and intense, provide the child with

direction. K. Lewin described these motives as *Quasi-Beduerfnisse* (quasi-needs) and argued that their inclusion in any given task leads to the reorganization of the child's whole affective and voluntary system. He believed that with the development of these quasi-needs, the child's emotional thrust is shifted *from a preoccupation with the outcome* to *the nature of the solution.* In essence, the "task" (*Aufgabe*) in experiments with apes exists only in the eyes of the experimenter; as far as the animal is concerned there exists only the bait and the obstacles standing in his way. The child, however, strives to solve the given problem and thus has an entirely different purpose. Because he is able to form quasi-needs, the child is capable of breaking the operation into its separate parts, each of which becomes an independent problem that he' formulates for himself with the help of speech.

In his excellent analysis of the psychology of purposeful activity, Lewin gives a clear-cut definition of voluntary activity as a product of the historical-cultural development of behavior and as a unique feature of human psychology. The fact that man displays extraordinary freedom with respect to even the most senseless intention is astounding in itself, he asserts. This freedom is incomparably less characteristic of children and probably of nonliterate humans, too. There is reason to believe that voluntary activity, more than highly developed intellect, distinguishes humans from the animals which stand closest to them.

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Mind and Society. Lev Vygotsky

Mastery of Memory and Thinking

In the light of what my collaborators and I had learned about the functions of speech in reorganizing perception and creating new relations among psychological functions, we undertook a broad study of other forms of sign-using activity in children in all its concrete manifestations (drawing pictures, writing, reading, using number systems, and so on). We also considered whether other operations not related to practical intellect would show the same laws of development we had discovered when analyzing practical intellect.

Several series of experiments carried out by my colleagues and myself dealt with these problems, and now, based on the data we obtained from them, we are able to describe in schematic form the basic laws that characterize the structure and development of the child's sign operations. These will be presented through a discussion of memory, which is exceptionally appropriate for study of the changes that signs introduce into basic psychological functions because it clearly reveals the social origin of signs as well as their crucial role in the individual's development,

Social Origins of Indirect (Mediated) Memory

A comparative investigation of human memory reveals that, even at the earliest stages of social development, there are two, principally different, types of memory. One, dominating in the behavior of nonliterate peoples, is characterized by the nonmediated impression of materials, by the retention of actual experiences as the basis of mnemonic (memory) traces. We call this *natural memory*, and it is clearly illustrated in E. R. Jaensch's studies of eidetic imagery. This kind of memory is very close to perception, because it arises out of the direct influence of external stimuli upon human beings. From the point of view of structure, the entire process is characterized by a quality of immediacy.

Natural memory is not the only kind, however, even in the case of nonliterate men and women. On the contrary, other types of memory belonging to a completely different developmental line coexist with natural memory. The use of notched sticks and knots, the beginnings of writing and simple memory aids all demonstrate that even at early stages of historical development humans went beyond the limits of the psychological functions given to them by nature and proceeded to a new culturally-elaborated organization of their behavior. Comparative analysis shows that such activity is absent in even the highest species of animals; we believe that these sign operations are the product of specific conditions of social development.

Even such comparatively simple operations as tying a knot or marking a stick as a reminder change the psychological structure of the memory process. They extend the operation. of memory beyond the biological dimensions of the human nervous system and permit it to incorporate artificial, or self-generated, stimuli, which we call *signs.* This merger, unique to human beings, signifies an entirely new form of behavior. The essential difference between it and the elementary functions is to be found in the structure of the stimulus-response relations of each. The central characteristic of elementary functions is that they are totally and directly determined by stimulation from the environment. For higher functions, the central feature is self-generated stimulation, that is, the creation and use of artificial stimuli which become the immediate causes of behavior.

Structure of Sign Operations

Every elementary form of behavior presupposes a *direct* reaction to the task set before the organism (which can be expressed by the simple S → R formula). But the structure of sign operations requires an intermediate link between the stimulus and the response. This intermediate link is a second order stimulus (sign) that is drawn into the operation where it fulfills a special function; it creates a new relation between S and R. The term “drawn into” indicates that an individual must be actively engaged in establishing such a link. This sign also possesses the important characteristic of

reverse action (that is, it operates on the individual, not the environment).

Consequently, the simple stimulus-response process is replaced by a complex, mediated act, which we picture as:

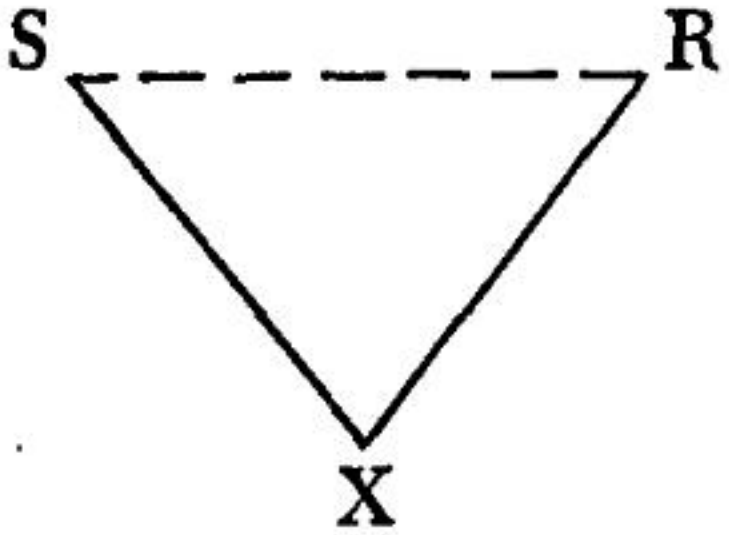

Figure 1

In this new process the direct impulse to react is inhibited, and an auxiliary stimulus that facilitates the completion of the operation by indirect means is incorporated.

Careful studies demonstrate that this type of organization is basic to all higher psychological processes, although in much more sophisticated forms than that shown above. The intermediate link in this formula is not simply a method of improving the previously existing operation, nor is it a mere additional link in an S — R chain. Because this auxiliary stimulus possesses the specific function of reverse action, it transfers the psychological operation to higher and qualitatively new forms and permits humans, by the aid of extrinsic stimuli, *to control their behavior from the* outside. The use of signs leads humans to a specific structure of behavior that breaks away from biological development and creates new forms of a culturally-based psychological process.

Early Sign Operations in Children

The following experiments, conducted under A. N. Leontiev in our laboratories, demonstrate with particular clarity the role of signs in voluntary attention and memory.

Children were asked to play a game in which they were to answer a set of questions without using certain words in their answers. As a rule each child was presented three or four tasks differing in the constraints placed upon answers and the kinds of potential stimulus aids the child could use. In each task the child was asked eighteen questions, seven of which had to do with color (for example, “What color is ... ?”). The child was asked to answer each question promptly using a single word. The *initial task* was conducted in exactly this fashion. With the *second task*, we began to introduce additional rules that the child had to follow in order to succeed. For example, there were two color names the child was forbidden to use, and no color name could be used twice. The *third task* had the same rules as the second, but the child was given nine colored cards as aids to playing the game (“these cards can help you to win”). The *fourth task* was like the third and was used in cases where the child either failed to use the color cards or began to do so only late in the third task. Before and after each task we asked the child questions to determine if she remembered and understood the instructions.

A set of questions for a typical task is the following (in this case green and yellow are the forbidden colors): (1) Have you a playmate? (2) What color is your shirt? (3) Did you ever go in a train? (4) What color are the railway-carriages? (5) Do you want to be big? (6) Were you ever at the theater? (7) Do you like to play in the room? (8) What color is the floor? (9) And the walls? (10) Can you write? (11) Have you seen lilac? (12) What color is lilac? (13) Do you like sweet things? (14) Were you ever in the country? (15) What colors can leaves be? (16) Can you swim? (17) What is your favorite color? (18) What does one do with a pencil?

For the third and fourth tasks the following color cards were provided as aids: black,

white, red, blue, yellow, green, lilac, brown, and gray.

The results for thirty subjects, ranging in age from five to twenty-seven years are summarized in table 1, which contains the average number of errors on tasks 2 and 3 and the difference between the two. tasks. Looking first at the data from task 2, we see a slight decrease in errors from ages five to thirteen and a sharp drop in adulthood. For task 3 the sharpest drop occurs between the five- to-six and eight-to-nine-year-old groups. The difference between tasks 2 and 3 is small for both the preschool children and the adults. The difference is largest for the school-age children.

Table 1. Errors on forbidden colors task.

	Number of	Errors (average)		
Age	subjects	Task 2	Task 3	Difference
5-6	7	3.9	3.6	0.3
8-9	7	3.3	1.5	1.8
10-13	8	3.1	0.3	2.8
2-27	8	1.4	0.6	0.8

The processes that give rise to the summary figures are most readily revealed by looking at transcripts representative of children in the different groups. The preschool children (age five to six years) were generally unable to discover how to use the auxiliary color cards and had a great deal of trouble with both tasks. Even when we tried to explain to them how the color cards could help them, children at this age were incapable of using these external stimuli in order to organize their own behavior.

The following transcript is from a five-year-old boy:

Task 4. Forbidden colors: blue and red (with cards).

2. What color are houses?	Red [without looking at forbidden colors].
3. Is the sun shining brightly?	Yes.
4. What color is the sky?	White [without looking at card; but after replying, searches for white card]. Here it is! [Picks it up and keeps it in his hand.]

8 What colors are tomatoes?	Red. [Glances at cards.]
9. And what color are exercise books?	White — like this! [pointing to white card].
12. What color are balls?	White [looking at card].
13. Do you live in the town?	No.
...	...
Do you think you have won?	Don't know — yes.
What must you not do if you want to win?	Mustn't say red or blue.
And what else?	Mustn't say the same word twice.

This transcript suggests that the "aids" actually hindered this child. His repeated use of "white' as a response occurred when his attention was fixed on the white card. The aids are only an accidental feature of the situation for him. Still, there is no doubt that preschool children sometimes demonstrate precursors of the use of external signs. From this point of view certain cases are of special interest. For example, after we suggested to a child that he use the cards to carry out his task ("take the cards, they will help you to win"), he searched for the forbidden colors and put all such cards out of his sight, as if trying to prevent himself from naming them.

In spite of their apparent variety, methods for using the cards can be reduced to two basic types. First the child may put forbidden colors out of sight, display the remainder, and, as he answers the questions, place the colors already named to one side. This is the less effective but the earliest method used. The card in this case serves only to register the named color. Initially, children often do not turn to the cards before they answer the question about color, and only after it is named do they search among the cards, turn over, move, or put away the one named. This is undoubtedly the simplest act of memorization with the help of external means. It is only later that the conditions of the experiment bestow a new, second function on the cards. Before naming a color the child makes a selection with the help of the cards. It makes no difference whether the child looks at the cards so far unused or whether she attends to the colors she has already named. In either case the cards are interposed in the process and serve as a means of regulating her activity. The preliminary hiding of forbidden colors, which is a distinguishing characteristic of the first method for using the cards, does not yet lead to the complete substitution of a less mature operation by

a more complex one; it represents merely a step in that direction. Its occurrence is explained partly by the greater simplicity of this operation in mastering memory and partly by a “magical” attitude toward various potential problemsolving aids that children frequently display.

The following examples from a thirteen-year-old schoolgirl illustrate these points:

Task 2. Forbidden colors: green and yellow (without cards).

1. Have you playmates?	Yes.
2. What color is your blouse?	Gray.
3. Have you been in a train?	Yes.
4. What color are railway carriages?	Gray. [Notices that she has repeated the same color twice, laughs.]
5. Do you want to be a big girl?	Yes.
6. Were you ever in a theater?	Yes.
7. Do you like to play in the room?	Yes.
8. What color is the floor?	Gray. [Hesitates.] Again — I repeated it.
9. And the walls?	White.
10. Can you write?	Yes.
11. Have you seen lilac?	Yes.
12. What color is lilac?	Lilac color.
13. Do you like sweets?	Yes.
14. Were you ever in the country?	Yes.

Task 2. Forbidden colors: green and yellow (without cards) — cont.

15. And what color were the leaves?	Green — no, shouldn’t have said green — brown, red, sometimes.
16. Can you swim?	Yes.
17. What is your favorite color?	Yellow! I can’t! [Throws up hands behind head.]
18. What do you do with a pencil?	Write.
What do you think, did you win or lose?	Lost.
What should you not have said?	Green and yellow.
And what else?	Shouldn’t repeat.

Task 3. Forbidden colors: blue and red (with cards).

The subject puts forbidden colors to one side and spreads out the remainder in a row before her.

1. Do you go for walks in the street?	Yes.
2. What color are the houses?	Gray. [After answering, looks at the cards and turned over the gray one.]
3. Is the sun shining brightly?	Brightly.
4. What color is the sky?	White. [First looks at card and then turns it over.]
5. Do you like candy?	Yes.
6. Have you seen a rose?	Yes.
7. Do you like vegetables?	Yes.
8. What color are tomatoes?	Green. [Turns over card.]
9. And exercise books?	Yellow. [Turns over card.]
10. Have you any toys?	No.
11. Do you play ball?	Yes.
12. And what color are balls?	Gray [without glancing at cards; after answering, glances and notices mistake].
13. Do you live in the town?	Yes.
14. Did you see the demonstration?	Yes.
15. What color are flags?	Black. [First looks at cards and then turns one over.]
16. Have you any books?	Yes.
17. What colors are their covers?	Lilac [turning over card].
18. When does it get dark?	At night.

Our results as reflected in the transcripts and table 1 indicate three basic stages in the development of mediated remembering. At the first stage (preschool age) the child is not capable of mastering his behavior by organizing special stimuli. The colored cards that might help the child in his task do not increase to any considerable extent the effectiveness of this operation. Although they act as stimuli, they do not acquire an instrumental function. The second stage of development is characterized by a sharp difference in the indices in both of the main tasks. The introduction of cards as a system of auxiliary, external stimuli raises the effectiveness of the child’s activity

considerably. At this stage the external sign predominates. The auxiliary stimulus is a psychological instrument acting from the outside. At the third stage (among adults) the difference between their performance in the two tasks decreases and their coefficients become more nearly equal, but now on a new and higher basis. This does not mean that the behavior of adults again becomes direct and natural. At this higher stage of development behavior remains mediated. But now we see that in the third task the auxiliary stimuli are emancipated from primary external forms. What takes place is what we have called internalization; the e xternal sign that school children require has been transformed into an internal sign produced by the adult as a means of remembering. This series of tasks applied to people of different ages shows how the external forms of mediated behavior develop.

The Natural History of Sign Operations

Although the indirect (or mediated) aspect of psychological operations is an essential feature of higher mental processes, it would be a great mistake, as I pointed out with respect to the beginnings of speech, to believe that indirect operations appear as the result of a pure logic. They are not invented or discovered by the child in the form of a sudden insight or lightning-quick guess (the so-called “aha” reaction). The child does not suddenly and irrevocably deduce the relation between the sign and the method for using it. Nor does she intuitively develop an abstract attitude derived, so to speak, from “the depths of the child’s own mind.” This metaphysical view, according to which inherent psychological schemata exist prior to any experience, leads inevitably to an a priori conception of higher psychological functions.

Our research has led us to quite different conclusions. We have found that sign operations appear as a result of a complex and prolonged process subject to all the basic laws of psychological evolution. This means that sign-using activity in children is neither simply invented nor passed down by adults; rather it arises from something that is originally not a sign operation and becomes one only after a series of qualitative transformations. Each of these transformations provides the conditions for the next stage and is itself conditioned by the preceding one; thus, transformations are

linked like stages of a single process, and are historical in nature. In this respect, the higher psychological functions are no exception to the general rule that applies to elementary processes, they, too, are subject to the fundamental law of development which knows no exceptions, and appear in the general course of the child's psychological development as the outcome of the same dialectical process, not as something introduced from without or from within.

If we include this history of higher psychological functions as a factor in psychological development, we must arrive at a new concept of development itself. Within a general process of development, two qualitatively different lines of development, differing in origin, can be distinguished.. the elementary processes, which are of biological origin, on the one hand, and the higher psychological functions, of sociocultural origin, on the other. The history of child behavior is born from the interweaving of these two lines. The history of the development of the higher psychological functions is impossible without a study of their prehistory, their biological roots, and their organic disposition. The developmental roots of two fundamental, cultural forms of behavior arise during infancy: the use of tools and human speech. This alone places infancy at the center of the prehistory of cultural development.

The potential for complex sign operations is embedded in the earliest stages of individual development. However, observations show that between the initial level (elementary behavior) and the higher levels (mediated forms of behavior) many transitional psychological systems occur. In the history of behavior these transitional systems lie between the biologically given and the culturally acquired. We refer to this Process as the natural history of the sign.

Another experimental paradigm designed to study mediated memorizing provides the opportunity to observe this natural history of the sign. N. G. Morozova presented children with words to remember and auxiliary pictures that could be used as mediators. She found that during the preschool years the idea of purposefully using the auxiliary picture (sign) as a means of memorizing is still foreign to the child. Even if the child did turn to the auxiliary picture in order to memorize a given word,

it was not necessarily easy for him to execute the reverse operation. At this stage the learner does not usually recall the primary stimulus when being shown the auxiliary stimulus. Rather, the sign evokes a new associative or syncretic series represented by the following scheme:

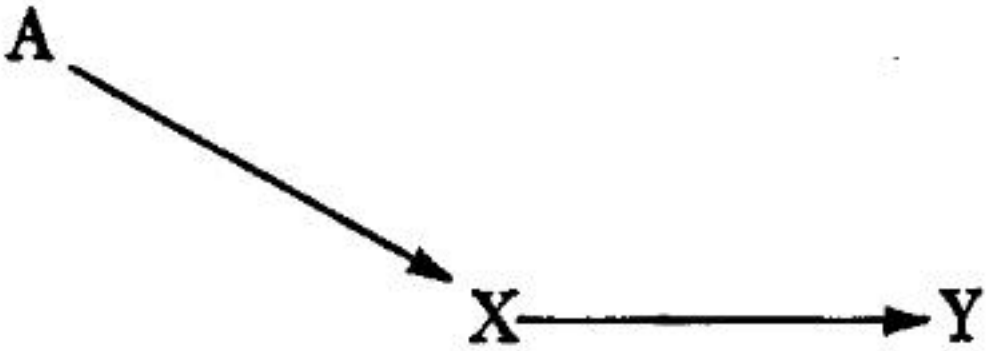

Figure 2

The operation has not yet progressed to the more advanced level which is mediated in form using culturally elaborated features. In contrast with figure 2, the usual scheme for mediated memorizing can be represented by the following:

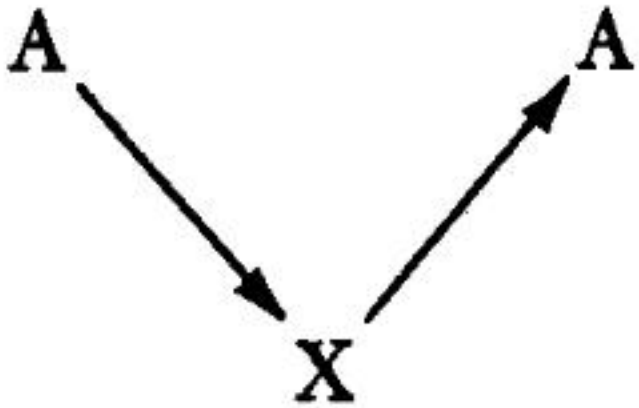

Figure 3

During the process represented by figure 2, Y may lead to a whole series of new associations, among which the subject may arrive at the starting point A. However, this sequence is still devoid of its purposeful and instrumental character. In the second scheme, the word's auxiliary sign, X, possesses the quality of reverse action, so that the subject can reliably retrieve A.

The steps leading from the scheme in figure 2 to the scheme in figure 3 can be illustrated by the following examples taken from the work of my students. L. V. Zankov demonstrated that younger children, particularly between the ages of four and six, must rely on meaningful, ready-made links between the "reminder" sign and the word to be remembered. If meaningless figures were presented as memory aids, the children would often refuse to make use of them; they would make no attempt to make up connections between the picture cue and the word they were supposed to remember. Rather, they would attempt to turn these figures into direct copies of the to-be-remembered word.

For example, the figure  , presented as a reminder of the word "bucket," was turned upside down by the children and served to remind them of the word only when the figure  really began to resemble a bucket. Similarly, the figure  became the sign of the word "bench" only when turned upside down (). In all these cases, children linked the figures to the word stimuli by changing the meaning of the sign instead of using the mediating link offered by the experimenter. The introduction of these meaningless figures encouraged the children to engage in active mnemonic activity instead of relying on already formed links, but it also led them to treat the sign stimulus as the direct representation of the object to be remembered. When this proved impossible, the child refused to memorize.

A similar phenomenon is apparent in U. C. Yussevich's unpublished study with small children. The auxiliary stimuli, which were pictures that bore no direct relation to the word presented, were rarely used as signs. The child looked at the picture and tried to see in it the object she had to remember. For example, when asked to remember the word "sun" with the help of a picture showing an axe, one child did it very easily; she

pointed to a small yellow spot in the drawing and said, “There it is, the sun.” This child replaced potentially complex instrumental memorization by a search for a direct representation of the stimulus (akin to an eidetic image). The child sought an eidetic-like representation in the auxiliary sign. *In both the Zankov and Yussevich examples, the child reproduced the required word through a process of direct representation rather than mediated symbolization.*

The laws describing the role of sign operations at this stage of development are completely different from the laws describing how the child links up a word with a sign in fully developed sign operations. Children in the experiments just described illustrate a stage of development between the elementary and the completely instrumental process from which fully mediated operations will later develop.

Leontiev’s work on the development of sign operations in memory provides examples supporting the theoretical points discussed above as well as later stages in the development of sign operations in memory. He gave a set of twenty words for recall to children of different ages and levels of mental ability. The materials were presented in three ways. First, the words were simply spoken at intervals of about three seconds and the child was told to recall them. In a second task the child was given a set of twenty pictures and told to use them to help recall the words. The pictures were not replicas of the words but were associated with them. In the third series twenty pictures bearing no obvious relation to the to-be-remembered words were used. The basic questions in this research were to what extent can children convert their remembering into a mediated activity using pictures as auxiliary memory aids and how does their success depend upon the different degrees of difficulty represented by the two, potentially mediated, series.

As we might expect, the results differed depending upon the group of children and the difficulty of the recall task. Normal children (ten to twelve years of age) recalled twice as many words when the pictures were available as memory aids as they did without them. They were able to make use of both picture series equally well. Mildly retarded children of the same age benefited little, if at all, from the presence of the pictures; and for severely retarded children, the auxiliary stimuli actually interfered

with performance.

The original transcripts from this study clearly show intermediate levels of functioning in which the child attends to the auxiliary picture stimulus and even associates it with the word to be recalled but cannot integrate the stimulus into his system of remembering. Thus, one child selected a picture of an onion to recall the word “dinner.” When asked why she chose the picture, she gave the perfectly satisfactory answer, “Because I eat an onion.” However, she was unable to recall the word “dinner” during the experiment. This example shows that the ability to form elementary associations is not sufficient to ensure that the associative relation will fulfill the *instrumental* function necessary to produce recall. This kind of evidence leads us to conclude that the development of mediated psychological functions (in this case, mediated memory) represents a special line of development that does not wholly coincide with the development of elementary processes.

I should mention also that the addition of pictures as memory aids did not facilitate recall of adults. The reason for the “failure” is directly opposite to the reasons underlying the failure of memory aids to affect the severely retarded children. In the case of adults, the process of mediated memorizing is so fully developed that it occurs even in the absence of special external aids.

Memory and Thinking

Remembering activities do not simply change as the child grows older; the role of these activities in the system of psychological functions also changes. Nonmediated memory takes place in the context of psychological operations that may have nothing at all in common with the psychological operations that accompany mediated remembering; consequently, experimental results may make it appear that some psychological functions are replaced by others. In other words, with a change in developmental level there occurs a change not so much in the structure of a single function (which, for example, we may call memory) as in the character of those functions with the aid of which remembering takes place; what changes is the

interfunctional relations that connect memory with other functions.

The memory of older children is not only different from the memory of younger children; it also plays a different role in the older child's cognitive activity. Memory in early childhood is one of the central psychological functions upon which all the other functions are built. Our analyses suggest that thinking in the very young child is in many respects determined by his memory, and is certainly not the same thing as the thinking of the more mature child. For the very young child, to think means to remember; at no time after very early childhood do we see such a close connection between these two psychological functions.

I will give three examples. The first is the definition of concepts in children, which are based on their recollections. If you ask a child to tell you what a snail is, he will say that it is little, it slithers, and it sticks out its foot; if you ask him to tell you what a grandmother is, he is likely to reply, "She has a soft lap." In both cases the child gives a very clear summary of the impressions which the topic has made upon him and which he recollects. The content of the thinking act in the child when defining such concepts is determined not so much by the logical structure of the concept itself as by the child's concrete recollections. It is syncretic in character and reflects the fact that the child's thinking depends first of all on his memory.

Another example is the development of visual concepts in very young children. Investigations of children's thinking when they are required to transpose a relation learned with one set of stimuli to a similar set have shown that their transfer is nothing more than remembering with respect to isolated instances. Their general representations of the world are based on the recall of concrete instances and do not yet possess the character of an abstraction.

The last example concerns the analysis of word meaning. Investigations in this area show that the connections underlying words are fundamentally different in the young child and in the adult. Children's concepts relate to a series of examples and are constructed in a manner similar to the way we represent family names. To name words for them is not so much to indicate familiar concepts as to name familiar

families or whole groups of visual things connected by visual ties. In this way the experience of the child and the “unmediated” influence of the child’s experience are documented in his memory and directly determine the entire structure of the young child’s thought.

All these facts suggest that, from the point of view of psychological development, memory rather than abstract thought is the definitive characteristic of the early stages of cognitive development. However, in the course of development a transformation occurs, especially in adolescence. Investigations of memory at this age have shown that toward the end of childhood the interfunctional relations involving memory reverse their direction. For *the young child, to think means to recall; but for the adolescent, to recall means to think.* Her memory is so “logicalized” that remembering is reduced to establishing and finding logical relations; recognizing consists in discovering that element which the task indicates has to be found.

This logicalization is indicative of how relations among. cognitive functions change in the course of development. At the transitional age all ideas and concepts, all mental structures, cease to be organized according to family types and become organized as abstract concepts.

There can be no doubt that to remember an item when thinking in concepts is a completely different task from thinking in complexes, although the processes are compatible with each other.” Therefore, the development of children’s memory must be studied not only with respect to changes happening within memory itself, but also with respect to the relation between memory and other functions.

When a human being ties a knot in her handkerchief as a reminder, she is, in essence, constructing the process of memorizing by forcing an external object to remind her of something; she transforms remembering into an external activity. This fact alone is enough to demonstrate the fundamental characteristic of the higher forms of behavior. In the elementary form something is remembered; in the higher form humans remember something. In the first case a temporary link is formed owing to the simultaneous occurrence of two stimuli that affect the organism; in the second case

humans personally create a temporary link through an artificial combination of stimuli.

The very essence of human memory consists in the fact that human beings actively remember with the help of signs. It may be said that the basic characteristic of human behavior in general is that humans personally influence their relations with the environment and through that environment personally change their behavior, subjugating it to their control. It has been remarked that the very essence of civilization consists of purposely building monuments so as not to forget. In both the knot and the monument we have manifestations of the most fundamental and characteristic feature distinguishing human from animal memory.

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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.

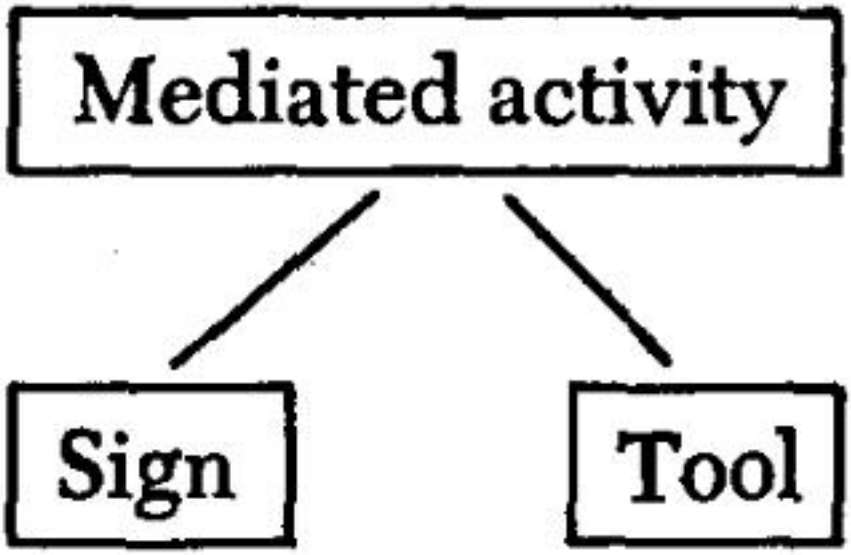

Figure 4

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.'” 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.”

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 (*intrapsychologi*cal). 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.

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Problems of Method

In general, any fundamentally new approach to a scientific problem inevitably leads to new methods of investigation and analysis. The invention of new methods that are adequate to the new ways in which problems are posed requires far more than a simple modification of previously accepted methods. Contemporary psychological experimentation is no exception in this respect; its methods have always reflected the ways in which fundamental psychological problems were viewed and solved. Therefore, our criticism of current views concerning the essential nature and development of psychological processes must inevitably result in a reexamination of methods of research.

Despite great diversity in procedural details, virtually all psychological experiments rely on what we shall term a stimulus-response *framework*. By this we mean that no matter what psychological process is under discussion, the psychologist seeks to confront the subject with some kind of stimulus situation designed to influence him in a particular way, and then the psychologist examines and analyzes the response(s) elicited by that stimulating situation. After all, the very essence of experimentation is to evoke the phenomenon under study in an artificial (and thereby controllable) way and to study the variations in response that occur in conjunction with various changes in the stimulus.

On the surface it may appear that various schools of psychology could not possibly agree on this methodology. The objective psychology of Watson, Bekhterev, and others, for example, was constructed in opposition to the subjective theories of Wundt and the Wurzburg school. But closer examination of the differences between schools of psychology reveals that those differences arise out of the *theoretical interpretation* psychologists want to assign to the consequences of various stimulating environments and not out of variations in the general methodological approach within which observations are made.

Reliance on a stimulus-response framework is an obvious feature of those schools of psychology whose theories as well as experiments are based on stimulus-response interpretations of behavior. Pavlovian theory, for example, has utilized the notion of cortical excitation incited by various stimuli to explain how connections are formed in the brain that enable the organism to learn to respond to hitherto neutral stimuli. It may be less obvious that exactly the same framework applies to introspective psychology as well, since the framework and the theory do not seem to coincide. However, taking Wundt as an example, we find that the stimulus-response framework provided the context within which the experimenter-theorist could obtain descriptions of the processes presumed to have been elicited by the stimulus.

The adoption of a stimulus-response framework by introspective psychology in the 1880s was a revolutionary step forward for psychology because it brought psychology closer to the method and spirit of the natural sciences and prepared the way for the objective psychological approaches that followed. But to claim that both introspective and objective psychology share a common methodological framework does not in any way imply that there are no important differences between them. I am emphasizing their common methodological framework because its recognition helps us to appreciate the fact that introspective psychology was rooted in the firm soil of natural sciences and that psychological processes have long been understood within a reactive context.

It is also important to realize that the experimental method was first formulated by introspective psychologists in that area of psychophysics and psychophysiology that dealt with the simplest psychological phenomena, phenomena that could plausibly be interpreted as directly and uniquely linked to external agents. Wundt, for example, saw the very essence of psychological method as the systematic alteration of the stimuli that generate a change in the psychological process linked to them. He sought the maximally objective way to record the external manifestations of these internal processes, which is what he believed the subject’s introspective reports to be.

At the same time, it is important to keep in mind that for Wundt the stimulus and

response functioned only to set up the framework within which the important events, psychological processes, could be studied in a reliable and controlled way. Introspective reports of these processes remained the paramount evidence concerning their nature — an interpretation not shared by later investigators.

Our description of the basic framework of psychological experimentation as practiced by Wundt implies limitations on its application: such experimentation was considered adequate only to the study of elementary processes of a psychophysiological character. The higher psychological functions did not allow study in this form and thus remained a closed book as far as experimental psychology was concerned. If we recall the kinds of experimentation on the cognitive development of children that characterized the research reviewed in earlier chapters of this book, we can easily understand why previous investigators concentrated on elementary psychological functions; this limitation is a built-in feature of the experimental method as it was generally accepted in psychology. Wundt understood and accepted this fact, which is why he eschewed *experimental* studies of higher psychological functions.

From the foregoing it should be clear that a stimulus-response framework for constructing experimental observations *cannot* serve as the basis for the adequate study of the higher, specifically human forms of behavior. At best it can only help us to record the existence of the lower, subordinated forms, which do not capture the essence of the higher forms. Using current methods, we can only determine quantitative variation in the complexity of stimuli and in the responses of different animals and humans at different stages of development.

It is my belief, based upon a dialectical materialist approach to the analysis of human history, that human behavior differs qualitatively from animal behavior to the same extent that the adaptability and historical development of humans differ from the adaptability and development of animals. The psychological development of humans is part of the general historical development of our species and must be so understood. Acceptance of this proposition means that we must find a new methodology for psychological experimentation.

The keystone of our method, which I will try to describe analytically in the following sections, follows directly from the contrast Engels drew between naturalistic and dialectical approaches to the understanding of human history. Naturalism in historical analysis, according to Engels, manifests itself in the assumption that only nature affects human beings and only natural conditions determine historical development. The dialectical approach, while admitting the influence of nature on man, asserts that man, in turn, affects nature and creates through his changes in nature new natural conditions for his existence. This position is the keystone of our approach to the study and interpretation of man's higher psychological functions and serves as the basis for the new methods of experimentation and analysis that we advocate.

All stimulus-response methods share the inadequacy that Engels ascribes to naturalistic approaches to history. Both see the relation between human behavior and nature as unidirectionally reactive. My collaborators and I, however, believe that human behavior comes to have that "transforming reaction on nature" which Engels attributed to tools. We must, then, seek methods adequate to our conception. In conjunction with new methods, we also need a new analytic framework, I have emphasized that a basic goal of our research is to provide an analysis of the higher forms of behavior, but the situation in contemporary psychology is such that the problem of analysis itself must be discussed if our approach is to be generalized beyond the specific examples presented.

Three principles form the basis of our approach to the analysis of higher psychological functions.

Analyzing process, not objects. The first principle leads us to distinguish between the analysis of an object and of a process. As Koffka put it, psychological analysis has almost always treated the processes it analyzes as stable, fixed objects. The task of analysis consisted in breaking these forms down into their components. Psychological analysis of objects should be contrasted with the analysis of processes, which requires a dynamic display of the main points making up the processes' history. Consequently,

developmental psychology, not experimental psychology, provides the new approach to analysis that we need. Like Werner, we are advocating the developmental approach as an essential addition to experimental psychology. Any psychological process, whether the development of thought or voluntary behavior, is a process undergoing changes right before one's eyes. The development in question can be limited to only a few seconds, or even fractions of seconds (as is the case in normal perception). It can also (as in the case of complex mental processes) last many days and even weeks. Under certain conditions it becomes possible to trace this development. Werner's work furnishes one example of how a developmental viewpoint may be applied to experimental research. Using such an approach, one can, under laboratory conditions, provoke development.

Our method may be called experimental-developmental in the sense that it artificially provokes or creates a process of psychological development. This approach is equally appropriate to the basic aim of dynamic analysis. If we replace object analysis by process analysis, then the basic task of research obviously becomes a reconstruction of each stage in the development of the process: the process must be turned back to its initial stages.

Explanation versus description. In associationistic and introspective psychology, analysis is essentially description and not explanation as we understand it. Mere description does not reveal the actual causal-dynamic relations that underlie phenomena.

K. Lewin contrasts phenomenological analysis, which is based on external features (phenotypes), with what he calls genotypic analysis, wherein a phenomenon is explained on the basis of its origin rather than its outer appearance. The difference between these two points of view can be elucidated by any biological example. A whale, from the point of view of its outer appearance, stands closer to the fish family than to the mammal, but in its biological nature it is closer to a cow or a deer than to a pike or a shark. Following Lewin, we can apply this distinction between the

phenotypic (descriptive) and genotypic (explanatory) viewpoints to psychology. By a developmental study of a problem, I mean the disclosure of its genesis, its causal dynamic basis. By phenotypic I mean the analysis that begins directly with an object's current features and manifestations. It is possible to furnish many examples from psychology where serious errors have been committed because these viewpoints have been confused. In our study of the development of speech, we have emphasized the importance of the distinction between phenotypic and genotypic similarities.

In their external, descriptive aspects, the first manifestation of speech in the one-and-a-half to two-year-old child are similar to adult speech. On the basis of this similarity, such serious researchers as Stern come to the conclusion that in essence the eighteen-month-old child is already conscious of the relation between sign and meaning. In other words, he classes together phenomena that have absolutely nothing in common from the developmental point of view. On the other hand, egocentric speech — which in its outer manifestations differs from internal speech in essential ways — must be classed together with internal speech from the developmental point of view.

Our research on young children's speech brings us to the basic principle formulated by Lewin: two phenotypically identical or similar processes may 'be radically different from each other in their causal-dynamic aspects and vice versa; two processes that are very close in their causal-dynamic nature may be very different phenotypically.

I have said that the phenotypic approach categorizes processes according to their external similarities. Marx commented on the phenotypic approach in a most general form when he stated that 'if the essence of objects coincided with the form of their outer manifestations, then every science would be superfluous" — an extremely reasonable observation. If every object was phenotypically and genotypically equivalent (that is, if the true principles of its construction and operation were expressed by its outer manifestation), then everyday experience would fully suffice to replace scientific analysis. Everything we saw would be the subject of our scientific knowledge.

In reality, psychology teaches us at every step that though two types of activity can have the same external manifestation, whether in origin or essence, their nature may differ most profoundly. In such cases special means of scientific analysis are necessary in order to lay bare internal differences that are hidden by external similarities. It is the task of analysis to reveal these relations. In that sense, real scientific analysis differs radically from subjective, introspective analysis, which by its very nature cannot hope to go beyond pure description. The kind of objective analysis we advocate seeks to lay bare the essence rather than the perceived characteristics of psychological phenomena.

For example, we are not interested in a des cription of the immediate experience elicited by a flashing light as it is revealed to us by introspective analysis; rather we seek to understand the real links between the external stimuli and internal responses that underlie the higher. form of behavior named by introspective descriptions. Thus, psychological analysis in our sense rejects nominal descriptions and seeks instead to determine causal-dynamic relations. However, such explanation would also be impossible if we ignored the external manifestations of things.

By necessity, objective analysis includes a scientific explanation of both external manifestations and the process under study. Analysis is not limited to a developmental perspective. It does not repudiate the explanation of current phenotypical idiosyncrasies, but rather subordinates them to the discovery of their actual origin.

The problem of "fossilized behavior." The third principle underlying our analytic approach is based on the fact that in psychology we often meet with processes that have already died away, that is, processes that have gone through a very long stage of historical development and have become fossilized. These fossilized forms of behavior are most easily found in the so-called automated or mechanized psychological processes which, owing to their ancient origins, are now being repeated for the millionth time and have become mechanized. They have lost their original

appearance, and their outer appearance tells us nothing whatsoever about their internal nature. Their automatic character creates great difficulties for psychological analysis.

The processes that have traditionally been referred to as voluntary and involuntary attention provide an elementary example that demonstrates how essentially different processes acquire outer similarity as a result of this automation. Developmentally speaking, these two processes differ very profoundly. But in experimental psychology it is considered a fact, as formulated by Titchener, that voluntary attention, once established, functions just like involuntary attention. In Titchener's terms, "secondary" attention constantly changes into "primary" attention. Having described and contrasted the two types of attention, Titchener then says, "There exists, however, a third stage in the development of attention, and it consists in nothing less than a return to the first stage." The last and highest stage in the development of any process may demonstrate a purely phenotypic similarity with the first or primary stages, and if we take a phenotypic approach, it is impossible to distinguish between higher and lower forms of this process. The only way to study this third and highest stage in the development of attention is to understand it in all its idiosyncrasies and differences. In short, we need to understand its origin. It follows, then, that we need to concentrate not on the *product* of development but on the very *process* by which higher forms are established. To do so the researcher is often forced to alter the automatic, mechanized, fossilized character of the higher form of behavior and to turn it back to its source through the experiment. This is the aim of dynamic analysis.

Inactive, rudimentary functions stand not as the living remnants of biological evolution but as those of the historical development of behavior. Consequently, the study of rudimentary functions must he the point of departure for evolving a historical perspective in psychological experiments. It is here that the past and the present are fused and the present is seen in the light of history. Here we find ourselves simultaneously on two planes: that which is and that which was. The fossilized form is the end of the thread that ties the present to the past, the higher stages of development to the primary ones.

The concept of a historically based psychology is misunderstood by most researchers who study child development. For them, to study something historically means, by definition, to study some past event. Hence, they naively imagine an insurmountable barrier between historic study and study of present-day behavioral forms. To *study some thing historically means to study it in the process of change;* that is the dialectical method's basic demand. To encompass in research the process of a given thing's development in all its phases and changes — from birth to death — fundamentally means to discover its nature, its essence, for 'It is only in movement that a body shows what it is." Thus, the historical study of behavior is not an auxiliary aspect of theoretical study, but rather forms its very base. As P. P. Blonsky has stated, "Behavior can be understood only as the history of behavior."

The search for method becomes one of the most important problems of the entire enterprise of understanding the uniquely human forms of psychological activity. In this case, the method is simultaneously prerequisite and product, the tool and the result of the study.

In summary, then, the aim of psychological analysis and its essential factors are as follows: (1) process analysis as opposed to object analysis; (2) analysis that reveals real, causal or dynamic relations as opposed to enumeration of a process's outer features, that is, explanatory, not descriptive, analysis; and (3) developmental analysis that returns to the source and reconstructs all the points in the development of a given structure. The result of development will be neither a purely psychological structure such as descriptive psychology considers the result to be, nor a simple sum of elementary processes such as associationistic psychology saw it, but a qualitatively new form that appears in the process of development.

The Psychology of Complex Choice Responses

In order to illustrate the contrasting approaches to psychological analysis, I will discuss in some detail two different analyses of one task. In the task I have chosen,

the subject is presented one or more stimuli (visually or auditorily as a rule). The required response differs according to the number of stimuli and the interests of the investigator: some approaches seek to break the reaction down into a series of elementary processes whose durations can be added and subtracted to establish the laws of their combination; others seek to describe the emotional reaction of the subject as he responds to the stimulus. In either case, the subjects' introspective analyses of their responses are used as basic data. In these experiments the inadequacies of prior formulations provide useful illustrations of our basic analytic principles.

It is also characteristic of these analyses that complex and simple responses are distinguished primarily by the quantitative complexity of the stimuli: a simple reaction is said to occur when a single stimulus is presented, and the complexity of the response is said to increase with an increasing number of stimuli. An essential presumption in this line of thinking is that the complexity of the task is identical to the complexity of the subject's internal response.

This identity is clearly expressed in the algebraic formulas commonly used in the analysis of responses to such tasks. If we present a single stimulus, we can write an equation in which the complex reaction is equivalent to a simple reaction (sensory recognition): $R^t = R^s$ where R^t is the response time for the total, complex reaction and R^s is the response time for a single recognition reaction. If we present two or more stimuli, from which the subject must select one, this equation becomes: $R^t = R^s + D$, where D is the time taken to discriminate between the target stimulus and the remainder. Using these two equations, we could establish the time required both for a simple reaction and for the discriminative reaction. If we complicate the task by requiring the subject to choose a different response for each stimulus (for example, press the left-hand key for stimulus A and the right-hand key for stimulus B), we obtain the classical choice reaction formula: $R^t = R^s + D + C$, where C is the time required to choose the correct movement, for example, to press the key corresponding to the stimulus presented.

A verbal description of the theory underlying this set of formulas would be the following: the discrimination response is a simple reaction plus discrimination; the choice reaction is a simple reaction plus discrimination plus choice.. The higher, more complex response is seen as the arithmetic sum of its elementary components.

Proponents, of this analytic approach apply it quite widely. Thus, for example, Cattell believes that by subtracting the time needed to comprehend and name a word from the time needed to comprehend, translate a word into another language, and name it, we can obtain a pure measure of the translation process." In short, even higher processes such as speech comprehension and production can he analyzed by these methods. A more mechanical notion of the complex, higher forms of behavior would be hard to imagine.

However, this analytic approach has been shown to lead to a variety of difficulties. The most basic, empirical observation that contradicts this theory comes from Titchener, who pointed out that the time to execute a carefully prepared choice reaction may be equal to the reaction time for a simple, sensory response. By the logic of the analysis summarized in the equations given above, this state of affairs is impossible.

In our view, the basic premise underlying this entire line of analysis is incorrect. It is not true that a complex reaction consists of a chain of separate processes which may be arbitrarily added and subtracted. Any such reaction reflects processes that depend upon the entire process of learning at every level of practice. This mechanical analysis substitutes relations existing between stimuli for the real relations underlying the process of choosing. This kind of substitution reflects a general intellectualism in psychology which seeks to understand psychological processes in the manipulations that make up the experiment itself; experimental procedures become surrogates for psychological processes.

While various scholars have demonstrated the inadequacy of psychological analysis based upon a mechanical decomposition of responses into their elements, these critics face the problem that their introspective' analyses of complex reactions must be

restricted to description: the description of external responses is replaced by the description of internal feelings. In either case, we are restricted to phenotypical psychological analysis.

Introspective analysis in which highly trained observers are instructed to note every aspect of their own conscious experience cannot carry us very far. A curious result of this work, as Ach put it in discussing choice reaction studies, has been the discovery that there are no conscious feelings of choice in the choice reaction. Titchener emphasized that one must keep in mind the fact that the names given to a complex or simple reaction (for example, “differentiation” or “choice”) refer to the external conditions of the task. We do not differentiate in the differentiation reaction and we do not choose in the choice reaction.

This kind of analysis broke the identity between experimental procedures and psychological processes. Process names like “choosing” and “differentiating” were treated as leftovers from a previous era of psychology when experimentation was still unknown: introspective observers were trained to make a clear distinction between process names and their conscious experience in order to circumvent this problem.

These introspective studies resulted in the conclusion that a situation which seems to require choice processes furnishes no grounds for speaking of a psychological choice response; talk of such responses was replaced by a description of the subjects’ feelings during the experiment. But no one could provide evidence that these feelings were an integral part of the particular response process. It seems more likely that they are only one of its components, and require explanation themselves; we are led to conclude that introspection is often unable to provide an accurate description, let alone a correct explanation, for even the subjective aspect of the response. For the same reasons, the frequent discrepancies among the introspective descriptions of various observers

which plague this area of research might be expected. It should be clear that introspective analysis cannot provide a real causal or dynamic explanation of a process; for that to occur, we must give up reliance on phenotypic appearances and

move to a developmental viewpoint.

Research on complex reactions also illustrates psychology's reliance on the analysis of processes only after they have become fossilized. This point was noted by Titchener, who remarked that researchers have concentrated on the reaction time of the responses they study, not on the learning processes or the content of the reaction itself. This same conclusion is seen clearly in the standard practice of discarding the data from early sessions when the response is being established. Uniformity was sought, so that it was never possible to grasp the process in flight; instead, researchers routinely discarded the critical time when a reaction appears and when its functional links are established and adjusted. Such practices lead us to characterize the responses as "fossilized." They reflect the fact that these psychologists were not interested in complex reactions as a process of development. This approach is also a major cause of the confusions which arose concerning complex and simple reactions that have surface similarities. It might be said that complex reactions have been studied postmortem.

Another perspective on this issue can be gained from comparing complex reactions with reflexes, which are psychologically different in many respects. One point of comparison will suffice for purposes of illustration. It is well known that the latent period for a complex reaction is longer than the latent period for a reflex. But Wundt long ago established that the latent period of a complex reaction decreases with practice. As a result, the latency of the complex reaction and the simple reflex become equivalent. The most important differences between a complex reaction and a reflex are usually most apparent when the reaction is in its early stages; as practice proceeds, the differences become more and more obscured. Therefore, the differences between these two forms of behavior should be sought in the analysis of their development. But instead of increasing the discernible differences between them, investigations of well-practiced choice reactions and reflexes hide these differences. The preparatory trials demanded by standard experimental methods often last for several long sessions. When these data are then discarded or ignored, the researcher is left with an automatized reaction that has lost its developmental difference from a reflex and has acquired a surface, phenotypical similarity to it. These factors have led

to our assertion that previous researchers have studied reactions in psychological experiments only after they have become fossilized.

This discussion of traditional analyses of complex reaction defines, albeit negatively, the basic tasks confronting us. In order to obtain the kind of causal-dynamic analysis we have been advocating, we will have to shift the focus of our research.

A Causal-Dynamic Study of Choice Reactions

Obviously, the early sessions during which a reaction is formed are of crucial concern because only data from this period will reveal the reaction's true origin and its links to other processes. Through an objective study of the entire history of the reaction, we can obtain an integrated explanation of both its internal and surface manifestations. Thus, we will want to study the reaction as it appears initially, as it takes shape, and after it is firmly formed, constantly keeping in mind the dynamic flow of the entire process of its development.

From my previous discussion, another part of the task is clear: the complex reaction must be studied as a living process, not as an object. We must transform the reaction back to its source if we encounter it in automatized form.

When we examine the experimental procedures used in complex reactions, we find that all are. restricted to meaningless connections between stimuli and responses. The subject is presented several stimuli to which he must respond in different ways . neither the relations between the stimuli and the required responses nor the sequence in which the stimuli are presented have any significance from the subject's point of view. When a motor response, such as a key press, is required, subjects may make the movement in any way they like. These conventions render the relations among the elements of the problem mechanical in principle and place the procedures on a plane with the research on memory that uses nonsense stimuli.

This analogy between choice reaction and memory studies can be extended by considering the similarity of the role of repetition in the two tasks. Although no one has dwelt on a study of the practice trials in choice reaction studies, it is safe to conclude that if the reaction is formed through repeated training (or training plus written or oral instruction), it has been learned by rote, just as learning the connection between two nonsense syllables is a rote process. If simple reactions were involved and the subject was given extensive explanation ahead of time so that the relation between stimulus and response were meaningful (for example, push key number 1 when I say “one,” push key number 2 when I say “two”), we would be dealing with already existing links. In neither case could we study the process of organizing the reaction, during which its underlying links would be discoverable.

To make all of this clear, let us trace the stages through which the choice reaction moves, first in experiments with adults and then with children.

If we set up a relatively simple choice reaction, say, pressing a button with the left hand when a red stimulus is shown and pressing with the right hand when a green stimulus is shown, adults quickly acquire a stable response. Suppose, however, we increase the number of stimuli and responses to five or six and diversify the responses so that the subject has to respond not only with both hands, but sometimes pressing a button and sometimes simply by moving a finger. With this larger number of stimulus-response pairings, the task is considerably more difficult. Suppose further that instead of a lengthy pretraining period in which the subject is allowed to learn the stimulus-response relations, we give only minimal instructions. Faced with this situation, adults often refused even to attempt to deal with the problem, objecting that they could not remember what to do. Even after the session started, they kept repeating the instructions to themselves, asked about aspects of the task they had forgotten, and generally sought to master the entire system of relations as a whole before they settled down to the task as it is usually conceived.

However, if we placed additional stimuli on the response buttons and keys in a manner analogous to the procedures in previously described memory studies, the adults immediately used these auxiliary means to remember the necessary stimulus-

response relations.

Among young children, a different picture emerged. We first presented the problem as we did with adults, by asking the child to make a number of different responses to different stimuli. Unlike the adults, children six to eight years of age often started right into the task after listening to the instructions and attempted to follow them without the slightest hesitation. As soon as the experiment began, most children found themselves in great difficulty. If a child recalled one or two of the required relations and responded correctly to those stimuli, he would naively ask about the remaining stimuli, treating each of them in isolation from each other. This behavior contrasted with that of the adults who generally failed to deal effectively with the individual stimuli until all the necessary relations were mastered. We view this behavior on the part of the children as evidence that they are in the stage of responding to the task in a natural or primitive manner because they rely on unmediated memory for the task elements. The fact that children would unhesitatingly accept the challenge of establishing a complex choice response to as many as ten stimuli suggests that they do not yet know their own capacities and limitations. They operate with complex tasks in the same way they operate with simple ones.

The child’s behavior also differs from adult behavior when we introduce auxiliary stimuli, although we can discern the beginnings of the restructuring that characterize the adult.

First, we introduce auxiliary stimuli that bear a clear relation to the primary stimuli with which we began. For example, if the primary stimulus was a horse, in response to which the child was supposed to press a key with his left index finger, we pasted a picture of a sleigh on that key. On the key corresponding to a loaf of bread we pasted a picture of a knife. In this case, the child understands that sleigh goes with horse, the knife with bread, and so on. Choice reactions are smoothly established from the outset. Furthermore, it does not matter how many stimuli and responses are involved; the qualitative features of responding remain the same. The child quickly works out a rule for the problem’s solution and makes his choice on the basis of this rule.

It would be incorrect, however, to assume that the child has mastered a mediated system of behavior in its full, adult form. We need only to change the relations among the primary. and auxiliary stimuli to. discover the limits of the child's response system. If we pair the stimuli in a different way (say, horse with knife, bread with sleigh) the child will no longer use the auxiliary stimuli in a proper way. The, child recalls only that horse helped to find sleigh in some way. He reveals by his responses that he had been using the conventional association of horse and sleigh to guide the choice, but had not mastered the internal logic of using one stimulus to mediate the response to another.

If we continue our experiment long enough, we will begin to see changes in the way the child responds. In the first stage of responding to arbitrarily related stimuli, the child has insufficient experience with the task to organize his behavior effectively. He uses experience naively. But in the course of the experiment, he gains experience necessary for restructuring his behavior. just as naive physical knowledge is acquired as the child operates with objects, knowledge of psychological operations is acquired as the child strives to carry out the choice reaction task. As he attempts to recall which stimuli are linked to which responses, the child begins to learn what remembering in this situation consists of and begins to use one or another of the auxiliary stimuli effectively. The child begins to realize that certain relations among the stimuli and auxiliary pictures produce correct choice responses, while others do not. He soon begins to object to the arrangement of pictures, asking that the pictures on the keys be arranged to fit the primary stimuli that are associated with the key. When told to press the bread key in response to the horse picture, the child answers "No, I want the sleigh key." This shows that the child is accumulating experience which is changing the structure of his own memorizing.

Having naively comprehended what the memorizing operations require, the child moves to the following stage. If presented with primary and auxiliary stimuli in an arrangement that seems haphazard, the child will ask to put them in a special order, thus personally establishing a specific relation between them. At this point the child is showing that he knows that certain signs will help to achieve certain operations. In

short, he is beginning to memorize through the use of signs.

Once this happens, the child no longer experiences difficulties in creating relations and using them. Given some pairing of primary and auxiliary stimuli, the child is no longer restricted to using already available relations (such as horse-sleigh) but can create relations of his own. This may be called the stage of external sign use. It is characterized by the independent formation of new relations in the child's internal operations using externally presented signs. Now the child is organizing external stimuli to carry out its responses. This fundamental stage is then followed by the stage at which the child begins to organize stimuli of an internal nature.

These changes are manifested in the course of the choice reaction experiment. After considerable practice in the choice experiment, the reaction time begins to grow shorter and shorter. If the reaction time to a particular stimulus had been 500 milliseconds or more, it reduces to a mere 200 milliseconds. The longer reaction time reflected the fact that the child was using external means to carry out the operations of remembering which key to push. Gradually, the child casts off the external stimuli, no longer paying attention to them. The response to the external auxiliary stimuli is replaced by a response to internally produced stimuli. In its most developed form, this internal operation consists of the child grasping the very structure of the process, learning to understand the laws according to which external signs must be used. When this stage is reached, the child will say, "I don't need pictures any more. I'll do it myself."

Characteristics of the New Method

I have attempted to demonstrate that the course of child development is characterized by a radical alteration in the very structure of behavior; at each new stage the child changes not only her response but carries out that response in new ways, drawing on new "instruments" of behavior and replacing one psychological function by another. Psychological operations that were achieved through direct forms of adaptation at early stages are later accomplished through indirect means. The growing complexity

of children's behavior is reflected in the changed means they use to fulfill new tasks and the corresponding reconstruction of their psychological processes.

Our concept of development implies a rejection of the frequently held view that cognitive development results from the gradual accumulation of separate changes. We believe that child development is a complex dialectical process characterized by periodicity, unevenness in the development of different functions, metamorphosis or qualitative transformation of one form into another, intertwining of external and internal factors, and adaptive processes which overcome impediments that the child encounters. Steeped in the notion of evolutionary change, most workers. in child psychology ignore those turning points, those spasmodic and revolutionary changes that are so frequent in the history of child development. To the naive mind, revolution and evolution seem incompatible and historic development continues only so long as it follows a straight line. Where upheavals occur, where the historical fabric is ruptured, the naive mind sees only catastrophe, gaps, and discontinuity. History seems to stop dead, until it once again takes the direct, linear path of development.

Scientific thought, on the contrary, sees revolution and evolution as two forms of development that are mutually related and mutually presuppose each other. Leaps in the child's development are seen by the scientific mind as no more than a moment in the general line of development.

As I have repeatedly emphasized, an essential mechanism of the reconstructive processes that take place during a child's development is the creation and use of a number of artificial stimuli. These play an auxiliary role that permits human beings to master their own behavior, at first by external means and later by more complex inner operations. Our approach to the study of cognitive functioning does not require the experimenter to furnish subjects with ready-made, external or artificial means in order that they may successfully complete the given task. The experiment is equally valid if, instead of giving children artificial means, the experimenter waits until they spontaneously apply some new auxiliary method or symbol that they then incorporate into their operations.

The specific area to which we apply this approach is not important. We might study the development of memorizing in children by making available to them new means for solving the given task and then observing the degree and character of their problem-solving efforts. We might use this method to study how children organize their active attention with the aid of external means. We might trace the development of arithmetic skills in young children by making them manipulate objects and apply methods either suggested to them or "invented" by them. What is crucial is that in all these cases we must adhere to one principle. We study *not only the final effect of the operation, but its specific psychological structure.* In all these cases, the psychological structure of the development appears with much greater richness and variety than in the classic method of the simple stimulus-response experiment. Although stimulus-response methodology makes it extremely easy to ascertain subjects' responses, it proves useless when our objective is to discover the means and methods that subjects use to organize their own behavior.

Our approach to the study of these processes is to use what we call *the functional method of double stimulation.* The task facing the child in the experimental context is, as a rule, beyond his present capabilities and cannot be solved by existing skills. In such cases a neutral object is placed near the child, and frequently we are able to observe how the neutral stimulus is drawn into the situation and takes on the function of a sign. Thus, the child actively incorporates these neutral objects into the task of problem solving. We might say that when difficulties arise, neutral stimuli take on the function of a sign and from that point on the operation's structure assumes an essentially different character.

By using this, approach, we do not limit ourselves to the usual method of offering the subject simple stimuli to which we expect a direct response. Rather, we simultaneously offer a *second series of stimuli* that have a special function. In this way, we are able to study the *process of accomplishing a task by the aid of specific auxiliary means;* thus we are also able to discover the inner structure and development of the higher psychological processes.

The method of double stimulation elicits manifestations of the crucial processes in the

behavior of people of all ages. Tying a knot as a reminder, in both children and adults, is but one example of a pervasive regulatory principle of human behavior, that of *signification*, wherein people create temporary links and give significance to previously neutral stimuli in the context of their problem-solving efforts.

We regard our method as important because it helps to *objectify* inner psychological processes; stimulus-response methods are objective, but they are limited to the study of external responses that are usually in the subject's repertoire to begin with. We believe that our approach to objectifying inner psychological processes is much more adequate, where the goals of psychological research are concerned, than the method of studying pre-existing, objective responses." Only the objectification of the inner process guarantees access to specific forms of higher behavior as opposed to subordinate forms.

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Mind and Society. Lev Vygotsky 1930

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.'

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.

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.” 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 supetimposed.

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 Kofika’s theory, in which development is based on two inherently different but related processes, each of which influences the other. 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 Thorn- dike’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 nonsystematic 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. 1n 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. 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 independent 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 Kohler, have dealt with this question of imitation quite well. Kohler'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. Kohler'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, Kohler 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 childrenÕs 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 tbought. 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.

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The Prehistory of Written Language

Until now, writing has occupied too narrow a place in school practice as compared to the enormous role that it plays in children's cultural development. The teaching of writing has been conceived in narrowly practical terms. Children are taught to trace out letters and make words out of them, but they are not taught written language. The mechanics of reading what is written are so emphasized that they overshadow written language as such.

Something similar has happened in teaching spoken language to deaf-mutes. Attention has been concentrated entirely on correct production of particular letters and distinct articulation of them. In this case, teachers of deaf-mutes have not discerned spoken language behind these pronunciation techniques, and the result has been dead speech.

This situation is to be explained primarily, by historical factors: specifically, by the fact that practical pedagogy, despite the existence of many methods for teaching reading and writing, has yet to work out an effective, scientific procedure for teaching children written language.

Unlike the teaching of spoken language, into which children grow of their own accord, teaching of written language is based on artificial training. Such training requires an enormous amount of attention and effort on the part of *teacher and* pupil and thus becomes something self-contained, *relegating living* written language to the background. Instead of being founded on the needs of children as they naturally develop and on their own activity, writing is given to them from without, from the teacher's hands. This situation recalls the development of a technical skill such as piano-playing: the pupil develops finger dexterity and learns to strike the keys while reading music, but he is in no way involved in the essence of the music itself.

Such one-sided enthusiasm for the mechanics of writing has had an impact not only

on the practice of teaching but on the theoretical statement of the problem as well. Up to this point, psychology has conceived of writing as a complicated motor skill. It has paid remarkably little attention to the question of written language as such, that is, a particular system of symbols and signs whose mastery heralds a critical turning-point in the entire cultural development of the child.

A feature of this system is that it is second-order symbolism, which gradually becomes direct symbolism. This means that written language consists of a system of signs that designate the sounds and words of spoken language, which, in turn, are signs for real entities and relations. Gradually this intermediate link, spoken language, disappears, and written language is converted into a system of signs that directly symbolize the entities and relations between them. It seems clear that mastery of such a complex sign system cannot be accomplished in a purely mechanical and external manner; rather it is the culmination of a long process of development of complex behavioral functions in the .child. Only by understanding the entire history of sign development in the child and the place of writing in it can we approach a correct solution of the psychology of writing.

The developmental history of written language, however, poses enormous difficulties for research. As far as we can judge from the available material, it does not follow a single direct line in which something like a clear continuity of forms is maintained. Instead, it offers the most unexpected metamorphoses, that is, transformations of particular forms of written language into others. To quote Baldwin’s apt expression regarding the development of things, it is as much involution as evolution.’ ‘this means that, together with processes of development, forward motion, and appearance of new forms, we can discern processes of curtailment, disappearance, and reverse development of old forms at each step. The developmental history of written language among children is full of such discontinuities. Its line of development seems to disappear altogether; then suddenly, as if from nowhere, a new line begins, and at first it seems that there is absolutely no continuity between the old and the new. But only a naive view of development as a purely evolutionary process involving nothing but the gradual accumulation of small changes and the gradual conversion of one

form into another can conceal from us the true nature of these processes. This revolutionary type of development is in no way new for science in general; it is new only for child psychology. Therefore, despite a few daring attempts, child psychology does not have a cogent view of the development of written language as a historical process, as a unified process of development.

The first task of a scientific investigation is to reveal this prehistory of children's written language, to show what leads children to writing, through what important points this pre-historical development passes, and in what relationship it stands to school learning. At the present time, in spite of a variety of research studies, we are in no position to write a coherent or complete history of written language in children. We can only discern the most important points in this development and discuss its major changes. This history begins with the appearance of the gesture as a visual sign for the child.

Gestures and Visual Signs

The gesture is the initial visual sign that contains the child's future writing as an acorn contains a future oak. Gestures, it has been correctly said, are writing in air, and written signs frequently are simply gestures that have been fixed.

Wurth pointed out the link between gesture and pictorial or pictographic writing in discussing the development of writing in human history.[2] He showed that figurative gestures often simply denote the reproduction of a graphic sign; on the other hand, signs are often the fixation of gestures. An indicating line employed in pictographic writing denotes the index finger in fixed position. All these symbolic designations in pictorial writing, according to Wurth, can be explained only by derivation from gesture language, even if they subsequently become detached from it and can function independently.

There are two other domains in which gestures are linked to the origin of written signs. The first concerns children's scribbles. We have observed in experiments on

drawing that children frequently switch to dramatization, depicting by gestures what they should show on the drawing; the pencil-marks are only a supplement to this gestural representation. I could cite many instances. A child who has to depict running begins by depicting the motion with her fingers, and she regards the resultant marks and dots on paper as a representation of running. When she goes on to depict jumping, her hand begins to make movements depicting jumps; what appears on paper remains the same. In general, we are inclined to view children's first drawings and scribbles rather as gestures than as drawing in the true sense of the word. We are also inclined to ascribe to the same phenomenon the experimentally demonstrated fact that, in drawing complex objects, children do not render their parts but rather general qualities, such as an impression of roundness and so forth. When a child depicts a cylindrical can as a closed curve that resembles a circle, she thus depicts something round. This developmental phase coincides nicely with the general motor set that characterizes children of this age and governs the entire style and nature of their first drawings. Children behave in the same way in depicting concepts that are at all complex or abstract. Children do not draw, they indicate, and the pencil merely fixes the indicatory gesture. When asked to draw good weather, a child will indicate the bottom of the page by making a horizontal motion of the hand, explaining, "This is the earth," and then, after a number of confused upward hatchwise motions, 'And this is good weather." We have had the occasion to verify more precisely, in experiments, the kinship between gestural depiction and depiction by drawing, and have obtained symbolic and graphic depiction through gestures in five-year-olds.

Development of Symbolism in Play

The second realm that links gestures and written language is children's games. For children some objects can readily denote others, replacing them and becoming signs for them, and the degree of similarity between a plaything and the object it denotes is unimportant. What is most important is the utilization of the plaything and the possibility of executing a representational gesture with it. This is the key to the entire symbolic function of children's play. A pile of clothes or piece of wood becomes a baby in a game because the same gestures that depict holding a baby in one's hands or feeding a baby can apply to them.. The child's self-motion, his own gestures, are

what assign the function of sign to the object and give it meaning. All symbolic representational activity is full of such indicatory gestures; for instance, a stick becomes a riding-horse for a child because it can be placed between the legs and a gesture can be employed that communicates that the stick designates a horse in this instance.

From this point of view, therefore, children's symbolic play can be understood as a very complex system of "speech" through gestures that communicate and indicate the meaning of playthings. It is only on the basis of these indicatory gestures that playthings themselves gradually acquire their meaning — just as drawing, while initially supported by gesture, becomes an independent sign.

We attempted experimentally to establish this particular special stage of object writing in children. We conducted play experiments in which, in a joking manner, we began to designate things and people involved in the play by familiar objects. For example, a book off to one side designated a house, keys meant children, a pencil meant a nursemaid, a pocket watch a drugstore, a knife a doctor, an inkwell cover a horse-drawn carriage, and so forth. Then the children were given a simple story through figurative gestures involving these objects. They could read it with great case. For example, a doctor arrives at a house in a carriage, knocks at the door, the nursemaid opens, he examines the children, he writes a prescription and leaves, the nursemaid goes to the drugstore, comes back, and administers medicine to the children.

Most three-year-olds can read this symbolic notation with great case. Four-or-five-year-olds can read more complex notation: a man is walking in the forest and is attacked by a wolf, which bites him; the man extricates himself by running, a doctor gives him aid, and he goes to the drugstore and then home; a hunter sets out for the forest to kill the wolf.

What is noteworthy is that perceptual similarity of objects plays no noticeable part in the understanding of the symbolic notation. All that matters is that the objects admit the appropriate gesture and can function as a point of application for it. Hence, things

with which this gestural structure cannot be performed are absolutely rejected by children. For example, in this game, which is conducted at a table and which involves small items on the table, children will absolutely refuse to_ play if we take their fingers, put them on a book, and say, “Now, as a joke, these will be children.” They object that there is no such game. Fingers are too connected with their own bodies for them to be an object for a corresponding indicatory gesture. In the same way, a piece of furniture in the room or one of the people in the game cannot become involved. The object itself performs a substitution function: a pencil substitutes for a nursemaid or a watch for a drugstore, but only the relevant gesture endows them with this meaning. However, under the influence of this gesture, older children begin to make one exceptionally important discovery — that objects can indicate the things they denote as well as substitute for them. For example, when we put down a book with a dark cover and say that this will be a forest, a child will spontaneously add, “Yes, ifs a forest because it’s black and dark.” She thus isolates one of the features of the object, which for her is an indication of the fact that the book is supposed to mean a forest. In the same way, when a metal inkwell cover denotes a carriage, a child will point and say, “This is the seat.” When a pocket watch is to denote a drugstore, one child might point to the numbers on the face and say, “This is medicine in the drugstore”; another might point to the ring and say, “This is the entrance.” Referring to a bottle that is playing the part of a wolf, a child will point to the neck and say, “And this is his mouth.” If the experimenter asks, pointing to the stopper, “And what is this?” the child answers, “He’s caught the stopper and is holding it in his teeth.”

In all these examples we see the same thing, namely, that the customary structure of thin gs is modified under the impact of the new meaning it has acquired. In response to the fact that a watch denotes a drugstore, a feature of the watch is isolated and assumes the function of a new sign or indication of how the watch denotes a drugstore, either through the feature of medicine or of the entrance. The customary structure of things (stopper in a bottle) begins to be reflected in the new structure (wolf holds stopper in teeth), and this structural modification becomes so strong that in a number of experiments we sometimes instilled a particular symbolic meaning of an object in the children. For example, a pocket watch denoted a drugstore in all our

play sessions. whereas other objects changed meaning rapidly and frequently. In taking up a new game, we would put down the same watch and explain, in accordance with the new procedures, “Now this — is a bakery.” One child immediately placed a pen edgewise across the watch, dividing it in half, and, indicating one half, said, “All right, here is the drugstore, and here is the bakery.” The old meaning thus became independent and functioned as a means for a new one. We could also discern this acquisition of independent meaning outside the immediate game; if a knife fell, a child would exclaim, “The doctor has fallen.” Thus, the object acquires a sign function with a developmental history of its own that is now independent of the child’s gesture. This is second-order symbolism, and because it develops in play, we see make-believe play as a major contributor to the development of written language — a system of second-order symbolism.

As in play, so too in drawing, representation of meaning initially arises as first-order symbolism. As we have already pointed out the first drawings arise from gestures of the (pencil-equipped) hand, and the gesture constitutes the first representation of meaning. Only later on does the graphic representation begin independently to denote some object. The nature of this relationship is that the marks already made on paper are given an appropriate name.

H. Hetzer undertook to study experimentally how symbolic representation of things — so important in learning to write — develops in three-to-six-year-old children.[3] Her experiments involved four basic series. The first investigated the function of symbols in children’s play. Children were to portray, in play, a father or mother doing what they do in the course of a day. During this game a make-believe interpretation of particular objects was given, making it possible for the researcher to trace the symbolic function assigned to things during the game. The second series involved building materials, and the third involved drawing with colored pencils. Particular attention in both these experiments was paid to the point at which the appropriate meaning was named. The fourth series undertook to investigate, in the form of a game of post office, the extent to which children can perceive purely arbitrary combinations of signs. The game used pieces of paper of various colors to denote

different types of mail: telegrams, newspapers, money orders, packages, letters, postcards, and so forth. Thus, the experiments explicitly related these different forms of activity, whose only common feature is that a symbolic function is involved in all of them, and attempted to link them all with the development of written language, as we did in our experiments.

Hetzer was able to show clearly which symbolic meanings arise in play via figurative gestures and which via words. Children's egocentric language was widely manifest in these games. Whereas some children depicted everything by using movements and mimicry, not employing speech as a symbolic resource at all, for other children actions were accompanied by speech: the child both spoke and acted. For a third group, purely verbal expression not supported by any activity began to predominate. Finally, a fourth group of children did not play at all, and speech became the sole mode of representation, with mimicry and gestures receding into the background. The percentage of purely play actions decreased with age, while speech gradually predominated. The most important conclusion drawn from this developmental investigation, as the author says, is that the difference in play activity between three-year-olds and six-year-olds is not in the perception of symbols but in the mode in which various forms of representation are used. In our opinion, this is a highly important conclusion; it indicates that symbolic representation in play is essentially a particular form of speech at an earlier stage, one which leads directly to written language.

As development proceeds, the general process of naming shifts farther and farther toward the beginning of the process, and thus the process itself is tantamount to the writing of a word that has just been named. Even a three-year-old understands the representational function of a toy construction, while a four-year-old names his creations even before he begins to construct them. Similarly, we see in drawing that a three-year-old is still unaware of the symbolic meaning of a drawing; it is only around age seven that all children master this completely. At the same time, our analysis of children's drawings definitely shows that, from the psychological point of view, we should regard such drawings as a particular kind of child speech.

Development of Symbolism in Drawing

K. Buhler correctly notes that drawing begins in children when spoken speech has already made great progress and has become habitual .4 Subsequently, he says, speech predominates in general and shapes the greater part of inner life in accordance with its laws. This includes drawing.

Children initially draw from memory. If asked to draw their mother sitting opposite them or some object before them, they draw without ever looking at the original — not what they see but what they know. Often children's drawings not only disregard but also directly contradict the actual perception of the object. We find what Buhler calls "x-ray drawings." A child will draw a clothed figure, but at the same time will include his legs, stomach, wallet in his pocket, and even the money m the wallet — that is, things he knows about but which cannot be seen in the case in question. In drawing a figure in profile, a child will add a second eye or will include a second leg on a horseman in profile. Finally, very important parts of the object will be omitted; for instance, a child will draw legs that grow straight out of the head, omitting the neck and torso, or will combine individual parts of a figure.[4]

As Sully showed, children do not strive for representation; they are much more symbolists than naturalists and are in no way concerned with complete and exact similarity, desiring only the most superficial indications.[5] We cannot assume that children know people no better than they depict them; rather they try more to name and designate than to represent. A child's memory does not yield a simple depiction of representational images at this age. Rather, it yields predispositions to judgments that are invested with speech or capable of being so invested. We see that when a child unburdens his repository of memory in drawing, he does so in the mode of speech — telling a story. A major feature of this mode is a certain degree of abstraction, which any verbal representation necessarily entails. Thus we see that drawing is graphic speech that arises on the basis of verbal speech. The schemes that distinguish children's first drawings are reminiscent in this sense of verbal concepts that communicate only the essential features of objects. This gives us grounds for

regarding children's drawing as a preliminary stage in the development of written language.

The further development of children's drawing, however, is not something self-understood and purely mechanical. There is a critical moment in going from simple mark-making on paper to the use of pencil-marks as signs that depict or mean something. All psychologists agree that the child must discover that the lines he makes can signify something. Sully illustrates this discovery using the example of a child who haphazardly drew a spiral line, without any meaning, suddenly grasped a certain similarity, and joyfully exclaimed, "Smoke, smoke!" Although this process of recognizing what is drawn is encountered in early childhood, it is still not equivalent to the discovery of symbolic function, as observations have shown. Initially, even if a child perceives a similarity in a drawing, he takes the drawing to be an object that is similar or of the same kind, not as a representation or symbol of the object.

When a girl who was shown a drawing of her doll exclaimed, "A doll just like mine!" it is possible that she had in mind another object just like hers. According to Hetzer, there is no evidence that forces us to assume that assimilation of the drawing to an object means at the same time an understanding that the drawing is a representation of the object. For the girl, the drawing is not a representation of a doll but another doll just like hers. Proof of this is provided by the fact that for a long time children relate to drawings as if they were objects. For example, when a drawing shows a boy with his back to the observer, the child will turn the sheet over to try to see the face. Even among five-year-olds we always observed that, in response to the question, "Where is his face and nose?' children would turn the drawing over, and only then would answer, "It's not there, it's not drawn."

We feel that Hetzer is most justified in asserting that primary symbolic representation should be ascribed to speech, and that, it is on the basis of speech that all the other sign systems are created. Indeed, the continuing shift toward the beginning in the moment of naming a drawing is also evidence of the strong impact of speech on the development of children's drawing.

We have had the opportunity of observing experimentally how children's drawing becomes real written language by giving them the task of symbolically depicting some more or less complex phrase. What was most clear in these experiments was a tendency on the part of school-age children to change from purely pictographic to ideographic writing, that is, to represent individual relations and meaning by abstract symbolic signs. We observed this dominance of speech over writing in one school child who wrote each word of the phrase in question as a separate drawing. For example, the phrase "I do not see the sheep, but they are there" was recorded as follows: a figure of a person ("I"), the same figure with its eyes covered ("don't see"), two sheep ("the sheep"), an index finger and several trees behind which the sheep can be seen ("but they are there"). The phrase "I respect you was rendered as follows: a head ("I"), two human figures, one of which has his hat in hand ("respect") and another head ("you").

Thus, we see how the drawing obediently follows the phrase and how spoken language intrudes into children's drawings. In this process, the children frequently had to make genuine discoveries in inventing an appropriate mode of representation, and we were able to see that this is decisive in the development of writing and drawing in children.

Symbolism in Writing

In connection with our general research, Luria undertook to create this moment of discovery of the symbolics of writing so as to be able to study it systematically.[6] In his experiments children who were as yet unable to write were confronted with the task of making some simple form of notation. The children were told to remember a certain number of phrases that greatly exceeded their natural memory capacity. When each child became convinced that he would not be able to remember them all, he was given a sheet of paper and asked to mark down or record the words presented in some fashion.

Frequently, the children were bewildered by this suggestion, saying that they could

not write, but the experimenter furnished the child with a certain procedure and examined the extent to which the child was able to master it and extent to which the pencil-marks ceased to be simple playthings and became symbols for recalling the appropriate phrases. In the three-to-four-year-old stage, the child's notations are of no assistance in remembering the phrases; in recalling them, the child does not look at the paper. But we occasionally encountered some seemingly astonishing cases that were sharply at variance with this general observation. In these cases, the child also makes meaningless and undifferentiated squiggles and lines, but when he reproduces phrases it seems as though he is reading them; he refers to certain specific marks and can repeatedly indicate, without error, which marks denote which phrase. An entirely new relationship to these marks and a self-reinforcing motor activity arise: for the first time the marks become mnemotechnic symbols. For example, the children place individual marks on different parts of the page in such a way as to associate a certain phrase with each mark. A characteristic kind of topography arises — one mark in one corner means a cow, while another farther up means a chimneysweep. Thus the marks are primitive indicatory signs for memory purposes.

We are fully justified in seeing the first precursor of future writing in this mnemotechnic stage. Children gradually transform these undifferentiated marks. Indicatory signs and symbolizing marks and scribbles are replaced by little figures and pictures, and these in turn give way to signs. Experiments have made it possible not only to describe the very moment of discovery itself but also to follow how the process occurs as a function of certain factors. For example, the content and forms introduced into the phrases in question first break down the meaningless nature of the notation. If we introduce quantity into the material, we can readily evoke a notation that reflects this quantity, even in four-and five-year-olds. (It was the need for recording quantity, perhaps, that historically first gave rise to writing.) In the same way, the introduction of color and form are conducive to the child's discovery of the principle of writing, For example, phrases such as "like black," "black smoke from a chimney," "there is white snow in winter," "a mouse with a long tail," or "Lyalya has two eyes and one nose" rapidly cause the child to change over from writing that functions as indicatory gesture to writing that contains the rudiments of representation.

It is easy to see that the written signs are entirely first-order symbols at this point, directly denoting objects or actions, and the child has yet to reach second-order symbolism, which involves the creation of written signs for the spoken symbols of words. For this the child must make a basic discovery — namely that one can draw not only things but also speech. It was only this discovery that led humanity to the brilliant method of writing by words and letters; the same thing leads children to letter writing. From the pedagogical point of view, this transition should be arranged by shifting the child's activity from drawing things to drawing speech. It is difficult to specify how this shift takes place, since the appropriate research has yet to lead to definite conclusions, and the generally accepted methods of teaching writing do not permit the observation of it. One thing only is certain — that the written language of children develops in this fashion, shifting from drawings of things to drawing of words. Various methods of teaching writing perform this in various ways. Many of them employ auxiliary gestures as a means of uniting the written and spoken symbol; others employ drawings that depict the appropriate objects. The entire secret of teaching written language is to prepare and organize this natural transition appropriately. As soon as it is achieved, the child has mastered the principle of written language and then it remains only to perfect this method.

Given the current state of psychological knowledge, our notion that make-believe play, drawing, and writing can be viewed as different moments in an essentially unified process of development of written language will appear to be very much overstated. The discontinuities and jumps from one mode of activity to another are too great for the relationship to seem evident. But experiments and psychological analysis lead us to this very conclusion. They show that, however complex the process of development of written language may seem, or however erratic, disjointed, and confused it may appear superficially, there is in fact a unified historical line that leads to the highest forms of written language. This higher form, which we will mention only in passing, involves the reversion of written language from second-order symbolism to first-order symbolism. As second-order symbols, written symbols function as designations for verbal ones. Understanding of written language is first effected through spoken language, but gradually this path is curtailed and spoken

language disappears as the intermediate link. To judge from all the available evidence, written language becomes direct symbolism that is perceived in the same way as spoken language. We need only try to imagine the enormous changes in the cultural development of children that occur as a result of mastery of written language and the ability to read — and of thus becoming aware of everything that human genius has created in the realm of the written word.

Practical Implications

An overview of the entire developmental history of written language in children leads us naturally to three exceptionally important practical conclusions.

The first is that, from our point of view, it would be natural to transfer the teaching of writing to the preschool years. Indeed, if younger children are capable of discovering the symbolic function of writing, as Hetzer's experiments have shown, then the teaching of writing should be made the responsibility of preschool education. Indeed, we see a variety of circumstances which indicate that in the Soviet Union the teaching of writing clearly comes too late from the psychological point of view. At the same time, we know that the teaching of reading and writing generally begins at age six in most European and American countries.

Hetzer's research indicates that eighty percent of three-year-olds can master an arbitrary combination of sign and meaning, while almost all six-year-olds are capable of this operation. On the basis of her observations, one may conclude that development between three and six involves not so much mastery of arbitrary signs as it involves progress in attention and memory. Therefore, Hetzer favors beginning to teach reading at earlier ages. To be sure, she disregards the fact that writing is second-order symbolism, whereas what she studied was first-order symbolism.

Burt reports that although compulsory schooling begins at age five in England, children between three and five are allowed into school if there is room and are taught the alphabet.[7] The great majority of children can read at four-and-a-half. Montessori

is particularly in favor of teaching reading and writing at an earlier age.[8] In the course of game situations, generally through preparatory exercises, all the children in her kindergartens in Italy begin to write at four and can read as well as first-graders at age five.

But Montessori's example best shows that the situation is much more complex than it may appear at first glance. If we temporarily ignore the correctness and beauty of the letters her children draw and focus on the content of what they write, we find messages like the following: "Happy Easter to Engineer Talani and Headmistress Montessori. Best wishes to the director, the teacher, and to Doctor Montessori. Children's House, Via Campania," and so forth. We do not deny the possibility of teaching reading and writing to preschool children; we even regard it as desirable that a younger child enter school if he is able to read and write. But the teaching should he organized in such a way that reading and writing are necessary for something. If they are used only to write official greetings to the staff or whatever the teacher thinks up (and clearly suggests to them), then the exercise will be purely mechanical and may soon bore the child; his activity will not be manifest in his writing and his budding personality will not grow. Reading and writing must be something the child needs. Here we have the most vivid example of the basic contradiction that appears in the teaching of writing not only in Montessori's school but in most other schools as well, namely, that writing is taught as a motor skill and not as a complex cultural activity. Therefore, the issue of teaching writing in the preschool years necessarily entails a second requirement: writing must be "relevant to life" — in the same way that we require a "relevant" arithmetic.

A second conclusion, then, is that writing should be meaningful for children, that an intrinsic need should be aroused in them, and that. writing should be incorporated into a task that is necessary and relevant for life. Only then can we be certain that it will develop not as a matter of hand and finger habits but as a really new and complex form of speech.

The third point that we are trying to advance as a practical conclusion is the requirement that writing be taught naturally. In this respect, Montessori has done a

great deal. She has shown that the motor aspect of this activity can indeed be engaged in in the course of children's play, and that writing should be "cultivated" rather than "imposed." She offers a well-motivated approach to the development of writing.

Following this path, a child approaches writing as a natural moment in her development, and not as training from without. Montessori has shown that kindergarten is the appropriate setting for teaching reading and writing, and this means that the best method is one in which children do not learn to read and write but in which both these skills are found in play situations. For this it is necessary that letters become elements of children's life in the same way, for instance, that speech is. In the same way as children learn to speak, they should be able to learn to read and write. Natural methods of teaching reading and writing involve appropriate operations on the child's environment. Reading and writing should become necessary for her in her play. But what Montessori has done as regards the motor aspects of this skill should now be done in relation to the internal aspect of written language and its functional assimilation. Of course, it is also necessary to bring the child to an inner understanding of writing and to arrange that writing will be organized development rather than learning. For this we can indicate only an extremely general approach: in the same way that manual labor and mastery of line-drawing are preparatory exercises for Montessori in developing writing skills, drawing and play should be preparatory stages in the development of children's written language. Educators should organize all these actions and the entire complex process of transition from one mode of written language to another. They should follow it through its critical moments up to the discovery of the fact that one can draw not only objects but also speech. If we wished to summarize all these practical requirements and express them as a single one, we could say that children should be taught written language, not just the writing of letters.