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The Role of L.S. Vygotsky in the Development of Problems of Perception

In his investigation of problems of the sociohistorical determinants of human consciousness, Vygotsky concentrated his attention mainly on study of the genesis, functions, and structure of the "higher mental functions"—verbal thought, voluntary regulation of actions, logical memory, creative imagination, and so forth, which together constitute man's specific identity as a social being. It was on the basis of these investigations that Vygotsky developed his concept of the sociogenesis of mental processes in man, which played such an important role in the development of the Soviet science of psychology.

As for the lower mental functions (direct perception, involuntary memory, prespeech thought, etc.), Vygotsky, who did not undertake a special study of their nature, was forced to make use of the data available at that time in psychophysiology on these processes as specific natural reactions of the organism that vary in the course of ontogeny under the influence of maturation. But Vygotsky understood quite well that even these processes (in particular, perception) acquire a special character in man. As he did not have sufficient data on the influence of social conditions of human activity on the internal structure of such pro-

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cesses, he attempted to explain their singularity and specificity by the circumstance that, while retaining their natural character, they enter into relation with higher mental functions and thereby form new psychological systems, for example, the system that unites perception with verbal thought.

Vygotsky contrasted this systemic approach to the problem of the atomism of associative psychology and to the gestaltist conception of the original integrity of perception, demonstrating in his studies that perceptual structures are a product of development and that the interfunctional connections underlying them are formed over the course of ontogeny, under the influence of verbal communication with other people, and of the individual's assimilation of social experience.

In his criticism of the antidevelopmental theory of perception propounded by Gestalt psychology, Vygotsky wrote:

> the legend that says that perception does not develop at all, that from the very outset, in the infant, it functions in the same way as it does later in the adult person, and that in the process of general modification of mental functions, perception enjoys the privilege of not developing, not changing, but remaining as it is, is steadily crumbling. In fact, the infant's perception resembles adult perception as little as do memory or thought at these two stages of development. [1, vol. 4, p. 114]

The principal qualitative changes in the development of perception occur**,** according to Vygotsky**,** in connection with the old and the emergence of new psychological systems. In the early stages of development, perception is directly associated with movement and with emotional processes. It is an inseparable part of the sensorimotor acts that are responsible for the affective relation of the child to the surrounding reality.

In the process of the child's development, these primary connections of sensory processes with affect and with movement break down, and in their place new interfunctional relations are formed between perception and memory. A union, a merger, of present stimuli and stimuli reproduced from memory takes place. Connections are made in the actual process of perception on the basis of past experience, that is, on the basis of mnemonic images formed earlier. As a result, such an important property of developed perception as its constancy, that is, the relative constancy of the magnitude, form, and color of perceived objects, comes into being. The development of perception does not end with the forma-

tion of perceptual-mnemonic systems. At higher stages of development, perception begins to approximate verbal thought, and intellectualization of perceptual processes takes place. A new psychological system is formed, uniting perception and thought into a single whole and to a process of rational, meaningful perception. One function begins to operate within the other as its component part. The two together form a unity of functions that can be distinguished only empirically, so that only a psychological experiment will identify meaningless perception—perception, so to speak, in pure form—and separate immediate perception from thought.

Since the development of a child's thought passes through a number of qualitatively unique genetic stages, the perceptual-intellectual system also undergoes substantial changes. In the earlier stages, perception is associated with concrete, complex thought. Later, in adolescence, perceptual processes merge with abstract, conceptual thought, forming the higher forms of categorical perception. Whereas in the stage of complex thought, the immediate data of perception are organized and invested with meaning in the form of images of certain concrete life situations, in the stage of conceptual thought, the person begins to perceive his or her surroundings as if through a prism of intellectual categories, ordering and giving meaning to incoming impressions through the system of abstract concepts formed in the person by that time.

The higher forms of meaningful perception, Vygotsky pointed out, can develop only through the participation of speech, only as the result of combining processes of perception with processes of verbal thought. This conjunction comes about, according to his hypothesis, as a result of the social conditions of man's life, in the process of the individual's verbal communication with other people and the systematic acquisition of the external, formal, and internal semantic aspects of language.

Vygotsky's theory of the systemic structure of human perception and the successive changes in this structure during phylogeny and ontogeny retains its importance to this very day and remains an important achievement in our attempt to resolve the problems of the genesis and structure of mental processes. However, theoretical and empirical studies undertaken since Vygotsky have shown that different aspects of his theory differ in value and importance. Whereas Vygotsky's concept of psychological systems and his description of the higher mental functions joining with perception represented a new step in the development of the science of psychology, the perceptual processes themselves

that are part of these complex psychological systems were construed in the old way, as responses or as subjective experiences accompanying those responses.

As a result of his studies of higher mental processes, Vygotsky rejected the "reactological" conception of such processes that prevailed at that time and developed a completely new theory of the nature of these processes, which he thus saw as unique, object-related operations or actions analogous to external practical actions. Like the actions of human labor, which are accomplished with tools and lead to useful transformations of the objective situation, the operations of verbal thought or logical memory are also mediated, transforming actions; but the tool in this case is replaced by the sign, and the reorganization of the situation is oriented not directly toward satisfaction of the material needs of the subject, but toward acquisition of needed information about the surroundings and toward optimal organization of how the subject controls his behavior.

As they develop, higher mental operations traverse the unique paths of "internalization" so that external actions accomplished with external means (for example, through external speech) are transformed into internal actions accomplished with internal means (for example, with the aid of inner speech). Thus do verbal thought, logical memory, voluntary attention, and other higher mental functions come into being, as a specific and distinctive feature of human beings, giving human activity a rational and intentional character. As for the lower, unmediated, mental processes in humans, particularly the processes of perception, their development, as we have already pointed out, depends, according to Vygotsky, mainly on the processes of organic maturation; only indirectly—that is, only insofar as perception enters into interfunctional relations with other higher mental processes, for example, memory or thought—do they depend on the sociohistorical conditions of a person's life. Perceptual processes per se remain unchanged, although they are also incorporated into new systems.

In Vygotsky's view, the new qualitative features of human perception come about "not as a consequence of changes in the internal composition or an internal property of perception itself, but from the fact that perception itself begins to operate in the system of other functions" [2, vol. 2, p. 371].

The composition and structure of perception and of the other lower mental functions are determined directly by man's biological nature; unlike the structure of higher mental processes, they do not undergo

substantial changes during the course of sociohistorical development. In Vygotsky's view, "All the elementary mental and physiological functions—perception, movement, reactions, and so on—in primitive man in no way differ from what we know about these same functions in civilized man" [3, vol. 3, pp. 27–28]. This assertion—which limits the sphere of action of the laws (discovered by Vygotsky) governing the social determinants of the development of human consciousness and wrongly breaks down the essentially unitary human mind into two purportedly completely different spheres (lower and natural, and higher and cultural mental functions)—underwent a thorough revision during the course of later psychological investigations.

It should be pointed out that rejection of the opposition of natural versus cultural functions by no means signified rejection of Vygotsky's fully valid positions concerning the complex, multitiered nature of the ontogeny of the human mind during which processes of development, maturation, and learning join together in complex ways. The point is that these processes are manifested not severally—some (for example, processes of maturation) in the genesis of more elementary mental functions, while others (for example, learning processes) are manifested in the formation of higher functions—but together, conjointly, although in different combinations and in different spheres of mental development.

It seems to me that any attempt to overcome the invalid opposition of natural versus cultural mental functions is entirely within the spirit of Vygotsky's theory of the uniqueness of the ontogeny of the human mind, which postulates that the processes of organic maturation and those concerned with assimilation of social experience are inseparably intertwined. As Vygotsky wrote:

> These two sequences of changes interpenetrate one another and together essentially constitute the unified sequence of sociobiological development of the child's personality. Since organic development takes place in a cultural environment, it becomes a historically determined biological process. At the same time, cultural development assumes a completely unique character, unlike anything else, since it takes place at the same time and inseparable from organic maturation, and since the vehicle of this development is the growing, changing, maturing organism of the child. [3, vol. 3, p. 31]

In fact, further studies have shown that, despite the profound qualitative differences between higher mediated functions and lower, direct (unmediated) processes, they have much in common, and the latter

even have an operational, practically effective character. Operationality, what formerly had been considered a distinctive attribute of higher mental processes began to be construed as a quality common to everything that had to do with the mind, which ultimately led to a new understanding of the subject matter of psychology. Mental activity began to be regarded as an activity that arose on the basis of practical activity and the associated functions of orientation and regulation.

Studies of perception and its development in ontogeny carried out over the past few decades assume a special interest in this connection. Soviet psychologists who have studied this problem (A.N. Leontiev, B.G. Anan′ev, P.Ia. Gal′perin, A.V. Zaporozhets, V.P. Zinchenko, D.B. El′kin, and others) came to reject the receptor conception of perception that had dominated psychology for so long and began to regard processes of perception as special perceptual acts. The effector components of perceptual acts, in the form of movements of the hand feeling an object or the eye tracing the contours of a perceived figure, play an important role in perceptual actions in the early stages. The function of such orienting-investigatory movements of receptor apparatuses is to examine the perceived object, to "appropriate" (A.N. Leontiev) its characteristics, and to model its properties, so that a copy is made, that is, an adequate image of that object is formed.

Developmental studies I have conducted, together with colleagues at the Institute of Psychology and the Institute of Preschool Education of the RSFSR Academy of Pedagogical Sciences [now renamed the Scientific Research Institute of General and Pedagogical Psychology of the USSR Academy of Pedagogical Sciences and the Scientific Research Institute of Preschool Education of the USSR Academy of Pedagogical Sciences—Ed.] [4, 5], have shown that the complex and perfected orienting-investigatory actions that characterize perception in the adult human being and enable the formation of adequate images of a perceived reality form only gradually in the child under the influence of living and learning.

Our colleagues have studied the formation of perceptual actions in the process of development of tactile (T.O. Ginevskaia, V.P. Zinchenko, A.G. Ruzskaia), visual (Z.M. Boguslavskaia, L.A. Venger, V.P. Zinchenko, M.I. Lisina, A.G. Ruzskaia), kinesthetic (Ia.Z. Neverovich), and auditory perception (T.V. Endovitskaia, T.K. Mukhina, T.A. Repina). In addition to visual observation, movie films (V.P. Zinchenko, A.G. Ruzskaia) and elec-

trophysiological recording [6] of the movements of receptor apparatuses have been used. These studies, plus the contributions of other authors, indicate that a child is born with a number of orienting reactions, which are expressed outwardly as movements of the receptors in the direction of incoming stimuli, in the fixation of those stimuli, in following their movements through space, and so forth. In the very first months of life, the child's orienting activity reaches a rather high level [7] and leads to the attainment of quite complex sensory effects, for example, an "orienting" discrimination of geometric figures [8, 9, and others]. Evidently, orienting reactions are the foundation, the natural material, on the basis of which perceptual actions later form. The transformation of orienting reactions into object-related orienting-investigatory actions, through which perceived objects are examined in detail and their properties are modeled, is a long and complex process embracing the whole of infancy and preschool age. Let us examine one example illustrating the dynamics of this process.

V.P. Zinchenko [10–12] and A.G. Ruzskaia [13] made similar recordings of orienting eye movements of children of different ages during the process of visual perception of complex figures unfamiliar to the children. They found that in very young children (three to four years old), eye movements in this experimental situation were relatively few, and, moreover, were much longer than in older children. The movements remained within the figure, and sometimes (once) proceeded along its axial line. The children's attention was often distracted by the lens of the camera. Movements of the gaze, tracing the contours of the figure, were totally absent. Given such a primitive way of becoming familiar with the figure, performance in terms of recognizing it was very low. Half of the responses were wrong, and figures differing considerably from one another in shape were confused.

In four- to five-year-olds, the movements of the gaze as the child examined a figure were also accomplished mainly within the figure. There were twice as many movements as in the young children, and, accordingly, the duration of fixations was less. Judging from the trajectory of the eye movements, one can assume that the children were orienting toward the size and the area of the figure. Many gross, broad movements were observed, evidently directed toward measuring the perceived object. Although subjects of this age also exhibited practically no movements tracing contours, these children displayed groups

of fixations located very close to one another and related to the most characteristic attributes of the figure. Such a method of familiarization led to commensurately better performance on the part of the children in recognizing figures in control experiments than was the case for three-year-olds.

Movements of the gaze tracing the contours of the perceived figure appeared at the age of five or six years. However, usually the children focused on only one, most characteristic, segment of the contour; the other parts remained unexamined. Five-year-olds displayed as many eye movements in the course of this session as did four-year-olds. Many of the movements still provided little information from the standpoint of the problem to be solved and remained, for example, within the bounds of the figure. Nevertheless, this method of examination was sufficient for subsequent recognition of the perceived object, and five-year-olds gave flawless answers in the control experiments.

Movements of the gaze in six- to seven-year-old children were mainly along the contour of the figure, as if reproducing or modeling its shape. At the same time, movements were observed intersecting the field of the figure; these movements also fulfilled an important orienting function in that they measured the area of the perceived object. More movements were observed for these children than for the younger children. At the same time, the duration of fixations continued to diminish. With this active and refined method of examining a figure, not only was complete success achieved in recognition of the figure in control experiments but it also became possible, as experiments and observations showed, to solve more complicated sensory tasks involving appropriate reproduction of a perceived figure in drawing, clay modeling, designing, and so forth.

Although the most detailed development of perceptual actions is, for the present, observed in the domain of touch and vision, the data obtained in our laboratory and the work of other authors provide grounds for assuming that similar changes take place in the other sensory modalities as well. For example, experiments by Ia.Z. Neverovich [14] indicate that the development of special, testing, orienting movements, clarifying the internal, proprioceptive picture of the motor act being accomplished, play an important role in the development of kinesthetic perceptions. A.N. Leontiev [15] and colleagues in our laboratory [16–18] point to the important role of the development of active methods of

reproducing audible sound through vocalization, modeling of high-frequency relations through various kinds of movements, and so on, in the genesis of high-frequency hearing. Similar phenomena have been observed in the development of phonemic hearing in children [19, 20], since modeling of the distinctive features of identifiable sounds of speech on the basis of their intonation plays an important role in auditory analysis of a word.

In describing the overall trend of development of perception, it should be borne firmly in mind that this process is more than simply a question of the reactions of receptor apparatuses' becoming more complex and establishing links with new trigger signals. The principal factor here is the formation of special object-related perceptual operations or actions that are, in turn, systems of motor, biomechanical, and other kinds of analyzer reactions formed during life. As in any other system, the laws of perceptual action are not equivalent to the laws of the sensory responses comprising them. The main quality of such a system is its objective nature, the fact that its logic, that is, the rules governing the accomplishment of an action, becomes increasingly dependent on the logic of the perceived object and on the distinctive features of its composition and structure. In this respect, perceptual actions are similar, on the one hand, to labor and practical actions, and, on the other, to intellectual actions carried out through ordinary speech or other symbolic means.

In contrast to the former, perceptual actions do not, however, lead directly to a purposive change in material reality, but merely orient and regulate practical activity directed toward such changes. At the same time, unlike intellectual actions, perceptual actions are produced not with symbolic substitutes of objects, but with real objects themselves; and the instruments used here serve only to provide a more detailed examination of what is perceived and to create a concrete image of the latter—its perceptual model. But despite all the differences in perceptual and intellectual processes, both are varieties of object-related orienting-investigatory actions, and their development is governed by general laws.

Our studies and the works of P.Ia. Gal′perin [21] have shown that during the course of sensory learning, orienting-investigatory actions, initially expanded, are gradually abbreviated, their effector components are inhibited, and the entire process gradually moves from outside to

within, being reduced to the movement of the focus of attention over the perceptual field. Thus, we see that the laws of "internalization" or "engrafting," which Vygotsky considered specific only to the formation of higher mediated mental processes, are also manifested in a unique way during the formation of direct perceptual processes. Clearly, this law is of universal psychological significance.

The new studies of perception I have mentioned above have revealed that lower perceptual processes, unmediated by signs, are, like higher processes, special actions that are carried out with the help of methods (developed during life) of investigation and modeling perceived objects. It is natural to assume that these perceptual actions and the ways they are accomplished under the sociohistorical conditions of human life would acquire a special nature, and that this assimilation of social experience would have not only an indirect (for example, through verbal thought) but also a direct influence on perception, altering its intrinsic structure.

In theoretical and experimental studies devoted to the historical approach to study of the human mind, A.N. Leontiev [15] further developed Vygotsky's positions, demonstrating the universal significance of man's appropriation of sociohistorical experience not only for the formation of higher mental functions but also for the whole of human mental development, including the development of man's sensory processes.

In addition to genetically fixed experience and individual experience, another factor that plays a crucial role in human mental development is the very special form, not found in animals, of species experience, materialized in the creations of social culture and in the products of physical and intellectual labor. The spiritual forces and indeed the essence of the human species are embodied and objectified in these products. To realize the achievements of his species in ontogenetic development, a person must, throughout childhood, assimilate the social experience accumulated by preceding generations and embodied in the objects of material and intellectual culture that mankind has created for himself. . . .

The individual's appropriation of social experience objectified in the products of material and social production is an active process.

As A.N. Leontiev has written:

> The child must actively explore even the most elementary tools, instruments, or everyday objects he first encounters in the capacity that is specific to them. In other words, with respect to them, the child must engage in practical or cognitive activity that *follows the exact lines* of the human

> activity embodied in them (although, of course, it is not identical with that activity). [15, p. 364]

These general propositions, all in equal measure, characterize appropriation by the individual of the products of the material and other domains of intellectual culture created by mankind, including the domain of sensory culture, embodied in the sounds of music and speech, the shapes of the tools of labor and household objects, in the lines and colors of works of representational art, and so forth. . . .

Later, the task became that of providing a more detailed analysis of the distinctive features of the composition and structure of perceptual actions acquired as the individual assimilates a sensory culture created by society. In a series of studies [4, 13, 22, 23], we attempted to elucidate the characteristics of the origin and development of those means used by a child in investigating and modeling the properties of the reality he perceives. The conclusions from these studies might be briefly formulated as follows. As a result of the many centuries of experience in production, learning, and art, mankind selects from the diverse and variegated reality he perceives certain qualities that are most important for achieving practical and cognitive ends, and, in a certain sense, quantifies and systematizes them and designates them with words. Throughout childhood, a person digests such condensed social sensory experience and learns to utilize it as a system of sensory measures of standards to analyze his surroundings and order his experience. This process begins very early, already at preschool age, and follows a complex path of development. As L.A. Venger [24, 25] has shown in his studies, these standards initially are of a very global and undifferentiated nature, so that an entire object, with all of its distinctive features, is seen to represent a specific quality (a circle is a ball, the color green is a leaf or grass, etc.). These sensory measures or yardsticks the child uses gradually acquire the differentiated character typical of them in the adult. In the normal methods of preschool education, which do not provide for systematic teaching of sensory standards and ways of using them to children, the entire process of sensory development is slow, and the measure of achievement is relatively low. However, the introduction of new methods of sensory education quickens this process and alters it substantially.

Studies done at the Institute of Preschool Education of the RSFSR Academy of Pedagogical Sciences [24–29 and others] have shown that if actions with standards are systematically cultivated in children, the

level of development of different kinds of perception may be considerably enhanced.

A study of perception under conditions of productive activity (drawing, clay modeling, designing) indicates that such activity brings children into contact with extremely difficult perceptual tasks that require complex processes of sensory analysis and synthesis. For example, when a child draws a visible object or uses building blocks to build something in accordance with a model, he must establish the general form of the object, the nature of the elements of which it is composed, and the distinctive features of the relations among them. As we know, this task is very difficult for children; initially they are unable to cope with it purely visually and resort to practical trial and error. However, such tasks are facilitated considerably if the child is first armed with a set of relevant standards that will help him identify correctly all the distinctive features of the complex shape and then reproduce it accurately in his drawing or construction.

For example, pedagogical [29, 30] and psychological studies [31, 32] have shown that if a preschooler is first familiarized with models of elementary geometric forms, he will then use these models in analyzing complex shapes, and the level of his visual analysis of a visible object will be increased substantially. L.A. Venger and I.D. Venev [33] obtained similar data when they studied the role of standards in children's perception of color. They found that assimilation of a standard goes through several stages. Initially, the required results are achieved only if the standards are given to the child in an external material form, for example, in the form of figures cut out of cardboard or colored paper, which are then compared with the characteristics of the objects and help to define them more precisely. Subsequently, the child finds that he no longer needs such external sensory markers and external manipulations with them and begins to operate with the internal imagined standards he now possesses.

If the sensory learning is appropriate, a child assimilates entire sets, *alphabets* of standards of different sensory qualities; this enables him to read incoming sensory information correctly and to perceive appropriately the visible form or the audible melody. At the same time as the child masters the sensory alphabets, he also learns some general rules and algorithms for combinations of sensory elements, rules corresponding to the real relationships among the perceived properties of

real objects. For example, A.G. Ruzskaia [34] and others [13] discovered that preschoolers can learn the rules of correlating elements of rectilinear geometric figures and are guided by these rules when they study new objects. T.V. Endovitskaia [16] and T.A. Repina [17, 18] showed that preschoolers begin to perceive correctly the ratios of sounds by frequency (if, of course, they are taught properly), in which they are guided by a generally accepted high-frequency scale. All these findings are evidence that in the process of the development of human perception, perceptual actions are formed *in the midst of life* and acquire a unique structure as a result of the individual's acquisition of social sensory experience.

An analysis of studies of the development of perception carried out after L.S. Vygotsky demonstrates that his influence on this area of psychology is very considerable, although it is not direct and is very complicated. On the one hand, his particular notions of the genesis and structure of human perception, which he regarded as a natural and direct process, underwent substantial revision during the course of later studies. On the other hand, his general propositions (which Vygotsky himself thought could be applied only to higher mental processes mediated by signs) concerning the practical, operational nature of human mental processes and the development of those processes through appropriation by the individual of social experience have, as we have discovered, broader significance and can be applied also to lower processes, particularly sensory processes.

The spread of these general propositions into a broader domain of psychological reality has been accompanied by a considerable change in their content. After Vygotsky, the distinctive features of human activity and its influence on mental development were intensively studied by Soviet psychology. As a result, ideas concerning the structure of this activity, its components, and the relations among them were enriched. In addition to means and operations carried out with them, the object of study has been the components of activity, such as goals and the motives stimulating it. Hence, the social determinants of mental development and the transformation of external material reality into internal mental reality are problems that have extended beyond the narrow sphere of study of mediation through signs and have acquired many more facets. Finally, identification in an activity of its orienting segment and clarification of mutual relations between that segment and a segment of ex-

ecutive action have enabled us to understand more deeply the nature and living role of mental processes (including the processes of perception) and opened a [door] to completely and unexpectedly new efficacy in objective study of these processes.

Thus, Vygotsky's propositions, particularly his proposition concerning the nature and genesis of human perception, were, during the course of later examinations, further developed, but, in addition, submitted to considerable changes. That possibly is the fate of any fruitful scientific end that is not frozen in the form of a dead dogma, but continues to live and influence the course of studies and continuously to change, enriching and finding new spheres of application.

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