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A.V. ZAPOROZHETS

The Development of Sensations and Perceptions in Early and Preschool Childhood

During the first years of a child's life, intensive development of the sensory system takes place. This is characterized not only by quantitative but also by deep qualitative changes in the content and structure of the appropriate processes. The study of this development has important theoretical and practical value insofar as the ontogenesis of the sensory system creates the necessary prerequisites for the emergence of thinking, perfection of practical activity, and the formation of a child's abilities. We will try to shed light on some general problems in sensory development in early and preschool childhood, basing our presentation on the results of psychological research conducted under our supervision at the Institute of Preschool Education and the Institute of Psychology of the APS of the RSFSR. These studies were conducted in close contact with A.P. Usova (in Sensory Education of the Preschoolers [*Sensornoe vospitanie doshkol′nikov*], 1963) and N.P. Sakulina (1963), and others.

Theoretical analysis of moving forces and the general nature

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of sensory development in children reveal the inadequacy of naturalistic concepts, which, until recently, have dominated psychological and physiological studies. According to these concepts, sensory development is supposedly identical to ontogenesis in the animal sensory system and is wholly determined by a maturation of innate anatomic-physiological mechanisms and by their adaptation to existing living conditions. In fact, the ontogenesis of human perception is profoundly unique, for it is not adaptation that plays a decisive role in it, but rather the acquisition of social sensory experience accumulated by previous generations (as shown by A.N. Leontiev, 1972). Its essence lies in mastering the systems of perceptible object properties that one can isolate, reproduce in various forms of human activity, and then fix in language, such as systems of musical or speech sounds, systems of colors and forms of surrounding objects, and so on. In the course of this acquisition, the child's perception acquires not only a specifically human content, but also a unique human structure, since children acquire socially fixed sensory tokens and learn to use them to examine perceived objects. Processes of acquisition certainly do not abolish processes of the maturing of analytic apparatuses and their functional adaptation to actual situations. Nevertheless, maturation and adaptation processes do not take on independent, but rather relative, value in the development of the child's perception—that is, a prerequisite for the mastering of social sensory experience.

Acquisition, which plays such an important role in the development of the sensory system, has an active rather than passive character. Sensory processes accommodate to various forms of activities, organizing and regulating them. The development of sensory processes depends on these activities in the course of which the child actively acquires the products of material and spiritual human culture. The task of acquisition of any sensory content assumes its specific meaning only in the context of certain forms of human activity.

Establishing the importance of the role of active, practical acquisition of social experience in the process of the child's sensory development allows us to approach the problem of specific developmental age stages in a new way. While the maturation of the analytical system creates certain contingencies or potential for the emergence of a higher level sensorial system, the realization of this potential and actual transition from one stage to another are necessarily connected with essential changes in the nature of children's activity. Such changes are directly or indirectly fostered by increasingly higher requirements that the adults pose on a child as his physical and mental abilities continue to grow. Thus, from the forms of fragmentary perception predominant at an early age, when only a few orienting features of the entire object are perceived, the child passes to the more advanced forms of perception characteristic of preschool age, reproducing a totality of properties of the perceived object in all the object's connections and relations. As demonstrated in experiments conducted in our laboratory by Z.M. Boguslavskaia (1958), L.A. Venger (1962, 1965), and others, this change in the sensory system is clearly connected to the transition from primitive activities using already existing objects to productive activities during which the child attempts to create new objects. This interdependence is preserved at later stages of development, and further development of the sensory system is caused by the transition to more complex forms of educational and working activity.

Thus, age changes in the sensorial system should not be studied in isolation from the development of all aspects of the child's personality, since they are merely subordinate points in overall changes in the child's interaction with his environment and in the course of overall development of the child's activity.

Integrally tied to various forms of activities and developing along with them, the sensory processes themselves have an operational character, and they are a kind of orienting-research actions. These actions consist of "imitation" of a perceived object and the modeling (in the broad sense) of its properties, which results in molding and forming the image of this object. Advanced methods of imitation or modeling, which characterize adult perception, are not given to the child in ready-made form at birth. They form only gradually, under the influence of life experience and special instruction.

As we know, a child is born with a number of unconditional orienting reflexes that consist of motions of receptor apparatuses toward acting stimuli, in fixation of these stimuli, in following their movement, and so on. In newborns, such orienting-adjusting reactions are still very primitive, but over the course of the first months of life they become differentiated, causing quite complex sensory effects to emerge. Thus, according to the data of Venger (1962, 1965) obtained in our laboratory, by the age of two to three months an infant already shows an orienting discrimination of geometric figures. Apparently, unconditional orienting reactions make up the organic prerequisite, the natural material, on the basis of which future perceptual actions form that are directed at exploring the perceived object, and creating its copy and its sensory image.

The process of forming of these actions is very complex and cover the entire preschool childhood period.

In our laboratory, Boguslavskaia (1961), T.O. Ginevskaia (1948), Ia.Z. Neverovich (1948, 1954), and others studied the orienting perceptual actions in children of different preschool ages during tactile, kinesthetic, and visual perception. V.P. Zinchenko (1958, 1961a) and A.G. Ruzskaia (1966a, 1966b) used a movie camera to record hand and eye movements to obtain more detailed characteristics of these actions. Their data demonstrated that the methods of examination used by children substantially change during preschool childhood, causing changes in the formation of sensory images of the perceived objects. Thus, in junior preschoolers, orienting and executing actions are still insufficiently separated; during their familiarization with the object, grasping motions, practical manipulations, and the like still play an important role. The images formed as a result of such familiarization are fragmentary. They usually reflect the individual properties of an object that are important for a given practical activity.

In the middle of preschool age, a separation of the orienting part of action from its performing part takes place. Different methods of visual and tactile familiarization with the object become separated and differentiated. Such familiarization, however, is directed at properties of individual most prominent details, without a thorough examination of the whole object and specifically, without systematic tracking of its outline.

By the end of preschool age, methods of visual and tactile examinations acquire a more systematic nature, covering not only individual details but also the entire object as well as the specific system of its interrelated parts. Sensory images that form on the basis of this familiarization acquire a more adequate and differentiated nature than is the case in younger children, and they can serve as an orienting basis for complex productive activities (drawing, modeling, construction, etc.).

Such are the data from experiments recording the formation of perceptual actions in children when the process takes place spontaneously, without special training.

Later, our laboratory conducted several instructional experiments designed on the basis of a certain hypothesis about the formation of perceptual actions. The hypothesis was developed on the basis of our previous research as well as theoretical and experimental studies of other authors (A.N. Leontiev, P.Ia. Gal′perin, and others), who studied the formation of other mental processes. Its essence can be described as follows.

The development of perception in the child, as we pointed out earlier, occurs mainly through his acquisition of social sensory experience. The most important element in this process is a child's acquisition of sensory standards commonly accepted in a given social environment and used to investigate the perceived object and to create its copy, its perceptual image. The formation of perceptual actions in the process of acquisition of social sensory experience goes through several stages or phases. In the first stage, perceptual actions are formed as external actions that use objective, material forms both for sensory standards and the models of a perceived object created with their aid. In connection with this, our design of formative experiments centered on teaching children to simulate exposed objects through graphic representations, construction, appliqués, and so forth. This object simulation, as demonstrated by our laboratory research, plays a very important role in the development of the child's cognitive processes in general and in the development of his perceptual processes in particular. Let us provide some examples.

Boguslavskaia (1966) investigated the preschool development of visual perception of depictions of concrete objects (a shovel, a vase, an apple, etc.), as well as abstract geometric figures. It turned out that not only all younger children (three to five years old) but also a significant share of the older children (five to seven years old) limit themselves under these conditions to a very fleeting inspection of the exhibited object, so that the image they form has a very incomplete and fragmentary character. Using this method of familiarization, children successfully recognize the object by one or two of its typical attributes, but cannot reproduce it through drawing or decoupage, because that requires a higher level of organization of the perceptual processes, a more complete and detailed sensory image. In subsequent experiments, children were trained to simulate the form of the perceived objects laying out their shapes with matches, strips of paper, and so on. At this point, children's activity was organized in a special way. They received special explanations on how laying out the shape would help them to become familiar with the object and then to draw it more accurately. Under such conditions, the models the children created were not the end in itself, that is, not the final product of activity (expected at drawing or decoupage lessons), but rather the means for solving certain cognitive, and subsequent practical tasks. After such exercises, the effectiveness of perceptual processes increased sharply in all children, as exemplified, for instance, in a noticeable increase in the accuracy of graphic representation of the perceived object, although no drawing instruction took place.

Similar methods of object simulation were used by G.A. Kisliuk (1953) and V.P. Sokhina (1963) in teaching children to perform visual analysis of a complex form while constructing it according to the assigned pattern. As shown in A.R. Luria's study of 1948, preschoolers cannot purely visually determine the elements of a suggested pattern necessary for laying out its shape. Usually they solve the problem empirically, trying different combinations until the desired result is achieved. To bring the child from this primitive level of problem solving to a higher one, Sokhina slightly modified the task by making its primary objective not the practical result, but rather the preliminary orientation in the course of achieving it. For this purpose, the sample and its elements (flat figures of various forms) were placed under glass, and the child had to point out in advance which figures he needed to recreate the suggested object. Then the experimenter took out the selected figures from under the glass, and the child set out to seek a practical solution of the problem, during which it became clear whether his preliminary visual analysis of the complex form was correct. When, after several unsuccessful attempts, the child realized that the problem was difficult and that he had made a mistake in selecting the necessary figures, the experimenter suggested using the method of object-related simulation of the task's requirements. The children were given patterns made of white paper that corresponded exactly to the sample and its components. Then, superimposing the copy-elements onto the copy-pattern, children were taught to determine which parts could be used to construct it.

Using such models to teach actions met with varying success depending on the child's age. In general, three-year-olds poorly understood the proposed actions, and the instruction did not produce noticeable results.

The children four to five years of age were more successful in learning to operate with the paper patterns; this action and its results, however, were understood by the subjects not as an important model for the subsequent solution of a structural problem, but as an independent practical achievement. They first superimposed the copies of elements onto the paper pattern, and then, completely independently of their solution of the first problem, began selecting other pasteboard figures under the glass to design a new construction. In order to subordinate the first action to the second and to add to it a truly simulating nature, the experimenter had to use additional effects, directed specifically toward strengthening the attractiveness of the main construction task (composing a beautiful building from the brightly colored cardboard), and to decrease somewhat the attractiveness of simulation (operating by patterns from the simple soft white paper), which was supposed to become the only means for the child to solve the main problem.

The older children (five to seven years old) were able to master, without any additional exercises, the method of object-related simulation and to use it adequately in achieving the required practical results.

During this instruction, all children from four to seven years old significantly increased their level of visual analysis of a complex form, and, in most cases, they were able to indicate correctly which geometric elements in a given sample could be used and approximately how these elements had to be arranged.

In the cases described above, the object perceived by the child and the model of the object he creates are located in a similar type of plane and belong to the same sensory modality. The studies carried out in our laboratory, however, show that the ability to model properties of one model in terms of properties and relations of the other becomes available to children relatively early (Zaporozhets, 1962, 1963; Zaporozhets et al., 1967; Zinchenko, Lavrent´eva, and Lomov, "Sravnitel´nyi analiz osiazaniia i zreniia," *Doklady APN of the RSFSR*, 1959–1962; *Razvitie vospriiatiia v rannem i doshkol´nom vozraste*, 1966; *Formirovanie vospriiatiia u doshkol´nika*, 1967). Such heterogeneous models acquire special importance for children's in forming adequate methods of analysis of musical and vocal sounds. The acoustic medium is extremely mobile and is grasped by a child with great difficulty, unless it is simulated, or, to use P.Ia. Gal′perin's words, "materialized" through various spatial properties and relations of objects.

The studies conducted in our laboratory by T.V. Endovitskaia (1959) and T.A. Repina (1966a, 1966b) showed that pitch discrimination of pure sounds (produced by an audio oscillator) presents great difficulties for children of preschool age, and the levels of differentiation boundaries used in this type of experiment are relatively high.

In formative experiments, objects were introduced with spatial properties simulating the pitch relations of a sound. Thus, Repina created scene-dramatizations for children in which there was a large "daddy bear," who produced low-pitched sounds, a smaller "mommy bear," who emitted higher-pitched sounds, and a little child bear emitting even higher-pitched sounds. After the experimenter acted out with the children various scenes from the life of all these characters, the bears hid in different places and a child had to find them by their voices. It turned out that, as a result of this instruction, even the younger children (two to four years old) not only easily distinguished the pitch of voices produced by the toy animals, but also began to differentiate any sounds more successfully, even voices they encountered for the first time that were not connected with any objects known to them.

Endovitskaia (1959) used more complex, but at the same time a more universal model of, sonic-pitch relations. She gave the child a rectangular ruler divided into equal squares, and a doll that had to jump from one square to another according to the sounds perceived by the child. If the difference between the sounds was small, the doll had to jump from the first square to the second, if greater, then from the second to the third, and so on. Initially the child and the experimenter did these exercises together, but later began to act independently. Teaching children this method for simulating sonic relations causes more effective pitch discrimination.

The application of heterogeneous models in child instruction apparently influences not only his sensory but also his intellectual development. Object-related simulation, which initially is constructed as external, material action, later, under certain conditions, can turn into internal action through sequential changes and reductions. Then it is directed not toward the creation of external material, but an internal, ideal model, the perceptual image of the perceived object. The transformation of material actions into perceptual ones was studied in our laboratory by Boguslavskaia (Boguslavskaia and Ruzskaia, 1966), Venger (1965), Zinchenko (1961a, 1961b), Neverovich (1954), Podd′iakov (1959), Ruzskaia (1966b), and others.

I will focus on data obtained in studies by A.G. Ruzskaia, who set a complex task for preschoolers of discriminating between variants of two geometric figures—a quadrangle and a triangle. The fact-recording experiments revealed that under these conditions, all preschoolers make a great number of mistakes, especially in the three- to five-year-old age group. Subsequent training experiments with the children produced appropriate external actions directed toward the detailed examination of an exposed figure. The children were taught to trace systematically the outline of the figure with a finger, paying attention to changes in direction of the motions at angles and accompanying these motions by counting (one, two, three, etc.). Examinations of triangles and quadrangles were alternated, and differences in their metric structure and number of angles and sides were established. Thus, the child grasped the algorithm of research actions, which made it possible for him to recognize the variants of any figure (formed by a curved line) in any position. During the first stages, however, the functions of examination and simulation could be achieved only by examining the object by touching it with the hand, while the eye performed an auxiliary role, perceiving and tracing the motions of the hand. Later, the eye developed the ability to solve these types of perceptual tasks independently, consecutively tracing the outline of a figure, as it was earlier done by a touching hand.

There were interesting transitional forms occurring when a child has already distinguished the figures visually, but accompanies the motions of the eye by abortive motions of the hand, which simulates at a distance the form of the seen object, thus organizing and controlling the processes of visual examination of the object. Later, children pass to purely visual orientation; at that point, as Zinchenko's (1958, 1961a) experiments demonstrate, initially, the eye motions have an extremely extensive nature, consecutively tracing the entire outline of the perceived figure and simulating its specifics in all details.

In the final stages of formation of the perceptual process, for instance, after the child has been extensively trained in recognition and discrimination of figures, the research motions of his eyes gradually begin to decrease and to focus on the individual, most informative attributes of the object. This is the stage at which the highest form of internalization of the perceptual process is reached—when an internal model is finally formed—a constant and orthoscopic perceptual image of the perceived object. It is formed on the basis of external models created earlier (i.e., with the aid of eye and hand motions), repeatedly compared with the object and corrected in accordance with its characteristics.

[. . .]

Now, without extensive research reactions, a single fleeting glance at the object, a glimpse, singling out an important feature, makes it possible for a child to actualize signally the entire internal model, thus causing instantaneous discretion of the perceived object's properties.

This was precisely the form in which Gestaltians described the perceptual process, claiming that it is initial in the ontogenesis and that it supposedly is determined primarily by the physical laws of structural formation. In fact, as we have attempted to demonstrate in this article, this form of perception is the product of prolonged development that takes place in the child under the influence of practical experience and education. Only genetic study can uncover the origin of this perceptual process and its dependence on children's practical and cognitive activity.

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