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On the Active Nature of the Visual Perception of an Object

With all the variety of perspectives on the nature of perception, there exist two basic theoretical lines in investigation of this (as well as other) psychological issues. One, known as the phenomenistic line, departs from subjective experiences as initially given, ignoring the subject's material activity with respect to the object, the activity in the process of which these experiences emerge.

The other line proceeds from objective conditions of the subject's material activity and consists in studying the way the adequate reflection of surrounding reality—necessary for a successful adaptation to it and for its expedient change—is formed in the process of this activity.

[. . .]

Human activity can be broken down into an executive part, *the system of executive actions*, which leads directly to a certain practical result, and an orienting part, which presents *the system of orienting actions*. To the simplest kinds of the latter belong, for example, the orienting motions of a groping hand or of an eye examining an object. The function of orienting actions lies in the

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activity of reproducing properties of the perceived object; when "imitating" it (A.N. Leontiev, 1972) through modeling its characteristics, orienting actions create a mold and cause an adequate reflection of the object.

Orienting actions initially arise and develop as an organic part of the subject's practical activity in tight connection with its executive part. In the course of development, one can observe specific changes in interrelations between executive and orienting actions, as well as the transformation of the first into the second. Investigation of the genesis and nature of orienting actions, which shape the image of the perceived object in children of different ages, has a fundamental significance for our understanding of any form of perception, including the visual one. Such studies were carried out under our supervision at the Institute of Psychology and at the Institute of Preschool Education of the APS [Akademiia Pedagogicheskikh Nauk] of the RSFSR [Russian Soviet Federated Socialist Republic].

T.I. Daniushevskaja (1960), Z.M. Boguslavskaja (1961), A.G. Ruzskaja (1966), and others studied the specifics of children's orientation during visual perception of various objects, as well as their perception of the objects' relations in size, color tint, and the like. It turned out that the character of the orienting eye movements in children of different ages was not the same. At the earlier genetic stages, a predominant method of familiarization for a child is to throw a fleeting glance at the demonstrated object and to proceed immediately to practical manipulations with it without a detailed examination. At later genetic stages, the orienting reactions are separated from executive ones, and the phase of familiarization with the content of the task begins preceding the phase of its practical execution. At the same time, the orienting eye movements acquire extensive character and begin more or less accurately to reproduce an outline of the perceived objects, the spatial-temporal relations among them, and so on. Such complexity and perfection of the orienting activity leads to the formation of more adequate images of perceived objects, which is revealed, for example, in an increase in the effectiveness of differentiation

and reproduction of the perceived forms. In other words, the sensory effect, that is, completeness and the adequacy of a perceived image, depends on the specifics of the child's orienting activity with respect to the perceived object, and this activity changes and improves in the process of ontogenetic development. Only gradually do children master those methods of object examination and forms of orienting eye movements that "imitate" special features of the object, allowing them to copy it and receive its adequate image.

In order to establish the mechanisms of such an imitation, it is important to investigate changes in orienting eye movements during multiple presentations of the same object. Such an investigation was undertaken in our laboratory by V.P. Zinchenko (1958, 1961a), who employed a video recording of eye movements in adults during their perception of a repeatedly presented series of electric bulbs lit in a particular sequence. In this experiment, during the first presentations of a series, only *belated* eye movements were marked, which occurred after a certain lamp bulb was lit. However, after three to four combinations, the subjects had already developed orienting reactions, consisting of *anticipating* eye movements directed from the recently lit bulb to the one that was supposed to light up next. Later, after a significant number of presentations, anticipating eye movements occurred consistently with respect to two to three light bulbs in response to a starting signal. Thus, a specific system of orienting reactions was formed corresponding to a demonstrated object and to the spatial-temporal relations of its components.

Similar changes in orienting activity were observed in our laboratory by Zinchenko (1958, 1961a), D.B. Godovikova (1958, 1972), and others during visual perception of more complicated objects such as sequences of signals with complex space arrangement, geometric forms, labyrinths, and so on.

There are reasons to suppose that the system of orienting reactions, imitating specific features of the perceived object, constitutes *the basis of the object's image*. A symptom of the emergence of such an image is a change in the practical activity of the subject.

Experiments conducted by T.V. Endovitskaia (1955), Ia.Z. Neverovich (1954), and others demonstrated that after the formation of such a system of orienting reactions in a subject, the chaotic tests disappeared, the erroneous motions were suppressed before arriving at the negative practical result as not corresponding to the present image, and subsequent behavior rapidly acquired an adequate character required by the circumstances.

It is necessary to bear in mind that the motion components of orienting reactions registered in our experiments represent only part of an entire system that has other components as well, and the most important role is played by the sensory-proper components. Only the totality of all components of the system can reproduce the appearance of a perceived object and compose the basis of its image. The formation of the object's image in the course of the orienting-research activity is the main result of this activity. When the image has already been formed, the orienting activity begins *decreasing*, acquiring an increasingly *reduced nature*.

During experiments conducted by Zinchenko and described above, when camera-registered eye movements followed consecutively lit lamp bulbs, the following observations were made: with an increase in the number of presentations, a release of motor components of orienting reactions took place, and the eye movements were reduced. The *belated* eye movements gradually transformed into *anticipating* ones and then even they disappeared. Perception of the situation, however, still took place at this stage of the process as well, and any change in order of the signals was immediately noticed by the subject and caused restoration of the orienting motions that had disappeared. In other words, appearing at the late stages of image formation is the *instantaneous* discernment of the object's properties that many psychologists consider to be the primary form of visual perception. In fact, as demonstrated by our genetic research, the possibility of this instantaneous discernment arises as the final phase of formation in the sensory process, as a result of sequential changes and reductions of the previously extensive orienting activity. Only with the aid of

the latter, can special properties of the perceived object be reproduced at the initial stages.

As we mentioned earlier in the discussion of the cited experimental data, a child learns only gradually, during life experience, to use the perfected means of orienting activity that is necessary for adequate perception of complex objects. At certain relatively advanced stages of development (as in the above-mentioned experiments of Zinchenko conducted on adult subjects), such learning is possible within a single visual familiarization with the object that is sufficient for forming the necessary systems of eye orienting reactions to reproduce particular properties of the stimuli system. At the earlier stages of development, however, such *purely sensory* learning does not produce the necessary results.

The orienting eye movements that are characteristic of adults' perception cannot develop in isolation, within the limits of just visual familiarization with an object. In her study of visual form discrimination in preschoolers, Boguslavskaja (1958, 1961) found that the best results were achieved by those who viewed the perceived figure by outlining it with their eyes. At the same time, Zinchenko, while video-recording orienting eye movements in children of different ages, discovered that without special instruction, such active tracking of the outline of a fixed object occurs relatively late (approximately in the middle of preschool childhood) and is preceded by passive following of the moving object. This prompted the idea of attempting to organize a *forced itinerary* for eye movement based on children's passive following of the object and to work out their active tracking of the outline of demonstrated figures.

For this purpose, Boguslavskaja drew on the blackboard for the child the outline of a suitable figure, which the child then had to recognize among a few others. Although the dynamic method of demonstrating the figure forced the child to follow its outline with his eyes, such tracking did not result in the formation of the orienting function—the function of examining the object to establish its properties. For a considerable number of young

preschoolers, the effectiveness of recognition remained as low as it was before the application of the *forced visual itinerary*. Thus, attempts at forming orienting eye movements adequate to object properties within visual perception itself, at least at the early stages of ontogenesis, proved to be of little effect. This reveals the decisive importance of the idea expressed by I.M. Sechenov (1947): before fulfilling its orienting function independently, the eye must first learn from the hand's examination of the object by touch.

The data obtained in our laboratory confirm this statement. A.G. Ruzskaia (1966), who investigated the process of differentiation and generalization of geometric forms, achieved a result of almost 100 percent by instructing the preschoolers first to trace the outline of the figures with their fingers and thus to grasp the figures' properties through touch. While carrying out these manipulations, the subjects simultaneously followed their actions with their eyes, and gradually their orienting eye movements began to correspond with increasing accuracy to the configuration of a perceived form. Later, the children could distinguish figures using only visual familiarization with the object, although for some time they preserved the *abortive* hand motions, so that the subjects traced the figure with their fingers without touching it, at a distance. Similar data were also obtained by Daniushevskaja (1960), who studied children's perception of dimensional differences among objects. She discovered that, initially, higher results were achieved by tactile acquaintance with the object, which later became the foundation for forming a visual comparison.

Why is tactile orientation primary with respect to visual orientation and why does touching with the hand play the role of a mentor with respect to the eye? Of great significance is the fact that the hand, as the contact receptor, constantly encounters the resistance of objects. In its orienting motions, the hand depends more directly on objects' properties than the eye does in executing its orienting functions at a distance, and is able to glide without difficulty along objects in any fashion or direction. What is even more important is that while the eye is only a contemplator, bearing

only orienting functions, the hand is not only the organ of orientation, but also that of practical interaction with the environment. Specifically, as the organ of praxis it is capable of checking and refining the data coming from other sensory organs and at the same time able to map the itineraries for their orienting motions corresponding to the objective properties of things—properties established in the process of practical activity.

The experiments conducted in our laboratory by Zinchenko (1960, 1961b), V.P. Sokhina (1963), and others demonstrate that at early genetic stages, the most effective tactile sensations are the ones that are directly related to practical object manipulations, such as filling various holes with figures, the simplest forms of construction, and so on. Tactile sensations of this kind also produce the most considerable influence on the subsequent development of visual orientation. In other words, the hand begins to teach the eye in the process of solving practical tasks related to grasping and manipulating objects.

Speaking of primacy of the action of a hand touching an object for practical purposes over orienting functions of the eye, we do not assume that this relationship is elementary and constant. A comparative study of touching and vision at different ontogenetic stages carried out in our laboratory by Zinchenko (1960, 1961b) and a group of colleagues (Zinchenko, Lavrent'ev, Lomov et al., 1959–62) shows that a relationship between eye and hand functions is rather complex, contradictory, and constantly changing in the course of development. The eye, however, while following the hand movements, gradually stores the accumulated experience and little by little acquires the ability to function independently. At this point, the eye begins to reveal its advantages as the organ of orientation in the environment, capable of inspecting a situation relatively independently of the immediate practical task and establishing more distant perspectives of behavior. At this stage, intersensory relations in some sense change places and the trained eye becomes *the teacher* of the hand. It not only anticipates and directs the practical actions

of the hand, but also affects differentiation and form of its orienting function.

The data obtained by Zinchenko indicates that higher forms of the tactile sense—detailed practical examination of a perceived object that is produced relatively independently of immediate practical needs—are shaped in the child under the control of vision. Nevertheless, in solving the most difficult cognitive problems and at the highest stages of development, the hand, which combines both gnostic and practical functions, still preserves its leading role.

The facts cited here substantiate our assumption that *the process of visual perception presents an abbreviated orienting action. Initially, it forms itself on the basis of extensive practical activity involving the object and in close connection with its executive part, and only later, gradually, the orienting action acquires relative independence and its ideal form.*

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