The Theory of the Organism-Environment System: III. Role of Efferent Influences on Receptors in the Formation of Knowledge*

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Abstract—The present article is an attempt to give—in the frame of the theory of the organism-environment system (Jarvilehto, 1998a)—a new interpretation to the role of efferent influences on receptor activity and to the functions of senses in the formation of knowledge. It is argued, on the basis of experimental evidence and theoretical considerations, that the senses are not transmitters of environmental information, but create a direct connection between the organism and the environment, which makes the development of a dynamic living system, the organism-environment system, possible. In this connection process, the efferent influences on receptor activity are of particular significance because, with their help, the receptors may be adjusted in relation to the parts of the environment that are most important in achieving behavioral results. Perception is the process of joining of new parts of the environment to the organism-environment system; thus, the formation of knowledge by perception is based on reorganization (widening and differentiation) of the organism-environment system, and not on transmission of information from the environment. With the help of the efferent influences on receptors, each organism creates its own peculiar world that is simultaneously subjective and objective. The present considerations have far-reaching influences as well on experimental work in neurophysiology and psychology of perception as on philosophical considerations of knowledge formation.

Keywords: efferent, epistemology, influences, knowledge, movement, perception, receptors, senses, systems approach.

Introduction

During the present century, several scientists have stressed the mutual dependence of the organism and its environment. Koffka (1935), for example, described an organism as a system that consists of both the body of the organism and its behavioral environment. Especially during the last decade, there have been several attempts to treat organisms as complex dynamic systems that have a very intimate connection with the environment (Freeman, 1995; Thelen, 1995; Tani and Nolfi, 1997) or that even include parts of the environment (Gibson, 1979; Maturana and Varela, 1987; Järvilehto, 1998a).

One of the basic problems in understanding the characteristics of such systems has been the question of formation of knowledge. From ancient times, the senses have been thought to have the role of channels through which knowledge arrives from the environment into the organism. The conception of the senses as "windows of knowledge" was so strong and irrefutable that usually attempts to treat organism and environment as one system broke down just here and the system had to be divided into two sub-systems. When dealing with
perception Koffka (1935) divided the animal-environment system into two systems, the environmental stimuli being represented in the animal in the form of isomorphic fields, and Gibson (1979) used the metaphor of resonance implying that the animal and environment were resonating as two separate sub-systems.

The arguments of sensory physiologists seem indisputable: the eye responds to light and transmits a picture from the environment. Let the philosophers speculate otherwise—in any case, the light stimulus is outside and perception inside! Although in the history of philosophy and psychology there has always been some dispute on whether human knowledge is based directly on the functioning of the senses or whether it is, in some sense, constructed by thinking (empirism contra rationalism), there has been no question about the role of the senses as transmitters of at least some kinds of raw data or simple sensations from the environment.

The Role of Movement in Perception

The theory of the organism-environment system (Jarvilehto, 1994, 1998a,b) starts with the proposition that, in any functional sense, organism and environment are inseparable and form only one unitary system that is organized for useful behavioral results. Thus, the formation of knowledge cannot be based on any transfer process from the environment into the organism, because there are no two systems between which this transfer could occur. According to the theory, mental activity is activity of the whole organism-environment system, and the traditional psychological concepts (like perception) describe only different aspects of organisation of this system as a whole. Knowledge is the form of existence of the organism-environment system, and new knowledge is created by perception when new parts of environment join to the system while changing the structure of the system. An increase in knowledge would mean a widening and differentiation of the system, which would make new kinds of behavioral acts and new results of behavior possible. From this, it would follow that knowledge is not, as such, based on any direct action of the senses.

Such a conclusion may seem to be simply contrary to the facts. However, there are some earlier considerations that go in the same direction, namely those ideas in which the role of movement has been stressed in perceptual activity. Already in 1855, Alexander Bain proposed that sensory and motor action together constitute conscious perception. He stressed the role of eye movements and thought that they determine, to a large extent, what we see. If the eyes move in a circle, we see a circle and the perception of a straight line is based on linear movement of the eyes. He maintained that the content of perception was directly related to the character of the motor activity.

In addition, the founder of experimental psychology, Wilhelm Wundt, saw the importance of motor activity when trying to explain visual illusions, for example. The horizontal-vertical illusion was, in his opinion, a typical example: here we have an illusory lengthening of the vertical line because the eyes must move upwards along the line and oppose gravity, and thus the energy needed for the eye movement is higher than with the horizontal movement of the eyes. Wundt (1897) writes: "The phenomena of seeing teach us that the idea of distance between two points depends on the motor energy of the eye used when the eye moves this distance (...) The motor energy becomes a component of the idea by combining with the sensation which we may perceive." (Wundt, 1897).

Wundt thus regarded sensation and motor energy as separate components of an idea. This would mean that, besides the sensory stimulation, movements have an essential