CHAPTERS IN GENERAL PSYCHOLOGY

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IN

GENERAL PSYCHOLOGY

BY

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CHAPTER 1

THE ELEMENTS OF BEHAVIOR

Psychology takes the common sense view that any animal is a physical object in a world of physical objects. It assumes that all these objects act upon each other in the ways described by physics, chemistry and physiology. It considers man's behavior as a physical event which can be analyzed into bodily movements. In this sense man's behavior is mechanical and his body is a machine.

Any attempt to construct a machine that would respond as elaborately and appropriately as do animals to the world of surrounding objects must certainly fail. This is not because the behavior of animals involves new and mysterious forces lacking elsewhere in nature but because their structure is too complex to be duplicated.

It must not be supposed that thinking is denied by physiological psychology. A behavioristic description of man's mind in no way contradicts the common sense assumption that men are conscious. We shall first find out what man *does*, and under what circumstances he does it, because this is open to observation and may be stated exactly. With this science of behavior as a groundwork, we shall later undertake an account of consciousness.

All that we can observe in our fellow man is his behavior. He moves his body and its appendages as he goes from place to place or as he rearranges the objects about him. In conversation he contracts the necessary muscles and is heard to speak. In emotional expression he blushes, his pulse is altered, his hands grow cold, his liver gives up its sugar, and we see shame, anger, or anxiety. His thoughts, as such, are known to no one but himself.

Any physical object is at all times being acted upon by forces which affect it in various ways. The stone lying in

the road is moved about by the impact of rain, warmed and expanded by the sun, and scratched by the wheels of passing vehicles. Its responses to these forces are simple and easily predicted because of the simplicity of its structure.

If we consider not only the stone in the road but also the gopher who sits beside it, we find the same forces acting. The light reflected from surrounding objects falls on both alike, both are struck by the rain or warmed by the sun, but the result of the action of these forces on the gopher is behavior quite different from the behavior of the stone. The light rays reflected from the approaching vehicle cause him to scurry away and those reflected from food cause him to approach. The impact of rain may move him toward the source of impact rather than away from it. Though, like the stone, he is a physical object, he is not merely buffeted about by his environment.

Behavior Dependent on Bodily Structure

The difference between the behavior of animals and the behavior of inanimate objects depends upon the fact that animals possess specialized structures. The most important of these structures are the *sense organs* (receptors), the *muscles and glands* (effectors), and the *nervous system.* The sense organs are placed in parts of the body where they are exposed to the action of physical forces. Because the various kinds of sense organs differ from each other in structure, some are provoked to action by one kind of physical force and some by another. The physical forces which arouse the sense organs to action are called *stimuli.*

Light has an effect upon the eye which it does not have upon the ear or upon the skin. Gases emanating from a flower act only upon the olfactory sense organs. The stimulus which commonly arouses the sense organ to its characteristic function is called the *adequate stimulus.* Many sense organs may be stimulated by pressure or an electric current in addition to their more frequently received stimuli.

The physical forces which stimulate the sense organs differ in kind. Light, sound, heat, impact, gravity, are a few of these and each acts upon some sense organ or another. All stimuli may vary in intensity, and their effect upon sense organs may vary correspondingly.

Sense organs are connected with distant muscles and glands by nerve structures. Along these nerve structures pass *nervous impulses* which result from the stimulation of the sense organs and which, on reaching muscles and glands, may cause muscular contraction or glandular secretion. It follows that any response to a stimulus can occur only when there is a conduction pathway established between the sense organ receiving the stimulus and the muscles concerned in the response. Such a pathway is called a *neural arc.*

The nervous system contains millions of nerve cells called *neurones.* These are microscopic in cross-section but are occasionally as much as two feet or more in length. Each neurone consists of a cell body from which extend branching processes which may lie adjacent to other cells. The points of contact so established offer varying resistance to the passage of nervous impulses from one cell to another. A connection between two neurones which permits the passage of a nervous impulse is called a *synapse.* The repeated passage of an impulse through a synapse is supposed to increase the conductivity of the synapse. Some synapses are present at birth, some occur in the maturation of the nervous system, whereas others are formed in the course of learning.

The great number of neurones and the complexity of their connections account for the fact that an impulse leaving a particular sense organ may find its way to one group of muscles at one time and to another group of muscles at another time.

The muscles and glands are the effectors or organs of response. They are so situated and so connected by nervous structures that their responses are coordinated and meet

suitably most situations. They are so connected with sense organs that their action is appropriate to the stimulus. The nervous impulse which is originated by placing something in the baby's hand finds its way to the muscles which cause the fingers of that hand to grip the object. Without such established pathways of conduction, behavior would be inappropriate.

A significant characteristic of all sense organs is that they are most sensitive to situations which affect the life processes of the animal. This is accomplished in two ways, first by the position of the sense organs in the body, and second by their structure and by the nature of their adequate stimuli. For example, the eyes are so placed in the front of the body as to receive stimuli from objects which the animal is approaching. Placed at the rear they would be less useful. The tongue has a strategic position, as all food must pass its inspection before being swallowed, and the sense organs of taste are affected as are no other parts of the body by chemical stimuli, which are indicative of the food value of any substances taken into the mouth.

Classes of Sense Organs

Sense organs are divided into three kinds according to their location in the body, the exteroceptors, the interoceptors, and the proprioceptors.[1] Those on the outer surface of the body which respond to external stimuli are called *exteroceptors*. These are the sense organs in the skin which respond to touch, temperature, and destructive stimuli, and along with these the sense organs in the eyes, ears, and nose. The eyes, ears, and nose are also called *distance receptors* because they respond to stimuli whose origin is commonly at a distance, a classification recognized by as early a writer as Aristotle.[2]

In addition to the external surface there is the surface of the enteric tract which consists of the mouth, pharynx, oesophagus, stomach and intestines. This surface is also provided

1 Sherrington, *The Integrative Action of the Nervous System*, Lecture 9.
2 Aristotle, *de sensu*, 436b.

with sense organs and these are called *interoceptors*. When parts of the external world are taken into the enteric tract as food the interoceptors are stimulated by them and the animal's behavior is adjusted to their presence. The mouse which is outside a cat stimulates the cat's exteroceptors and the cat responds in a conspicuous and characteristic way. Once the mouse is transferred to the cat's enteric tract, the cat's reactions are less obvious but none the less important. Movements of rejecting food, of swallowing and of peristalsis, the secretion of digestive fluids, and much of the animal's observable behavior result directly from the stimulation of interoceptors.

Sense organs occur not only on the outer and the inner surfaces of the animal but are found also deeply imbedded in the body tissue. These deeply imbedded sense organs are called *proprioceptors*. Among the contractile muscle fibers are situated receptors which are stimulated by muscle tension. Other receptors in the tendons receive stimuli in a similar way. The walls of bloodvessels are also supplied with sense organs so that circulatory changes affect the animal's behavior. In the head are located the semicircular canals and the organs of static sense, which are stimulated by the movement or by the position of the animal. The proprioceptors are all important in making possible the coordination of bodily movements.[3]

The Exteroceptors

The most highly developed of the exteroceptors are the distance receptors, namely the organs of vision, hearing, and smell.[4]

The Eye. Anyone having an acquaintance with the camera will find it easy to understand the mechanism of the eye. Light passes into the eye through a diaphragm called the iris, just inside the anterior wall of the eye, which is called the cornea. Behind the iris is the lens and behind the lens, on the

3 On the classes of sense organs and their functions see Sherrington, *Integrative Action of the Nervous System*, Lecture 9.

4 For a more detailed account of the structure and function of sense organs and nervous system see Ladd and Woodworth, *Elements of Physiological Psychology*.

inner surface of the eye's globe-like wall, is the sensitive retina. The internal cavity of the eye is filled with a transparent mass. That in front of the lens is called the aqueous humor and that behind the lens, the vitreous humor. As we view our own eye in the mirror we see at the center a black spot, the pupil, surrounded by a pigmented ring, the iris. The pupil is a hole in the iris and appears black because it is an opening into the unlighted interior of the eye. It is the color of the iris to which we refer when we speak of brown eyes or blue eyes. Outside the circle of the iris is the white sclerotic, continuous with the cornea, which with the cornea constitutes the external wall of the eye. (See Figure 1.)

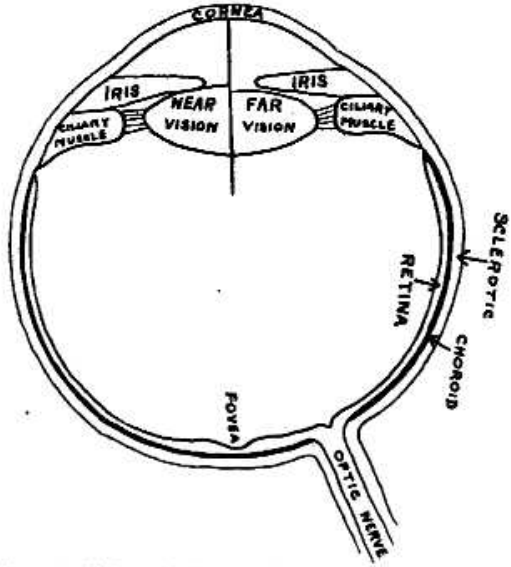

Figure 1—Schematic diagram of a section through the eye.

By means of six external muscles the eyeball is moved about in its socket, and in this way a person looks up or down, to the right or the left, converges the two eyes in fixating a near object or so directs them that the axes of vision are