Physiological Learning Theory

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Attention or "concentration" requires control of activity in those excess neurons that are not necessary for the present task. The control is probably not a massive inhibitory suppression but may be a recruiting process, a function of complex perceptual and associative learning that begins with early experience. Inhibition, however, may still be of crucial importance as a sharpener of associative mechanisms, and the child with minimal brain damage may have suffered a selective loss of inhibitory neurons.

The more we learn about the nature of learning, the farther we seem to get from being able to give firm answers. I do not hope here to tell you how to handle the schoolchild whose learning is impaired as a result of minimal brain damage. The human brain is an incredibly complex entity and it would be unrealistic to suppose that we will master its intricacies even in this century; it seems quite possible to me that we will never master them fully, which means also that we may never fully understand the effects of brain injury. Just to show what this complexity is that I am talking about, let me remind you that the normal cerebrum has some 10 billion—10 thousand million—separate living cells, intricately arranged, the number of possible ways these may be combined being very much greater. Legény (1967) according to Alwyn Scott (1975), has made a conservative estimate of the number of basic ideas or ideational components the brain is capable of developing: one thousand million. A "conservative" estimate which means that these basic ideas must be formed at the rate of one per second for 30 years, sleep included, or one per second for 45 years of waking time.

All this arises from physiological considerations, but it is far removed from direct physiological observation. The ideas on which it is based also derive

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from the study of human and animal perception, thinking, and problem solving, and for that matter from common human experience as well as clinical observation. It is not something remote from the experience of the classroom teacher. Her knowledge of how children think and perceive and learn, if she is a good observer, is as relevant evidence as that of the clinician.

A physiological theory of learning is likely to spend time on synaptic changes—an interaction of individual neurons—or deal mostly with conditioned reflexes. Neither is my concern here. Instead I want to get closer to the child’s actual behavior. I am very much concerned with the physiological basis of learning, but learning as it appears in the real world. I have been much impressed by Estes’s (1970) book, and I hope to see how some of his conceptions look from a physiological perspective. In all this, of course, I am still being very theoretical. Theory is the best source of methodological advance in the long run—but it is the short run that we are concerned with at the moment, so I repeat, I can’t hope to be very practical.

Perhaps you think this should be about the synapse, and about conditioning. It is quite true that the synapse is where learning is determined, to the best of our present knowledge, and it might seem that the whole question is: How does synaptic change occur? The question is indeed fundamental, and much has been learned about it. But the practical realities of a child’s learning are a very different matter, and it is worth taking a moment to say why.

Psychology—or physiology—may have given you a picture of learning like this. You may think of a pathway through the brain with a stimulus at this end, a response at that end, and some synapses in between. Each time the stimulus is applied the response follows, getting a little quicker or stronger each time because the connections at the synapses are getting a little closer. But that picture has no relation at all to what actually happens in the home and in the classroom. At most it applies to the case where the child must learn to make some specific response to a specific stimulus. How often does that occur? How big a part is that of the educational process? And even when learning is of that kind, the theory forgets that there are wrong responses to be got rid of, as well as the right one to be strengthened. But the most important kinds of learning are often ones where no specific response is to be made, and where the child must generalize and become prepared to respond in the future in different ways, in various future situations. This learning is not a stimulus—response conditioning, but consists of a modified relation between internal ideational systems. There is no particular response at the time the learning occurs, and whether it has occurred or not becomes evident only when one sees, later, whether the child’s behavior has changed the next time he is exposed to that kind of situation—or even a different situation, but one in which the information acquired earlier is relevant.