JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 1969, 12, 187-189 NUMBER 1 (JANUARY)

ON A PARTICULAR FORM OF CONDITIONED REFLEX[1]

S. MILLER AND J. KONORSKI

[*Translator's Note: This important paper appeared under the title "Sur une forme particulière des reflexes conditionnels" in* Les comptes rendus des seances de la société de biologie. Société polonaise de biologie. *Volume XCIX, page 1155, June 1928. When my paper "Two types of conditioned reflex and a pseudo-type" was published in* The Journal of General Psychology *(1935,* **12,** *66-67), Konorski and Miller replied in a paper called "On two types of conditioned reflex", which appeared in the same journal (1937,* **16,** *264-272). They sent me a copy and I was therefore able to answer in the same issue. The paper was called "Two types of conditioned reflex: a reply to Konorski and Miller". (1937,* **16,** *272-279.)*

The present translation was sent to Professor Konorski and some changes suggested by him have been made. The word particulière *has a much richer meaning in French than in English. In addition to* personal *or* private, *it suggests something* special *or* unusual. *A key phrase appears in French as follows: The dog flexes its leg* pour former ainsi le complexe conditionnel total.

Professor Konorski has supplied the Postscript, giving his present views.

B. F. Skinner]

The work presented below is based on Pavlov's theory of conditioned reflexes. As a starting point, we have taken the experiments of Zeleny, Manuilov, and Krylov on the synthetic activity of the cerebral cortex, who have established the following fact: when a compound consisting of two stimuli, A and B, is accompanied by an unconditioned stimulus R, which reinforces only the whole of the compound without reinforcing either of its components presented separately, a conditioned reflex is established only to the compound AB, whereas the conditioned response is not evoked by either of the two stimuli presented separately. Let us take now: for A any stimulus whatsoever, for example, a tone produced on the piano; for B all the sensations generated by a particular movement such as lifting the leg—that is, a set of muscular, tactile, and other sensations. We can generate this set either by causing the dog to lift its leg as a reflex response (active movement) or by lifting its leg (passive movement). Finally, for R, let us take first (Case I) the presentation of food. According to Pavlov's theory, after some time the compound AB will function alone as a conditioned stimulus, for it alone has been reinforced by the presentation of food. But at the same time a new phenomenon will appear which is not predicted by Pavlov's theory: after some time the lifting of the leg, whether reflex or passive, becomes superfluous, because the sound of the piano itself will elicit the movement. The stimulus A will then be capable of provoking by itself the appearance of the stimulus B—in order to complete the conditioned compound. On the other hand, if we take for R beating the dog or puffing air into its ear—that is to say, presenting any stimulus which elicits a defense reaction (Case II)—then the stimulus A will act as an inhibitor of movement B: this movement will not appear in spite of the presentation of the stimulus which normally elicits it, unless that stimulus is stronger than the stimulus R.

We see then that there are two kinds of stimuli: some, such as food, when they always follow the compound composed of an external stimulus plus the sensations generated by a movement (and only that compound), will cause the external stimulus to elicit this movement; others, like a blow, presented after the compound, will cause the stimulus to inhibit the movement. We call the first stimuli positive, the other stimuli negative. All stimuli may be placed in one of these two categories. It is obvious that positive stimuli

[1]Reprints may be obtained from B. F. Skinner, Psychology Dept., Harvard University, William James Hall, Cambridge, Mass. 02138.

correspond in psychology to pleasant stimuli and the negative to unpleasant. Thus, the experiments described provide an objective physiological definition of pleasant and unpleasant stimuli. We shall not use the latter terms, since they are not purely physiological. The phenomena that we have just described have the same general properties as conditioned reflexes: they originate without doubt in the cortex, and they are not innate but are formed and disappear during the life of the individual. It is for this reason that we regard them as conditioned reflexes, but their mechanism is different from that of the conditioned reflexes of Pavlov, hence we call them conditioned reflexes of the second type.

The principal characteristics of the second type of conditioned reflex are as follows: the conditioned stimulus A (conditioned stimulus of the second type) can be either any transient agent or, as we will show in our next communications, a long-lasting condition. The response B appears in the form of any movement of the animal or of the inhibition of movement. The reinforcing stimulus R can be a positive or negative stimulus which evokes a specific reaction, in opposition to the conditioned reflexes of Pavlov where the response to a reinforcing stimulus must be the same as that of the conditioned stimulus.

In addition to these two varieties of conditioned reflexes of the second type, there are others. Case III: if the stimulus A is followed by the negative stimulus R and if after the compound consisting of stimulus A plus movement B, the stimulus R does not appear, then, after some time, the stimulus A begins to evoke the movement B. Case IV: if the stimulus A is followed by a positive stimulus R, and if, after the compound AB, the stimulus R does not follow, then, after some time, the stimulus A begins to inhibit the movement B (it should be noted that our experiments on these two cases are not yet completed).

It is important to see whether conditioned reflexes of the second type can be reduced to the conditioned reflexes of Pavlov. We have demonstrated that: 1) the conditioned reflex of the second type is not the ordinary first type of conditioned reflex $A \rightarrow B$, because: (a) A is not always followed by B; (b) even if the conditioned reflex $A \rightarrow B$ were established, this reflex no longer reinforced by the unconditioned stimulus eliciting the movement B would have disappeared; 2) the conditioned reflex of the second type is not the second-order conditioned reflex of Pavlov; 3) the conditioned reflex of the second type (Case II) is not Pavlovian external inhibition [we do not present demonstrations of points 2 and 3]. Hence, unable to reduce the reflexes of the second type to the conditioned reflexes of Pavlov, we should consider them consequently as the second fundamental mechanism of the function of the cerebral cortex.

The laws which apply to conditioned reflexes of the second type (laws of inhibition, irradiation, concentration, and so on) are probably the same as those of conditioned reflexes of the first type. We have verified the following laws: (1) the law of generalization holds for conditioned reflexes of the second type; (2) in conditioned reflexes of the second type, one can produce differential inhibition; (3) extinction of the reflex is identical with that of the conditioned reflex of the first type; (4) in conditioned reflexes of the second type, we have applied conditioned inhibition, and it has been demonstrated that the inhibiting stimulus inhibits not only the primary reflex but also the other reflexes.

Differences between conditioned reflexes of the first and second types are considerable. (1) In the ordinary conditioned reflex, the conditioned stimulus always elicits the same reaction as the reinforcing stimulus, while in conditioned reflexes of the second type these reactions are different. Hence we can form "families" of reflexes, all the reflexes of a given family being reinforced by the same unconditioned stimulus but differing among themselves by their centripetal and centrifugal links. (2) The role of Pavlov's conditioned reflex is limited solely to signalization, while the role of conditioned reflexes of the second type is entirely different: whether they serve to complete a given stimulus in order to compose the conditioned compound, if this compound is followed by a positive agent, or whether they prevent the appearance of the conditioned compound, if this compound is followed by a negative agent. (3) In conditioned reflexes of the first type, the reaction is effected by organs innervated through the central or autonomic nervous system, while, in conditioned reflexes of the second type, the effector can probably be only a striate muscle.

POSTSCRIPT

This paper, published 40 years ago, was the first of a series of papers written by Miller and myself in the prewar period; it was concerned with a new experimental procedure which led us to the concept of "type II conditioned reflex". The experimental results obtained by us in that period are now available, since they have been presented systematically in Chapter VIII of my recent book "Integrative Activity of the Brain", published by the University of Chicago Press. Here I would like to make some comments on this first paper.

Our original thesis claiming that for the formation of type II conditioned reflexes the compound composed of an exteroceptive stimulus and proprioceptive stimulus must be differentiated from its components is now of only historical interest. In fact, it was shown by special experiments that proprioception of a trained movement does not play any essential role in type II conditioning (Konorski, op. cit., Chapter XI).

The notion that the source of the trained motor act may derive either from active (reflex) movement, or from purely passive movement is also not correct, since it has been shown that passive movement as a rule cannot be instrumentalized, unless it includes reflex elements (Konorski, op. cit., Chapter XI).

The thesis that the effector of the type II conditioned reflex is "probably only the striate muscle" seems now to be seriously undermined by a recent series of most important experimental research guided by Professor Neal Miller.

I cannot understand why we claimed that all *stimuli can be classified either to the category of "positive" (or attractive) or "negative" (or aversive) stimuli. In fact, at that time we were well aware of the existence of "neutral" stimuli, which, after habituation, are neither positive nor negative. I don't think that we repeated that thesis in our later papers.*

Finally, the sharp distinction between, not only the procedural side of type I and type II conditioned reflexes, but also between their physiological mechanisms seems to me now largely exaggerated. In fact, further investigation shows with increasing clarity that both types can be explained on the basis of the same general principles of connectionistic processes.

To sum up, we may come to the conclusion that almost every single thesis of the above paper is more or less erroneous. I consider this fact very fortunate, because it shows that further experimentation has led to an increasing clarification of our ideas concerning one of the most important problems in brain physiology: the intimate nature of type II, alias operant, alias instrumental, alias voluntary activities of the organism.