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Emotional Response to Nonreinforcement

In an interesting report describing cycles in the force of a lever response during the execution of fixed-ratio reinforcement sequences [*Science* **138**, 516 (1962)], D. E. Mintz interprets his results in the light of a supposition that the animal discriminates the strength of its own response on the occasions when reward is obtained. This explanation places the phenomena in the category of response-shaping by operant discriminations.

There is, however, a clear possibility that the changes in response force during fixed ratio reinforcement sequences reflect, rather, an emotional reaction of the organism to nonreinforcement. One would expect such responses, if they occur, to contaminate the strength of instrumental level press, because tension of both smooth and skeletal muscle is part of the pattern of emotional discharge.

That conditioning procedures produce emotionality is, of course, a classic finding of Pavlov and Liddell. A particular verification as regards the case of the fixed-ratio paradigm demonstrates that gradually shifting the ratio toward higher values produces, in the cat, muscular tension which may conveniently be measured by the number of vocalizations emitted but which includes, in a pattern, tail-flicking, flexion of limbs, pacing, and so on [M. F. Halasz and H. F. Hunt, report to the 3rd World Congress of Psychiatry, Montreal (1961)]. Thus, the schedule employed by Mintz seems to be one where failure to obtain reward may have emotional repercussions. If the consequent tonus be thought of as cumulating from one nonreinforced response to the next, and as declining over successive reinforced presses, the curves presented might well be accounted for by simple superposition of general tension on the lever response.

The respondent side effects of operant schedules are often such as to interact with the positively rewarded instrumental behavior. Since these elicited reactions are in many cases primitive, phylogenetically and neurally, parsimony requires that they be considered before more complex discriminations are invoked by way of explanation.

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It is quite possible that the force variations during fixed-ratio responding are mediated by emotional responses, as Halasz suggests. However, in the study reported, the systematic changes in force were generally enhanced through repeated exposure to the reinforcement schedules, contrary to what one might expect if emotional habituation played a significant role. Moreover, the cycles that showed high and low forces typically had a period of less than 30 seconds. Twenty-five daily variations in force with cycles of this relatively high frequency do not appear to reflect the more integrative changes in tonus that would be produced as a concomitant of emotional response.

A discriminative basis for the increase in the force of response after nonreinforcement has been proposed by Notterman and Block [*J. Exptl. Anal. Behavior* **4**, 289 (1960)]. They suggest that the organism *learns* to respond "harder" when reinforcement does not occur. This direction of change is learned in an environment in which an increase in vigor frequently produces reinforcement after other behavior has been inefficacious.

Nature provides relatively few situations in which "softer" is an effective direction of behavioral change. It is possible that within the evolutionary process there has been selection for an increase in vigor of response and the phenomenon has become a basic property of the operant. This pattern may frequently be correlated with a more general pattern of emotional response of the sort Halasz has noted. However, the force changes may well be functionally independent of the emotional pattern.

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