Reversal of an operant discrimination by noncontingent discrimination reversal training[1]

MILTON A. TRAPOLD
UNIVERSITY OF MINNESOTA

Rats who had received extensive training on a free-operant bar-pressing discrimination were given discrimination reversal training with the bar removed and reinforcements noncontingent, and then were tested on the reversed problem with reinforcements again bar press-contingent. In comparison to control groups that, prior to exposure to the reversed-contingent problem, received either no noncontingent discrimination training or noncontingent discrimination training on the unreversed problem, these Ss showed marked transfer (both immediate transfer and savings) from the noncontingent to the contingent reversal problem. This result is related to previous findings and to several possible theoretical interpretations.

A number of recent studies have shown that the rate of acquisition of a free operant (S^D - S^Δ) discrimination can be markedly affected by discriminative pretraining conditions which involve S^D and S^Δ but which do not explicitly involve differential reinforcement of the reference response. For example, Trapold & Odom (1965) showed that Ss who have learned a discrimination with one response (R_1) will subsequently acquire the same discrimination with a second response (R_2) much faster than Ss who are acquiring the discrimination for the first time with R_2. In that same study, it was also shown that after the same discrimination had been learned with both R_1 and R_2, discrimination reversal training with R_1 effected virtually complete reversal of the discriminative output of R_2 despite the fact that R_2 had never explicitly been subjected to the reversed discrimination contingency.

In another study (Trapold & Fairlie, 1965) it was shown that noncontingent discrimination training also transferred to a discrimination problem involving the same discriminative stimuli, but with reinforcements now contingent upon a specified response. Indeed, the amount of transfer to R_2 discrimination learning produced by noncontingent training was essentially identical to that produced by discrimination training with reinforcements contingent upon R_1. In other words, these transfer effects appear to depend only upon the S^D and S^Δ having been paired with reinforcement and nonreinforcement per se, rather than upon a more response specific process such as response generalization or induction.

The purpose of the present experiment was to extend the observations of the effects of noncontingent discrimination training to the case of discrimination reversal learning. That is, given that Ss have already learned an S^D - S^Δ discrimination with some response, will *noncontingent* reversal training (like reversal training with a different response) lead to reversal of the discriminative output of that response?

Method

Ss were 11 male albino rats maintained at 80% of ad lib body weight throughout the experiment by controlled-amount feedings after each daily session. The apparatus consisted of two identical operant conditioning chambers each housed in its own sound-shielding chamber, controlled by programming equipment located in a different room, and containing a retractable response lever, a foodcup into which .045 gm P. J. Noyes food pellets could be delivered, and a houselight that served as the discriminative stimulus.

The basic daily session throughout the experiment consisted of eight 5-min. periods during which the houselight was alternately on and off. During each phase of the experiment, one of these stimulus conditions defined the S^D, the other the S^Δ. During S^D periods, reinforcements were delivered on a variable interval 1-min. schedule, contingently upon bar-pressing during the response-contingent phases, and noncontingently during the noncontingent phases. Reinforcements were never delivered during S^Δ under any circumstances.

All Ss had served in a previous experiment in which they had received extensive discrimination training with light-on as S^D and light-off as S^Δ, and reinforcements contingent upon bar pressing. As a result of this training, Ss were making an average of approximately 85% of their responses in the light-on stimulus condition at the beginning of the present experiment.

The final test phase of the present experiment, lasting seven days, involved a simple reversal of the S^D and S^Δ with reinforcements continuing to be contingent upon bar pressing. However, prior to that phase, Ss were divided into three groups and subjected to differential treatment.

The noncontingent reversal group (Gp. NC-R, N = 4) received 40 sessions of noncontingent reversal training. With the bar removed from the chamber, pellets were delivered as described above during the light-off periods and not during the light-on periods. The noncontingent nonreversal group (Gp. NC-NR, N = 4) was treated identically except that they received noncontingent pellets in the light-on periods and not in the light-off periods. The contingent reversal group (Gp. C-R, N = 3) was included as a control against which to assess the completeness of any transfer observed in Gp. NC-R. This group received 36 days of response-contingent discrimination reversal training (sufficient to produce asymptotic performance on the reversal problem) followed by four days of noncontingent reversal training. The purpose of this noncontingent reversal training was to control as much as possible for any decremental effects that noncontingent reinforcement might have on subsequent bar pressing performance in Gps. NC-R and NC-NR. Such decremental effects were observed on absolute bar pressing rates in a previous study (Trapold, Myers, & Carlson, 1965), and, while they did not appear to affect relative response output to the discriminative stimuli, it was nonetheless thought desirable to at least partially control for such effects by exposing Gp. C-R to some noncontingent training prior to the test phase.

Results and Discussion

Figure 1 shows the performance of all three groups on all seven test days in terms of the mean proportion of responses emitted in S^D. It also shows the performance of Gp. C-R over the *first* seven days of its exposure to contingent discrimination reversal training. It is apparent that in comparison to either Gp. NC-NR on the test days or to Gp. C-R on its first seven days of reversal training, the noncontingent reversal training given to Gp. NC-R resulted in considerable facilitation of reversal learning. Not only did Gp. NC-R learn

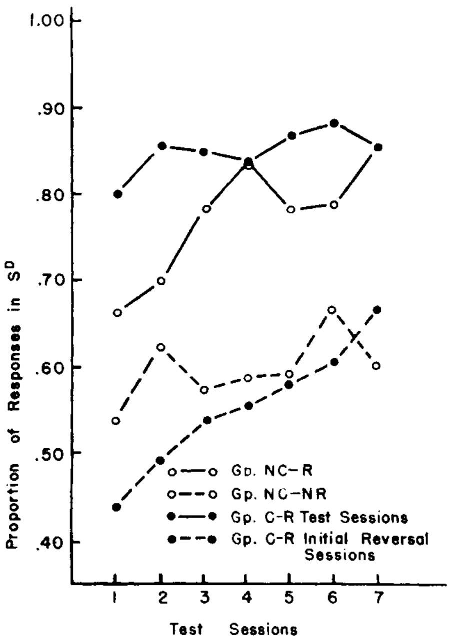

Fig. 1. Mean proportion of responses in S^D per session.

the reversal problem faster, but it also showed a sizeable amount of discriminative responding on the first day.

A repeated measures analysis of variance of Gps. NC-R, NC-NR, and C-R over the seven test days yielded a significant group main effect ($p < .05$) as did a parallel analysis comparing Gps. NC-R and NC-NR with the first seven days of reversal training for Gp. C-R ($p < .01$). Individual pairwise comparisons of the various groups on each test day within these overall analyses showed Gp. NC-R to be significantly ($p < .05$) superior to the initial reversal performance of Gp. C-R on all test days, significantly superior to Gp. NC-NR on test days 3, 4, 5, and 7, and significantly inferior to Gp. C-R on none of the test days.

In short, then, these data support earlier conclusions (Trapold & Odom, 1965; Trapold & Fairlie, 1965; Bower & Grusec, 1964) that (a) the acquisition and reversal of discriminative responding with a given response can be strongly influenced by prior discrimination procedures that do not allow for the differential reinforcement of that response, and (b) noncontingent discrimination training and discrimination training involving a different response are both effective means of facilitating discriminative output of the reference response.

From the standpoint of theory, these data can be most readily interpreted in terms of some form of two-process or mediation theory. In its most general form such a theory assumes that learning such as that studied here is actually based upon two separate learning processes. One process consists of the acquisition of differential strength of tendency (i.e. habit strength) to make the specific instrumental response to the S^D and S^Δ (or correlated stimulus events) and is dependent upon the differential reinforcement of that response with respect to these stimulus events. The second process is seen as involving the acquisition of some class of collateral responses, this learning being dependent only upon the temporal pairing of the S^D and S^Δ with reinforcement and nonreinforcement respectively. It is then assumed that these collateral responses have the capacity to interact with the instrumental response tendency so as to modulate the output of the reference response.

Perhaps the most familiar version of this type of theory for postively reinforced behavior is that proposed by Spence (1956), in which the collateral responses ($r_g - s_g$) are classically conditioned (based upon the reinforcer acting as the UCS), and are seen as interacting in a motivational fashion with habit strength to produce performance. A plausible alternative to Spence's theory views these r_g's as sources of stimuli (s_g's) to which the reference response becomes conditioned (cf. Shapiro & Miller, 1965); still other plausible alternatives can be constructed on the assumption that the collaterals are instrumentally rather than classically conditioned (cf. Trapold & Fairlie, 1965). In the writer's opinion, there is not at the present time sufficient grounds for making a rational choice among these theoretical alternatives. Neither are there sufficient grounds for deciding such questions as (e.g.) whether it will be necessary to assume a collateral process associated with nonreinforcement as well as reinforcement, or the extent to which the collateral processes are specific to a given reinforcer. However, the existence of transfer phenomena such as have been shown here and in previous studies leaves little question that the traditional response-specific uniprocess model of free operant discrimination learning is not sufficient to deal with the currently available facts.

References

Bower, G., & Grusec, T. Effect of prior Pavlovian discrimination training upon learning an operant discrimination. *J. exp. Anal. Behav.*, 1964, 7, 401-404.

Shapiro, M. M., & Miller, T. M. On the relationship between conditioned and discriminative stimuli and between instrumental and consummatory responses. In Prokasy, W. F. (Ed.), *Classical conditioning: a symposium*. New York: Appleton-Century-Crofts, 1965.

Spence, K. W. *Behavior theory and conditioning*. New Haven: Yale University Press, 1956.

Trapold, M. A., & Fairlie, J. Transfer of discrimination learning based upon contingent and noncontingent training procedures. *Psychol. Rep.*, 1965, 17, 239-246.

Trapold, M. A., Myers, W. A., & Carlson, J. G. The effect of noncontingent fixed-and variable-interval reinforcement upon subsequent acquisition of the fixed-interval scallop. *Psychon. Sci.*, 1965, 2, 261-262.

Trapold, M. A., & Odom, P. B. Transfer of a discrimination and a discrimination reversal between two manipulandum-defined responses. *Psychol. Rep.*, 1965, 16, 1213-1221.

Note

1. This research was supported in part by NIMH Grant 08799-02 to M. A. Trapold and in part by grants from NSF, NICHHD and the Graduate School of the University of Minnesota to the Center for Research in Human Learning, University of Minnesota.