

Proactive inhibition in rats after prior partial reversal: A critique of the spontaneous recovery hypothesis¹

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Forty-eight rats were taught a simultaneous visual discrimination, S_1+ vs S_2- . Subsequently, they learned a second discrimination, involving one of the old stimuli and a new one. Half of them now learned S_3+ vs S_1- . The other half learned S_2+ vs S_3- . Retention of the second discrimination was tested one day or 32 days after training. The two different partial reversals resulted in proactive inhibition and to the same degree. It is argued that this result is inconsistent with the spontaneous recovery interpretation of proactive inhibition.

The occurrence of proactive inhibition (PI) and its increase with increasing retention intervals (e.g., Underwood, 1948) has generally been attributed to spontaneous recovery of the first task responses unlearned or extinguished during acquisition of the second task. This interpretation is central to the most influential current approach to long-term forgetting (Underwood, 1957). However, direct tests have found no evidence for spontaneous recovery of the first task responses in human verbal learning situations (Koppelaar, 1963; Slamecka, 1966). The present paper adds to the burden of negative evidence by demonstrating that PI in animal discrimination is difficult to attribute to spontaneous recovery of the first learned response.

Gleitman & Jung (1963) and Maier & Gleitman (1967) have shown that PI and its increase over time occurs in rats. In these studies the PI groups were trained on one discrimination (S_1+ vs S_2-) followed by its reversal (S_1- vs S_2+). Retention of the second discrimination was measured either one day or several weeks after acquisition. It could be argued that extinction (and eventual spontaneous recovery) of the responses learned during the first discrimination occurred as the animal learned the reversal: S had to inhibit the tendency to approach the formerly positive stimulus. This argument suggests that the occurrence of PI and its increase over time was primarily due to that half of the reversal procedure which involved changing $S+$ to $S-$. Changing $S-$ to $S+$ should not have been relevant for here there is no excitatory tendency to be inhibited and later recovered. To determine whether PI is due to the shift of $S+$ to $S-$ rather than the shift of $S-$ to $S+$, a partial reversal procedure must be utilized in which only one stimulus is reversed. The present study utilizes such a design. All Ss were first trained on a visual discrimination, S_1+ vs S_2- . Subsequently, the Ss were trained on either of two partial reversals, S_3+ vs S_1- (plus-minus shift) or S_2+ vs S_3- (minus-

plus shift). If PI and its increase over time is the result of spontaneous recovery, one should expect more PI when the second discrimination involved a plus-minus rather than a minus-plus shift.

Method

The Ss were 48 male hooded rats maintained on a 23 h feeding schedule and at 85% of their ad lib body weights throughout the entire experiment. Nine of the Ss were discarded due to apparatus failure and ill health. Three standard rat test chambers served as apparatus, each equipped with two response panels on the front wall. Stimuli were projected on the panels by means of in-line projectors. Details of apparatus and of pretraining are described in Maier & Gleitman (1967).

After pretraining, Ss were randomly assigned to four groups, each of which was presented with a different simultaneous discrimination. The stimuli were a triangle (T), vertical stripes (V), or horizontal stripes (H), each white on a black background. Group 1 was presented with $T+$ vs $H-$, Group 2 with $T+$ vs $V-$, Group 3 with $T-$ vs $H+$, Group 4 with $T-$ vs $V+$. The Ss were run for 40 trials a day, with a 7-sec intertrial interval, and using a noncorrection procedure. This method was in force until S reached a criterion of 32 or more correct trials in a session. On the day following the criterial session, S was presented with a new discrimination which provided for partial reversal: Now the two stimuli were horizontal and vertical stripes with the contingency reversed for the stimulus already encountered in the previous discrimination. Thus for Ss in Group 1, the new discrimination was $V-$ vs $H+$, for those in Group 2 it was $H-$ vs $V+$, for those in Group 3 it was $V+$ vs $H-$, and for those in Group 4 it was $H+$ vs $V-$. It is readily seen that the partial reversals required of Groups 1 and 2 were of the minus-to-plus category (MP); those required of Groups 3 and 4 were plus-to-minus (PM). Ss were run on the second discrimination until it had been learned to the same criterion as was used for the first; the training procedure was identical in all respects to that utilized before.

For half of the Ss, retention of the second discrimination was tested one day after the criterial session; for the other half the retention test followed 32 days later. The retention test consisted of one further session on the second discrimination conducted in precisely the same manner as were all prior sessions on that discrimination.

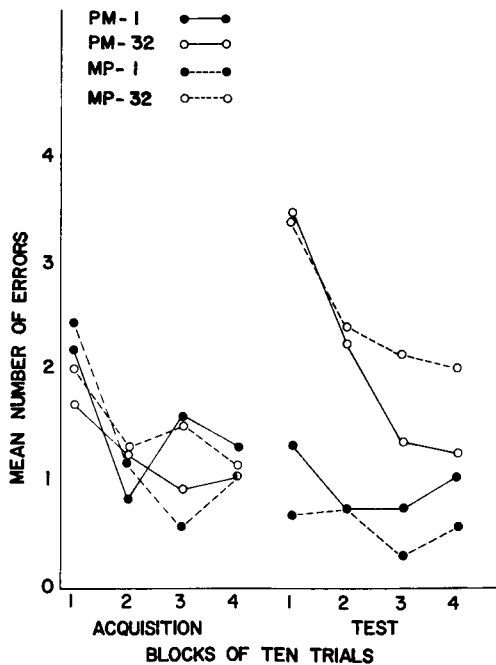


Fig. 1. Mean number of errors on last day of acquisition and on test day.

Results

Acquisition. Mean days to criterion for the first discrimination was 5.5 for the plus-to-minus groups, and 8.9 for the minus-to-plus groups ($t=4.4$, $df=37$, $p < .01$), a difference which may reflect some initial preference for stripes of whatever orientation. For the second discrimination the mean days to criterion was 10.1 for the plus-to-minus groups and 7.75 for the minus-to-plus groups ($t=1.7$, $df=37$, $p > .05$). Obviously, there is massive negative transfer for the plus-to-minus groups ($t=5.5$, $df=19$, $p < .01$), but no evidence for such with the groups shifted from minus to plus.

Retention. Errors on the last day of acquisition and on retention test are presented in Fig. 1, for the MP and PM groups at 1 day and 32 day retention intervals. A previous study (Maier & Gleitman, 1967) using the same horizontal-vertical discrimination found no retention loss over a 32 day interval when no prior discrimination had been provided. Thus, any retention loss occurring in the MP or PM groups can be attributed to PI. As the figure indicates, both MP and PM groups show sizable PI with a 32 day retention interval. The mean error scores of the MP-32 and PM-32 groups are clearly larger than those obtained for the corresponding 1 day test groups, MP-1 and PM-1 (the two respective t values are 3.42 and 3.28, with dfs of 17 and 18 in the two cases; for both, $p < .01$). Of most importance for our purposes, however, is the com-

parison between the MP-32 and PM-32 groups: There is not the slightest indication that plus-to-minus reversal leads to more PI than reversal in which the shift is minus-to-plus.

Discussion

PI was demonstrated for a discrimination which consisted of a partial reversal of another discrimination learned previously. This effect was no greater if the partial reversal was of the plus-to-minus than of the minus-to-plus variety. This result presents difficulties for the view that PI is caused by the spontaneous recovery of inappropriate responses extinguished in the course of learning. What response was extinguished (and thus later recovered) while learning the minus-to-plus shift? One might suggest that S learned an avoidance response to the initially negative stimulus, and that this response was the one extinguished while acquiring the second discrimination and later recovered during the retention interval. This interpretation is not consistent with the data of the present study. Had S acquired an avoidance response to the initially negative stimulus, there should have been considerable negative transfer to the second discrimination. While there was negative transfer given the plus-to-minus shift, no negative transfer was found when the shift was minus-to-plus.

What then might account for the fact that PI increases with increasing retention interval? We suggest a simple possibility: forgetting. S forgets which of the two discriminations it had encountered more recently, an effect which grows as the retention interval increases and the relative recency of the two situations becomes more alike. It may be that the explanation of PI rests with the phenomenon of forgetting and not the other way around.

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Notes

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