Proactive interference in a T maze brightness-discrimination task¹

DAVID A. CHISZAR AND NORMAN E. SPEAR, DEPARTMENT OF PSYCHOLOGY, RUTGERS UNIVERSITY, New Brunswick, N. J. 08903

The influence of proactive interference (PI) on forgetting of a brightness discrimination was tested in 70 rats. The design was a 2 by 2 factorial combination of presence or absence of a source of PI with two retention intervals (one or five days). Forgetting was greater with a source of PI. Consideration was given to both "task recency" and "spontaneous recovery" in interpreting these and other data.

The literature contains several failures to obtain proactive interference (PI) in lower animals (Crowder, 1967; Kehoe, 1963; Rickard, 1965) as well as some positive instances (Gleitman & Jung, 1963; Maier & Gleitman, 1967; Koppenaal & Jagoda, 1967). However, the variables critical to the operation of this phenomena have not yet been isolated. Kehoe (1963) suggested that her noncorrection procedure may have resulted in extinction of original responses to a point from which they could not recover, but Maier & Gleitman (1967) showed this not critical by demonstrating PI after noncorrection training.

Maier and Gleitman suggested that length of retention interval might be an important interacting variable. Gleitman and his associates have demonstrated PI several times after intervals of 32-44 days, while most studies failing to demonstrate PI have used shorter intervals such as seven days (e.g., Crowder, 1967; Rickard, 1965). This fact undoubtedly has been important in leading Maier, Allaway, & Gleitman (1967) to conclude that spontaneous recovery of extinguished first-task responses is not likely to be the mechanism underlying PI. These authors suggested that a "forgetting-of-task recency" construct seems better able to handle the existing facts. However, there are at least two studies in which PI was observed to increase during much shorter intervals. Spitzner & Spear (1967, Exp. 5) found marginally significant PI after 14 days, and Koppenaal & Jagoda (1967) observed substantial PI after only three days. These studies indicate that relatively long intervals are not necessary for PI in lower Ss. The present study supports this conclusion, since increasing forgetting as a consequence of PI was observed after only five days.

Method. The Ss were 70 experimentally naive Sprague-Dawley albino rats, 60-80 days old at the start of the study. The experiment was run in two replications containing 30 and 40 Ss respectively, which involved identical treatments and essentially identical results, so they were pooled for description and analysis. After 10 days of handling and accommodation to the daily ration of 12 g ground Purina chow, 35 Ss (the PI Ss) were given 60 trials of Acquisition on the T maze brightness-discrimination apparatus described by Spear & Spitzner (1967).

Trials were distributed at the rate of six per day for 10 days. Trials 1 and 6 of each day were free; Trials 2 through 5 were forced—two trials to the more favorable alternative (MFA) and two to the less favorable alternative (LFA). The order of forcing was randomly determined, and a new order was selected each day. The bright and dark alternatives of the maze occurred equally often as the MFA. The reinforcer on the MFA was 10 .045-g Noyes grain pellets, and, on the LFA, S was confined for 25 sec in the empty goal box. Two days after the end of Acquisition, Ss began Reversal training in which the Acquisition MFA became the LFA, and vice versa. Reversal training continued for seven days with six trials per day presented as in Acquisition. During Reversal, 30 sec access to wet mash (water mixed with Purina powder) was given in the MFA vs 30 sec confinement in the empty LFA. The remaining 35 Ss (controls) differed from the PI Ss only in their absence of Acquisition training.

One day after Reversal, 15 PI and 15 control (C) Ss (Groups PI-1 and C-1) were given five free trials reinforced as in Reversal. Five more free trials were given on the following day. The remaining 20 Ss from each of the PI and C groups (Groups PI-5 and C-5) were given identical treatment starting five days after Reversal. Of the 30 Ss in the first replication, five were in Group PI-1, five in C-1, 10 in PI-5 and 10 in C-5. In the second replication, 10 Ss were run

in each factorial cell. During Reversal in the second replication the PI-1 group was inferior to the PI-5 groups in terms of per cent correct choices on free trials on all but one day ($p = .01$ by Sign Test). By the same measure this PI-1 group was also inferior to both PI groups in the first replication ($p = .06$). Therefore, these PI-1 Ss were given an extra day of Reversal bringing their terminal performance approximately equal to that of the other PI Ss. In the second replication one S (Group PI-1) was discarded for failure to reverse and one (Group C-5) because it became trapped on a position preference. Therefore, one S from each of the remaining groups was randomly discarded to balance the design.

Results. On the last day of Acquisition, 98.48% of the free-trial choices were correct ($X^2 = 62.06$, $df = 1$, $p < .001$) indicating that the PI Ss had acquired a significant preference for the MFA. On the last day of Reversal the C Ss made 98.48% correct responses on free trials, and the PI Ss made 92.42% correct responses ($X^2 = .48$, $df = 1$, $p > .20$). Thus, the groups were comparable in terms of preference for the MFA at the end of Reversal.

There was little forgetting across the 5-day interval unless Ss had a source of PI (see Fig. 1). Although the tendency for the PI Ss to make more errors after five days was present on the first test trial, the effect was not statistically significant with this measure ($X^2 = .54$, $df = 1$, $p < .30$). However, when the first five test trials were taken together, the PI-source-X-retention-interval

Fig. 1. Probability of an error during relearning for Ss with (PI) and without (C) an experimentally induced source of proactive interference. Relearning was given 1 or 5 days after original learning.

interaction was significant ($F = 6.00$, $df = 1/62$, $p < .05$) indicating that forgetting over the interval was greater for the Ss with the source of PI. Furthermore, although rapid relearning by Ss in Group PI-5 obscured the interaction when Trials 6-10 were considered separately ($F < 1$), it remained significant when all 10 test trials were pooled ($F = 4.93$, $df = 1/62$, $p < .05$).

Discussion. The present results agree with those of Koppenaal & Jagoda (1967) in showing that intervals as long as 32-44 days are not a necessary condition for producing retention deficits attributable to PI. Both Koppenaal and Jagoda's procedure and that of the present study produced Reversal learning in fewer trials than required for Acquisition. However, when negative transfer (i.e., more trials required for Reversal than Acquisition) occurs, PI apparently is demonstrated convincingly after long intervals (44 days in Gleitman & Jung, 1963; 32 days in Maier & Gleitman, 1967), with borderline significance after moderate intervals (e.g., 14 days in Spitzner & Spear, 1967, Exp. 5), and not after shorter intervals (e.g., seven days; Kehoe, 1963; Spitzner & Spear, 1967, Exp. 4). Although this classification is not perfectly inclusive (e.g., Rickard, 1965, failed to show reliable PI after positive transfer) and comparisons are confounded by other potential sources of variance, it may imply that retention effects occurring after different forms of transfer are mediated by different processes. It is reasonable to suppose that when Ss have learned successive tasks in a common stimulus context, they will respond in terms of the more recent task on a retention test (cf. Maier, Allaway, & Gleitman, 1967). Indeed, they are reinforced for this behavior which must be consistent if the reversal criterion is to be attained. If Ss must continue on Task 2 (reversal) for a long period (e.g., because of negative transfer) then the temporal distance between Task 1 and Test becomes exaggerated relative to the distance between Task 2 and Test. Thus, the recency of Task 2 should be more pronounced, and correspondingly less influence of the competing Task 1 expected after a short retention interval. With longer retention intervals, the differential in recency of Tasks 1 and 2 becomes increasingly inconsequential.

It is also reasonable to expect that spontaneous recovery of extinguished responses would interfere with the retention of subsequently learned responses. Although research on spontaneous recovery usually measures the

phenomena in terms of minutes and hours, it is plausible that a response remains viable in terms of interference properties for a lengthy period subsequent to its recovery. To integrate these notions it is suggested that when task recency has become a pronounced differentiating cue (as in the case of negative transfer) it will be prepotent over spontaneous recovery after a retention interval. Thus, S will be able to reject the recovered tendency on the basis of recency of Task 2. After positive transfer (shorter time on Task 2 than Task 1) the recency cue should not be as strong, and spontaneous recovery may have a higher probability of being expressed.

REFERENCES

- CROWDER, R. G. Proactive and retroactive inhibition in the retention of a T-maze habit in rats. *J. exp. Psychol.*, 1967, 74, 167-171.
- GLEITMAN, H., & JUNE, L. Retention in rats: The effect of proactive interference. *Science*, 1963, 142, 1683-1684.
- KEHOE, J. Effects of prior and interpolated learning on retention in pigeons. *J. exp. Psychol.*, 1963, 65, 537-545.
- KOPPENAAAL, R. J., & JAGODA, E. Proactive inhibition of a maze position habit. Paper given at meetings of the Eastern Psychological Association, Boston, 1967.
- MAIER, S. F., ALLAWAY, T. A., & GLEITMAN, H. Proactive inhibition in rats after prior partial reversal: A critique of the spontaneous recovery hypothesis. *Psychon. Sci.*, 1967, 9, 63-64.
- MAIER, S. F., & GLEITMAN, H. Proactive interference in rats. *Psychon. Sci.*, 1967, 7, 25-26.
- RICKARD, S. Proactive inhibition involving maze habits. *Psychon. Sci.*, 1965, 3, 401-402.
- SPEAR, N. E., & SPITZNER, J. H. PRE in a T-maze brightness discrimination within and between subjects. *J. exp. Psychol.*, 1967, 73, 320-322.
- SPITZNER, J. H., & SPEAR, N. E. Proactive interference and retention of free- and discrete-trial operant behavior. Paper given at meetings of Psychonomic Society, Chicago, 1967.

NOTE

1. This research was supported by MH-12064 and a predoctoral fellowship to the first author awarded by the National Institute of Mental Health.