Perseveration in septal cats¹

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Abstract

Lesioned Ss, deficient at passive avoidance, also extinguished more slowly when punished for making an active-avoidance response and required more training to reverse a learned position-habit.

Problem

Bilateral lesions overlapping limbic cortex and septum in cats produce a deficit in passive-avoidance behavior; when shocked at a source of food, such operated Ss still return to eat, in contrast to normal Ss. Since the lesion produces no impairment in active-avoidance behavior, investigators have suggested that the passive-avoidance deficit results from an inability to suppress the approach-response to the potentially punishing source of reward (McCleary, 1961; Kaada et al., 1962; Fox et al., 1964; Lubar, 1964). The present study attempted to determine whether such lesion-induced perseveration is a general impairment, observable in other samples of behavior involving response suppression.

Method

Lesions were placed stereotaxically in 15 cats and there were nine unoperated controls. Twelve days postoperatively, on the average, operated Ss were screened on a passive-avoidance test, described in detail elsewhere (McCleary, 1961). For this test, Ss eat their daily ration of food, for six days, in small aliquots on successive trials in a specially designed enclosure. On the seventh day, they are shocked while eating and given 15 test trials, separated by 1 min. intervals, to see whether or not they return to the food dish. Five Ss showed a total deficit, returning to eat on all 15 post-shock trials; five had a partial deficit, returning to the food during at least one trial but not all 15 trials; the remaining Ss showed no deficit, passively avoiding in a normal manner on all 15 trials.

All Ss then were trained to a position-habit in a WGTA, using food reward. The criterion for acquisition was 18 correct responses out of 20. The Ss then were trained to the same criterion on two successive reversals of the position-habit. Two operated Ss and two controls failed to complete all stages of training and do not contribute to this portion of the experiment.

All Ss finally were trained for 20 trials each day on a 'one-way' active-avoidance problem, using a 5-sec. buzzer as CS and floor-shock (1082 v. (ac), 500,000 ohms internal impedance) as US. The apparatus and procedure have been described in detail elsewhere (Lubar, 1964). After reaching a criterion of 18 correct responses out of 20, Ss were extinguished to the same criterion and re-trained to the lesser criterion of nine avoidance responses out of 10. An electric bell then was substituted

for the buzzer and punishment-extinction was started: Ss were shocked in the goal-box for each response until they failed to avoid on 18 trials out of 20. Unless otherwise stated, all statistical significances are $p < .05$ by one-tailed, Mann-Whitney U test.

Results

The lesioned groups with either a total or partial deficiency at passively avoiding shock also made significantly more perseverative errors when required to reverse the learned position-habit as compared to the lesioned Ss having no passive-avoidance deficit or the unoperated controls (Fig. 1). During early reversal training, the two groups with effective lesions also responded for significantly ($p < .01$) more trials in succession than control Ss who, at first, tended to extinguish for the day after sampling the originally correct stimulus-object a few times and finding it unbaited. There were no significant differences among the groups during the second reversal or the original acquisition of the position-habit.

Fig. 1. Errors to criterion on first reversal of the position-habit. The black, shaded and white bars show the mean scores for operated Ss with a total (N=4) partial (N=5) or no (N=5) deficit on the passive-avoidance test. Dashed horizontal line shows mean performance of unoperated controls (N=7).

Fig. 2. Trials to criterion during punishment-extinction. The black, shaded and white bars show the mean scores for operated Ss with a total (N=4), partial (N=5) or no (N=6) deficit on the passive-avoidance test. Dashed horizontal line shows mean performance of unoperated controls (N=9).

The lesion also prolonged extinction of the active-avoidance response when the subjects were required to generalize to a novel CS and then punished for responding (Fig. 2). Each of the three lesioned groups differed significantly from the control animals. The two lesioned groups that were, respectively, totally deficient or completely normal at passive avoidance also differed significantly from one another during punishment-extinction. Only two of the 15 lesioned Ss but, in marked contrast, six of the nine controls failed to avoid on the first trial of the punishment-extinction series when the bell replaced the buzzer as CS. The three controls that did respond were extinguished with significantly fewer shocks than the most deficient lesioned group. The groups did not differ during acquisition or ordinary extinction of the active-avoidance response.

With one exception, all Ss showing a deficit in passive avoidance had bilateral damage in the dorsal half of the septum and the limbic cortex immediately rostral to it. The one exception had bilateral damage of the limbic cortex but only unilateral involvement of the septum. The six operated Ss that passively avoided normally had unilateral septal damage or else (N=2) a minimal bilateral lesion limited to the extreme dorso-rostral edge of the septum.

Conclusions

The perseverative tendency underlying the passive-avoidance deficit in the present lesioned Ss is to some extent a general abnormality, being apparent also during the punishment-extinction of a generalized active-avoidance response and the reversal of a food-reinforced habit. The lesion induced impairment thus is not specifically dependent on increased alimentary drive nor is it simply a form of pathological reaction to shock. Nevertheless, the response perseveration does not appear under all circumstances where it might be expected: Neither the ordinary extinction of an active-avoidance response nor the second reversal of a position-habit are abnormally prolonged.

References

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Notes

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