The effect of deprivation level on extinction following acquisition under random deprivation conditions

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Abstract

Sixteen albino rats learned to run a straight alley after 10-1/2, 22-1/2, 34-1/2, and 46-1/2 hr. of food deprivation. The order of these deprivation periods for a given animal was randomized over successive trials. After 12 acquisition trials, Ss were randomly assigned to either a 10-1/2 or 46-1/2 extinction group. Results showed no significant effect of deprivation level on performance during acquisition but did show that animals extinguished under 46-1/2 hr. took significantly more trials to extinction and tended to run faster during this period. The results were interpreted as supporting a non-specific drive effect for deprivation level on extinction performance.

Introduction

There are at least two ways in which to view the effects of different levels of deprivation on performance during extinction: (1) in terms of the similarity of deprivation cues present in extinction to deprivation cues present during learning (Estes, 1958), and (2) in terms of a nonspecific energization effect brought about by different deprivation levels (Brown, 1961). Experiments dealing with this problem have made extensive use of a factorial design in which two (or more) groups of animals are trained under two (or more) different levels of deprivation and are either maintained at the same level of deprivation or switched to the other level of deprivation during extinction (see Kimble, 1961, pp. 411 ff). The use of this type of design raises a number of methodological concerns, the most important of which are that in order to make valid comparisons among animals during extinction, all animals must have been exposed to the same length and conditions of training and that variations in the level of deprivation during extinction must represent no change in cue conditions from those present during acquisition. The purpose of the present study was to investigate the effects of different levels of deprivation during acquisition and extinction on performance during extinction through the use of a procedure which was able to control both of these methodological problems.

Method

Subjects. The Ss were 16 experimentally naive male albino rats obtained from the Budd Mountain Rodent Farm of New Jersey. The Ss were approximately 3 months old at the beginning of the experiment.

Apparatus. The straight alley used in the present experiment was constructed of 1/8 in white Plexiglas. The alley was 55 in long, 4 in wide, and 5 in deep.

The start box comprised the first 7 in of the alley, the runway the next 36 in, and the goal box the last 11 in. A recessed food cup was located in the far end of the goal box. Both the start box and runway were enclosed by clear plastic hinged tops while ventilation was achieved by means of a removable wire mesh top over the goal box. A covering of black fabric minimized overhead cues. Running latency was measured by two photoelectric relays (Lafayette, Model PC-45) spaced 2 ft apart in the exact center of the runway itself. These relays were connected to a Hunter Klock Kounter (Model 120 A, .001 sec.).

Procedure. The first stage of pretraining was designed to acquaint Ss with a random feeding schedule and with eating in the goal box. Four Ss were randomly assigned to each row of a 4 by 4 latin square containing 10-1/2, 22-1/2, 34-1/2, and 46-1/2 hr. deprivation periods. After each deprivation period Ss were brought to the experimental room and allowed to eat two 94 mg food pellets on each of five opportunities approximately 2 min. apart. The Ss were then returned to their individual home cages and allowed to eat for 1 additional hour. Purina Lab Rat Chow was fed in the home cage and water was always available. Following the completion of four preliminary deprivation periods Ss were randomly reassigned within a latin square for the second stage of pretraining. This second stage was conducted under the same deprivation condition as the first with the exception that after each of the four periods Ss were placed in successively increasing blocked-off units of the runway. After the final deprivation period Ss were required to run 3/4 of the distance of the runway proper. The result of this procedure was to eliminate any retracing behavior during acquisition. The entire pretraining schedule covered 10 days and also served to stabilize Ss at approximately 80% initial body weight.

For the purpose of acquisition four Ss were randomly assigned to each row of three, 4 by 4 latin squares. After each of the 12 deprivation periods, Ss were placed in the start box and allowed to run five times at 2 min. intervals. Running speed (1/latency) was averaged for each S over the five runs and this value was taken as the mean running speed for that trial. After each run the alley was cleaned with a 10% vinegar solution. The entire acquisition phase lasted 14 days.

Immediately following acquisition two Ss from each row of the latin square were randomly assigned to

Fig. 1. Mean running speeds for acquisition and extinction.

either a 10-1/2 or 46-1/2 hr. extinction group. The procedure used in this phase of the experiment was the same as that during acquisition except that no food was placed in the goal box. The two extinction measures recorded were the mean running speed for the first five runs during extinction and the mean number of runs prior to a criterion of three consecutive runs in which S failed to reach the food cup in 30 sec. Latency was not recorded after the first five runs since the apparatus and training procedure were not designed to prevent retracing behavior.

Results and Conclusions

Figure 1 presents the acquisition and extinction running speeds for the various groups of animals with deprivation level serving as a parameter. Each of the points on any one of the acquisition functions confounds animals and deprivation levels. Each successive point represents one complete block of trials for four animals in each row of the latin square described earlier. In order to evaluate the effects of Level of Deprivation on running speed during acquisition,

TABLE I
Number of Trials Required to Reach Extinction
Criterion for Each Animal

Animal Number	Level of Deprivation During Extinction		Animal Number
	10½	46½	
4	9	43	11
10	15	44	15
13	15	49	5
6	16	49	12
9	21	52	3
7	24	62	1
2	35	66	8
16	41	73	14

Note: Values in columns 2 and 3 denote number of trials to extinction.

tation, taking this confounding into effect, an analysis of variance was performed in which the unit of analysis employed was the value of all 16 animals for that deprivation level over that block of four trials. This analysis failed to reveal any significant effect of deprivation on acquisition ($F(3,45)$) or any significant interaction between level of deprivation and stage of practice ($F(6,90) = 1.50$). As expected, stage of practice i.e., successive blocks of trials, did exert a significant effect on running speed ($F(2,30) = 203.00$; $p < .001$).

For the extinction phase, each point represents the mean running speed for all eight animals in each group over the first five runs of extinction. An examination of the data for each of the five runs failed to reveal systematic differences and consequently all five were treated as a single trial. A t-test of the significance of the difference between these means revealed a tendency for animals extinguished under 46-1/2 hr. to run faster than animals extinguished under 10-1/2 hr., although this difference was not unequivocal ($t = 1.63$; $p = .13$, two-tailed test).

A second measure of the difference between groups extinguished under 10-1/2 and 46-1/2 hr. is presented in Table 1 and concerns the number of trials taken to the extinction criterion for animals under both of these conditions. As can be seen, there is no overlap in the distribution of scores between the two groups indicating a significant effect of extinction deprivation level on the number of trials to extinction (Mann-Whitney, $U = 0$; $p < .001$).

Although the running speed results fail to reach an acceptable level of statistical significance, the trends reported are consistent with an energization analysis. The failure to attain a comfortable level of significance is probably best attributable to the small number of animals entering into the statistical evaluation of this effect.

In terms of the trials to criterion data, however, the present results strongly support a non-specific energization explanation of the effects of deprivation level on performance during extinction. This occurred in the present experiment despite the fact that the length, and conditions of acquisition were equivalent for animals in both groups. These conditions preclude an explanation of these data in terms of a cue change hypothesis, and strongly suggest that the level of deprivation present during extinction may be conceptualized as providing a non-specific energization effect on behavior.

References

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