Running for stimulus change¹

RICHARD B. MAY,² Claremont Graduate School, Claremont, Calif. 91711

In three stages of training, two groups of rats were (a) exposed to a runway goal box, (b) presented with different amounts of visual change in the goal box, and (c) treatment conditions in the second phase were reversed. Speed of running was found to be a function of the amount of change in goal box stimulation.

The effects of perceptual rewards (e.g., stimulus changes) have been widely studied in choice and exploratory situations although a few studies have dealt with their effectiveness in runway situations. The runway studies have usually involved a comparison of food- and water-deprived Ss with nondeprived Ss. For example, Chapman & Levy (1958) found that when a change in the visual characteristics of the goal box was introduced, sated Ss ran faster than before the change but no change in running time was observed in food-deprived Ss.

Dember (1961) stated that stimulus changes are no different in principle from conventional reinforcers and "any distinction in principle between primary drives and the motive underlying exploration . . . is artificial and misleading [p. 252]." The present study was designed to assess Dember's hypothesis by testing two groups of nondeprived Ss presented with varying amounts of visual goal box change. Since variation in amount of food in a runway goal box has been shown to lead to corresponding changes in running speed (Crespi, 1942) it was expected that Ss receiving visual goal box change would run faster than those receiving no change, and shifts in amount of goal box change would lead to systematic changes in running behavior.

Subjects

Sixteen male and 16 female naive hooded rats from the Claremont Graduate School colony served as Ss. These were 70-90 days old at the beginning of training and had ad lib access to food and water in their home cages at all times before and during training.

Apparatus

The maze consisted of an unpainted enclosed runway 48 in. long, 6 in. high, and 3 in. wide. Cubicle starting and goal boxes, 6 in. on a side, were attached to each end of the alley. Guillotine doors at the entrance of each end box prevented retracing. A photocell and microswitch arrangement with sound insulated relays permitted measurement of starting and running times.

Four stimulus inserts were constructed to cover completely the three walls of the goal box. Each insert was painted with a different 6-in. x 6-in. black-white pattern. A given insert had the same pattern replicated on each wall. The areas of black and white were equal within and between inserts and the patterns consisted of geometrical nonsense figures of approximately equal complexity (May, 1963).

Procedure

All Ss were handled in groups of four or five for 15 min daily for 14 days prior to training. On Day 14 Ss were individually placed in the maze for 5 min with both doors open. The black-white patterns were not present.

Training trials were administered, four per day for seven consecutive days. During the first two days all Ss were treated alike (Pretest) and received (a) four trials with an empty goal box followed by (b) four trials with a single black-white pattern on all trials of Day 2. An equal number of Ss had each pattern presented during this pretest period.

The Ss were then randomly assigned to two groups with an equal number of males and females in each group. On Training Days 3 and 4 (Test) one group continued trials with the Pretest pattern present in the goal box on all trials and on Days 5, 6, and 7 (Reversal) had a different one of the four patterns present on each of the four daily trials (Group NC). The second group had a different pattern presented on each trial of a given day during the Test and the Pretest pattern present on Days 5, 6, and 7 (Group CN). Therefore, the three training stages were (a) Pretest for two days, (b) Test for two days, and (c) Reversal for three days.

The order of presentation of the patterns for the Stimulus Change condition was random for each rat but constant between days with the Pretest pattern always presented on the last trial of each day. A trial consisted of 45 sec in the starting box, raising the starting box door, and 30 sec in the goal box at the end of a run. The Ss not starting within 180 sec or completing a run within 360 sec of starting were given a score of 180 and/or 360 sec for that trial. The Ss were run in squads of four or five. The intertrial interval for a given S was determined by the time taken to give one trial to the remaining Ss in the squad and ranged from 10 to 15 min.

Results and Discussion

Starting and running times (in seconds) were transformed ($\log X + 1$) and submitted to a Treatment by Trials analysis of variance. Two analyses were made of each dependent variable. The first analysis compared Pretest scores with Test scores and the second compared Test scores with Reversal scores. Analysis of starting times indicated that only the trials main effect in the first analysis was significant ($F = 7.268$, $df = 1/28$, $p < .025$). Both treatment groups started faster in the Test phase than in the Pretest phase of the experiment.

For running times, the amount of change by stage of training interaction was significant in the first analysis ($F = 4.741$, $df = 1/28$, $p < .05$) and in the second analysis ($F = 8.955$, $df = 1/28$, $p < .01$). The main effects of Amount of Change, Sex, Trials, and the Sex by Trials interaction were nonsignificant in both analyses. A summary of these findings is given in Table 1. Group NC ran slower in the Test than in Pretest while Group CN ran slightly faster. In the Reversal stage of training, Group NC was shifted from constant to changing goal box stimulation and exhibited a decrease in running time. Similarly, Group CN, which was shifted from changing to constant goal box stimulation, exhibited an increase in running time. Analysis of running times to the four goal box patterns during nonchanging treatment in the Test and in Reversal indicated no significant differences in responsiveness to the four patterns ($F < 1$ in each case).

In general the running time data support the contention that visual stimulus change may serve as an incentive for nondeprived Ss in a runway situation. Speed of running appeared to be a function of amount of change in goal box stimulation. While there were no significant differences between treatment groups in their starting times, pilot work with rather old Ss (200-250 days) indicated that this measure also may vary with amount of goal box change in a manner similar to that for running times (May, 1963).

Table 1
Mean Log (X+1) Running Time in Seconds

Group	Pretest	Test	Reversal
CN	1.072	1.043	1.260
NC	1.068	1.240	1.132

These data are consistent with the theoretical analysis of response to change by Earl (1961), who stated that stimulus change may elicit approach responses if the change is perceptible, not too large, and novel (has been experienced never or infrequently). In the present study, pilot work was used to determine an amount of change which would be "not too large," and would thus fall within the range of changes eliciting an approach response.

REFERENCES

CHAPMAN, R. M., & LEVY, N. Hunger drive and reinforcing effect of novel stimuli. *Journal of Comparative & Physiological Psychology*, 1957, 50, 233-238.

CRESPI, L. P. Quantitative variation of incentive and performance in the white rat. *American Journal of Psychology*, 1942, 55, 467-517.

DEMBER, W. N. Alternation behavior. In D. W. Fiske and S. R. Maddi (Eds.), *Functions of varied experience*. Homewood, Ill.: Dorsey Press, 1961.

EARL, R. W. *A theory of stimulus selection*. Fullerton, Calif.: Hughes Ground Systems, 1961 (SD 61-132).

MAY, R. B. Running for stimulus change. Unpublished M.A. thesis, Claremont Graduate School, 1963.

NOTES

1. Based upon part of a thesis submitted in partial fulfillment of the requirements for the M.A. degree at Claremont Graduate School. Supported in part by U. S. Public Health Grant MPM-15,908.

2. Now at University of Victoria, Victoria, B. C., Canada.