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A Test of Learning with Responses Minimized by the Use of a Movable Maze

By CHARLES F. HANER and RICHARD PETERSON

INTRODUCTION

Several experiments have investigated the possibility of learning when their subjects have been either restricted in their movements or proprioceptive cues have been reduced. A number, as Harlow and Stagner (1), have restricted movement by the use of drugs (as curare). Thorndike (2) suggests a series of "experiments which aim to provide opportunities to acquire expectations with a minimum of helpful association of accompanying impulses." Typical of these suggested studies was the following: A rat might be placed in a cage which was mounted on wheels. The cage would then be pushed through a simple maze and the animal rewarded at the correct end and not rewarded at incorrect end. Learning would then be tested by observing the performance of the animal on free runs. Waters (3) reports a study based on one of Thorndike's suggestions. He placed two boxes on a table. One contained food. The other was empty. He carried his rats alternately to each box for twenty trials and then set them free to observe their behavior. He concluded that learning did occur, and "that expectancy does operate as a factor influencing the direction and character of behavior."

The present study was undertaken to investigate the possibility of learning in physically intact and properly functioning animals when presented with distinctive stimuli which were consistently followed by reward or non-reward but when responses on the part of the animal were greatly reduced.

METHOD

Subjects: The subjects in this study were twenty-eight albino rats. All were experimentally naive. There were assigned at random to the conditions under which they were run.

Equipment: A small wire cage about the length of a rat was constructed of hard-ware cloth. One side was removable, the other side, top and bottom, and ends were rigid. The rat was placed in this cage and the movable side pushed in until the rat was snugly fastened and the movable side locked at that point. Between the front and hind legs of the rat was a block of wood belly-high, which further restricted movement. This small cage was securely fastened to rigid strap-iron hangers from the ceiling.

A special single unit T maze was constructed. This maze was mounted on silent casters which ran in channels under and to the

side of the maze itself. The maze could be pulled back and forth by the experimenter. At the beginning of the familiarization runs the maze was placed so the wire cage was in the base end of the T. The experimenter could then pull the maze along until a block stopped it with the cage at the choice point. It could then be turned in either direction and the casters run down a different set of channels until the goal box came down to the cage. A door could then be inserted and the animal released from his stationary cage directly into the goal box. By inserting carefully cut and folded black and white cardboard in the wings of the T the ends could be given a distinctive appearance.

Procedure: All rats were handled for about five minutes a day for three days. Then for two further days each was allowed to run free in a straight alley for five minutes. They were then divided randomly into control and experimental groups. They were put on a restricted diet five days prior to the beginning of training. Food was used as a reward.

The animals in the experimental group received six "rides" in the cage per day for three days. Half of the "rides" were to the reward side and half to the non-reward side in random order. For half the black side was the reward side, and for half the white was. The colored inserts were varied between the right and left wings of the T in random sequence, being on each side half of the trials. Following these eighteen "rides" over three days the rats were placed at the starting point and allowed to run free for twelve trials on the fourth day. They were rewarded for correct responses on the test day.

The control animals were given twelve trials in learning the maze in the normal fashion without the familiarization "rides" in the cage. Half were rewarded at the white end and half at the black end.

RESULTS

The alley which the rat chose on each of the twelve test trials was recorded. Time required to run from the starting box to the goal box was recorded by stopwatch for five of the rats in each group.

The results are as follows:

Mean number of correct responses—total

Control	6.3	
		$t = 1.56$

Experimental	7.8	Not significant
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Chance	6.0	
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First half of the test trials

Control	2.78	
		$t = 1.10$

Experimental	3.35	Not significant
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Chance	3.0	
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Second half of the test trials		
Control	3.50	$t = 1.75$
Experimental	4.43	
Chance	3.0	Not significant

On the first free run seven of the fourteen experimental animals went to the rewarded side and seven to the non-rewarded side.

The mean time for the experimental subjects was fourteen seconds and for the control was twenty-one seconds. The t on the difference is 1.28. This, however, is based on only 10 of the 28 subjects.

Confounding the results, however, is an unanticipated tendency for the subjects to choose the black alley in preference to the white. This is shown by the following tabulation.

Of the total runs for the experimental group 65.5 were to the

Group	Alley Rewarded	Correct responses in 12 trials	Correct responses in first 6 trials	Correct responses in last 6 trials
Experimental	Black	9.3	4.14	5.14
	White	6.3	2.57	3.71
	Combined	7.8	3.35	4.43
Control	Black	8.3	3.71	4.57
	White	4.3	1.85	2.42
	Combined	6.3	2.78	3.50

black side and 66.7 were for the control subjects. Thus, while no difference exists between the two groups in choice of the black alley, a very significant difference exists between the choice of the white and black alleys by both groups.

SUMMARY AND CONCLUSIONS

In terms of all of the indices of learning used the experimental animals are slightly but insignificantly better than the control animals. They made more correct choices and ran more rapidly. Whether this reflects a slight amount of learning from practice "rides" or is due entirely to chance can't be determined. The results of this study, however, provide no basis for believing that learning occurs in a situation in which the organism has what would seem to be an adequate opportunity to form expectations or cognitions but little or no opportunity to make responses in attaining the goal.

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