Pre-exposure and stimulus choice: Effects of odor trail¹

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Rats pre-exposed in one arm of a T-maze enter the other arm on a subsequent free choice trial. It is possible that the odor-trail avoidance tendency reported by Douglas accounts for this phenomenon. The present experiment, however, found no effect on the phenomenon from presence or absence of the rat's own odor trail.

Exposure of a rat to one arm of a T-maze does affect subsequent choice in the maze. However, pre-exposure of a rat to a stimulus outside of the maze does not affect subsequent choice of the stimulus in the maze (Lester, 1968b). The present paper tests a possible explanation for the effects of the locale of pre-exposure on subsequent choice.

Studies of the effects of pre-exposure of a rat to an arm of a maze are not altogether consistent. When pre-exposure in the arm has allowed rats to investigate the arm near the choice point then an effect from pre-exposure has been found (Dember, 1960; Glanzer, 1958; Lester, 1968b). When pre-exposure has confined the rats in the goal box away from the choice point then the results conflict. Walker et al (1955) found no effect whereas Dember (1960) and Sutherland (1957) did find an effect.

Work by Douglas (1966) may explain the effects of locale of pre-exposure (inside or outside of the maze; near or away from the choice point). Douglas found that two cues alone were operating in the determination of spontaneous alternation: a tendency to move in an opposite spatial direction to that recently moved in and a tendency to avoid own odor trail. In pre-exposure, avoidance of own odor trail could be the factor causing the effects and this would account for failures to obtain the effect for pre-exposure outside of the maze and away from the choice point since in these cases there would be no odor trail to avoid. The present studies were designed to test this idea.

STUDY 1

Procedure. The S were 30 male and 30 female rats from the Charles River Breeding Laboratories, strain CD. They were 140 days old.

On Day 1 each rat was tested in a T-maze. The maze was made of wood and covered with wire netting. There was no floor to the maze. The arms and stem of the maze were 18 in. long, 4-1/2 in. wide, and 6 in. deep.

Each rat was placed in one arm of the maze for 2 min. For half the rats the maze was moved to a new part of the table for the free choice trial.² For the other half the maze was left where it had been for the pre-exposure trial. Thus, half the rats had an opportunity to avoid their own odor trail and half did not have this opportunity. The interval between the pre-exposure and the free choice trial was about 15 sec.

Half of the rats were pre-exposed to black and half to white. After each rat had been tested the table was cleaned with Lysol solution.

On Day 3 each rat was tested as on Day 1. The rats were pre-exposed to the same arm as on Day 1 but were tested under the alternate odor present/absent condition to that experienced on Day 1.

On Day 8 each rat was tested once as on Day 1. The only difference in procedure was that the floor of the maze was newspaper and for half of the rats this newspaper was changed after the pre-exposure trial. This was done since it was considered possible that rats might find Lysol to be an aversive stimulus.

Results. Lysol condition: For the first day of testing the effect of odor presence/absence was in the predicted direction but the difference failed to reach significance. Of the rats allowed to avoid their own odor trail, 23 out of 30 alternated arms whereas of the rats not allowed to avoid their own odor trail 17 out of 30 alternated arms ($\chi^2 = 1.88$, $df = 1$, n.s.). This difference was due

entirely to the male rats but again the difference for the males failed to reach significant ($\chi^2 = 2.13$, $df = 1$, n.s.). For females the chi-square value was 0.00. The data are shown in Table 1.

For the second day of testing (Day 3) there was no difference in the rats allowed to avoid their own odor trails and those not allowed to do so. In each case 16 out of the 30 rats alternated arms. The chi-square value was, therefore, 0.00. For each sex considered alone the chi-square values were also 0.00.

Newspaper condition: There was no significant effect of odor presence/absence when newspaper was used to eliminate odor. There was no difference for the females ($\chi^2 = 0.00$, $df = 1$, n.s.) and the difference for the males, though in the predicted direction, was not significant ($\chi^2 = 0.13$, $df = 1$, n.s.). The data are shown in Table 1.

Discussion. The study failed to find a consistent and significant effect from odor presence/absence in the pre-exposure test on subsequent choice in the maze. No effect was found whether Lysol solution or newspaper was used to eliminate odor trails.

To show that pre-exposure under normal conditions does have an effect on the behavior of these rats a second study was carried out.

STUDY 2

Procedure. The Ss were those of Study 1. The procedure was exactly the same as on Day 8 of Study 1 except that the same newspaper floor was used for all trials of the males and the same newspaper floor was used for all trials of the females. Each rat was given one test on Day 10.

Results. Of the 30 rats pre-exposed to black, nine subsequently chose black whereas of the 30 rats pre-exposed to white, 19 subsequently chose black. This difference was significant ($\chi^2 = 5.43$, $df = 1$, $p < 0.02$).

The effect was shown predominately by the females. Of the 15 females pre-exposed to black, one subsequently chose black whereas of the 15 females pre-exposed to white, eight subsequently chose black ($\chi^2 = 5.71$, $df = 1$, $p < 0.02$).

Of the 15 males pre-exposed to black, eight subsequently chose black whereas of the 15 males pre-exposed to white, 11 subsequently chose black. This difference is the expected direction but is not significant ($\chi^2 = 0.57$, $df = 1$, n.s.).

Discussion. Pre-exposure on one locale does have an effect on subsequent choice in that same locale. The present study found this effect only for female rats [a finding which replicates the report on these same rats by Lester (1968b)]. It may be that the male rats had a higher fear level than the female rats and this greater fear level may have disrupted the behavior. In an earlier experiment with these rats (Lester, 1968a) the males did defecate more than the females in an open-field test. Although the rats were tamer in the present experiment (for example, no rats defecated in the maze during these studies) there may still have been differences in the fear levels of the rats.

The suggestion that the effects from pre-exposure on subsequent choice in the same locale may be a result of odor trail

Table 1
The Number of Animals Alternating (A) and Repeating (R)
Under Each Condition

	First Test Lysol		Second test Lysol		Third test newspaper	
	A	R	A	R	A	R
Females						
odor present	13	2	8	7	9	6
odor absent	12	3	9	6	9	6
Males						
odor present	10	5	8	7	7	8
odor absent	5	10	7	8	9	6

avoidance was not supported. Thus, the effects reported by Douglas (1966) may not be very general effects. It appears that rats can attend to maze cues and that their choice behavior can be affected by these maze cues.

REFERENCES

- DEMBER, W. N. Replication report: alternation following exposure without choice. *J. exp. Psychol.*, 1960, 60, 64.
- DOUGLAS, R. J. Cues for spontaneous alternation. *J. comp. physiol. Psychol.*, 1966, 62, 171-183.
- GLANZER, M. Stimulus satiation in situations without choice. *J. comp. physiol. Psychol.*, 1958, 51, 332-335.
- LESTER, D. Two tests of a fear-motivated theory of exploration. *Psychon. Sci.*, 1968a, in press.
- LESTER, D. Pre-exposure and stimulus choice: Effects of locale. *Psychon. Sci.*, 1968b, in press.
- SUTHERLAND, N. S. Spontaneous alternation and stimulus avoidance. *J. comp. physiol. Psychol.*, 1957, 50, 358-362.
- WALKER, E. L., DEMBER, W. N., EARL, R. W., FLIEGE, S. E., & KAROLY, A. J. Choice alternation II: exposure to stimulus or stimulus and place without choice. *J. comp. physiol. Psychol.*, 1955, 48, 24-28.

NOTES

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2. The maze was moved about 9 in. in a direction parallel to the stem of the maze and, thus, was not re-oriented.