

The sweet smell of success: Apparent double alternation in the rat ¹

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Fourteen rats received 104 acquisition and eight extinction trials in a 7 ft runway. Reward and nonreward were administered in double-alternation sequences such that if on rewarded and nonrewarded trials Ss left characteristically different odors, then these odors could act as discriminative cues for subsequent Ss in Group P but not in Group NP. Group P displayed a clear double-alternation pattern of running and extinguished rapidly, whereas Group NP's responses were not patterned and it extinguished slowly. This supports the hypothesis that rats exude odors which, depending on the manner in which the study is conducted, can serve as a powerful source of contamination among treatments or among Ss within a treatment.

It is usually assumed that the behavior of an S in an experimental environment does not significantly alter than environment or the behavior of Ss subsequently placed into it. Recent evidence, however, indicates that at least in runway-type studies using rats as Ss such an effect can occur. Independently, McHose & Ludvigson (1966) and Spear & Spitzner (1966), studying discrimination, found that control Ss, which received the same reward in two discriminanda, tended to respond differentially to these discriminanda in a manner somewhat like experimental Ss, which received differential reward. These Es proposed that experimental Ss had laid down in the discriminanda quantitatively- and/or qualitatively-different odors which had elicited differential responding from the control Ss.

Such data suggest that there is an *unconditioned* response of the rat to odor which serves to interfere with its approach to a goal toward which previous rats have shown a reluctance to approach. While this unconditioned response did not seem particularly strong, if, as McHose & Ludvigson (1966) pointed out, the odors were consistently followed by different rewards, either by design or accident, then markedly differential *conditioned* responses might be established to these odors.

The present preliminary study sought to establish conditions favorable to the formation of such conditioned responses while administering a double-alternation pattern of reward and nonreward—a pattern which previous data indicate the rat cannot learn. **Method**²

The Ss were 14 naive, female, Sprague-Dawley rats, 86 days old on Day 1 of the study. The apparatus consisted of a 1 ft start box (SB), a 4 ft runway, and a 2 ft goal box (GB). It was 2-3/4 in. wide and 3-5/8 in. high. Photocells located 6 in., 54 in., and 66 in. from the SB

permitted, in conjunction with a microswitch on the SB door, three measures of response speed, expressed in ft/sec, and called start, run, and goal speeds. It may be noted that the goal speeds came from the middle 1 ft segment of the GB.

The 104 acquisition trials began on Day 45 at the rate of eight per day. One day of extinction followed acquisition. A reward was 20 sec access to 45 mg food pellets. On nonrewarded trials S was confined in the GB for 20 sec.

The daily acquisition schedules of reward (R) and nonreward (N) for the two groups are presented in Table 1. One group received all its daily trials before the other group received its trials, with a given group being first on alternate days. All Ss within a group received, in the fixed order indicated in Table 1, a given ordinally-numbered trial before proceeding to the next trial. The alley was swabbed with a damp sponge just before each trial of S1 in each group. It may be noted that the reward schedule is such that for S2-S7 in Group P, R, and N are consistently preceded by at least one R or N trial, respectively, of previous Ss. For S2-S7 in Group NP, R, and N equally often follow both R and N on the immediately preceding trial. Thus if differential odors are laid down on R and N trials, Group P has a much better opportunity to learn differential behavior and thereby display a double-alternation pattern of response.

Table 1

Daily schedules of reward (R) and nonreward (N) and order of trials (S1 through S7, in that order, received Trial 1, then Trial 2, etc.)

Group	Trial								
	S	1	2	3	4	5	6	7	8
P	S1	R1	R2	N1	N2	R1	R2	N1	N2
	S2	R1	R2	N1	N2	R1	R2	N1	N2
	S3	R1	R2	N1	N2	R1	R2	N1	N2
	S4	R1	R2	N1	N2	R1	R2	N1	N2
	S5	R1	R2	N1	N2	R1	R2	N1	N2
	S6	R1	R2	N1	N2	R1	R2	N1	N2
	S7	R1	R2	N1	N2	R1	R2	N1	N2
NP	S1	R1	R2	N1	N2	R1	R2	N1	N2
	S2	R	N1	N2	R1	R2	N1	N2	R
	S3	N1	N2	R1	R2	N1	N2	R1	R2
	S4	N	R1	R2	N1	N2	R1	R2	N
	S5	R1	R2	N1	N2	R1	R2	N1	N2
	S6	R	N1	N2	R1	R2	N1	N2	R
	S7	N1	N2	R1	R2	N1	N2	R1	R2

Note: Numbers following R and N designate first and second events of the doublets for which data were summarized. Thus Trials 1 and 8 for S2, S4, and S6 of Group NP were excluded from the data.

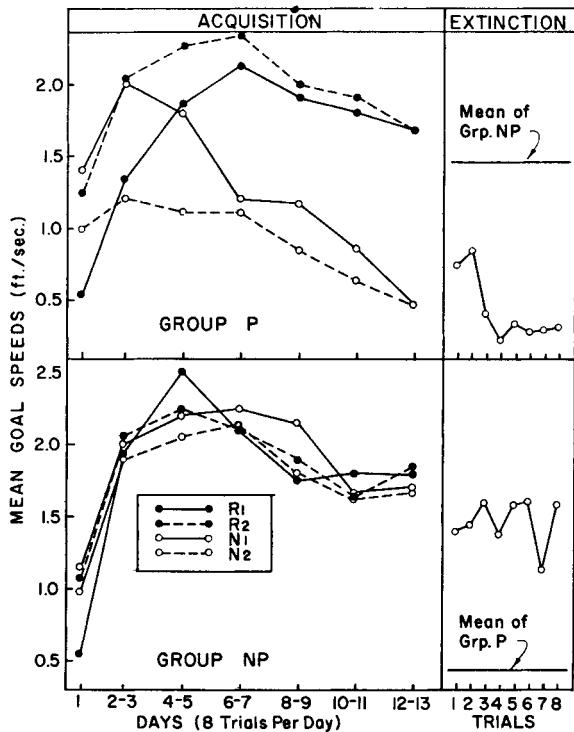


Fig. 1. Mean goal speeds during acquisition and extinction.

Results

Mean goal speeds over the course of training are presented in Fig. 1. The four trials of the double-alternation cycle are plotted separately with the first S in each group omitted.

The striking feature of acquisition was the marked double-alternation patterning (R vs N effect) displayed by Group P in the goal speeds ($p < .001$), and the absence of such patterning in Group NP. As evidence by its absence in run speeds and start speeds (not shown) this patterning appeared confined to the goal section where the olfactory hypothesis would predict it to be strongest.

Large extinction differences were also obtained which, interestingly, were not confined to the goal section.

In goal speeds the Groups differed in mean level ($F=15.84$, $df=1/10$, $p < .01$), in run speeds the groups differed in mean level ($F=24.88$, $df=1/10$, $p < .01$) and displayed different trends ($F=7.70$, $df=7/70$, $p < .01$), and in start speeds the trends differed ($F=3.02$, $df=7/70$, $p < .01$) suggesting that Group P had begun to extinguish while NP had not.

Discussion

Although of a preliminary nature these data are striking in their support of the odor hypothesis. They suggest a source of experimental contamination which may require the reinterpretation of much published data. For example: (1) Ludvigson & McHose (1965) reported that a group of rats, rewarded for running an alley, slowed their speed of response, for no apparent reason, in a manner parallel to that of a group which had reason to slow (they were being detained enroute to the goal). This could have been an unconditioned reaction to odor. (2) Certain studies (e.g., Capaldi & Spivey, 1964) report that rats can learn a single alternation pattern of reward and nonreward when given but one trial per day. This might be an artifact resulting from an unconditioned response to odor, or, more likely, odor discrimination. (3) There have probably been very few extinction studies ever conducted on runway behavior of rats in which, in addition to the removal of reward, there was not also a strong accumulation of an external stimulus—odor associated with nonreward.

References

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Notes

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2. An expanded version of this paper is available from the senior author.