Effect of food deprivation upon elation of saccharin drinking following a temporary shift to water*

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Elation of saccharin intake was seen after a temporary shift to water in nondeprived rats but not after a temporary absence of solutions or after a temporary shift to an empty drinking tube. Deprivation tended to attenuate elated responding after a water shift. The relationships of the present design to others involving reinforcement shifts were discussed.

A recent study (Gandelman & Trowill, 1969) investigated the drinking response of nondeprived rats by ingesting a saccharin solution before and after a temporary 3-day shift to tap water. In that study there was observed an immediate and durable elation effect when the animals were returned to saccharin. The authors stressed the need for a reevaluation of animal behavior in the absence of the intense drive conditions usually employed to insure continuous responding. More specifically, it was suggested that deprivation conditions may interact with certain behavioral effects (contrasted conditions of reward) in such a way as to mask the phenomenon. The present experiments investigate the effect of food deprivation on the "elation" effect observed by Gandelman and Trowill and also answer the question of whether or not the animal must sample a second solution in order to display the increased intake upon return to the saccharin solution.

EXPERIMENT 1

Subjects

Twelve 60-day-old female albino rats, bred in the University of Massachusetts Psychology Department colony, were selected from a group prescreened as saccharin drinkers. All Ss were individually housed and maintained on ad lib food (Purina Lab Chow pellets) and tap water in a ventilated room under conditions of continuous illumination. All testing was done in Ss' home cages.

Procedure

A graduated water bottle (Wahmann IC-274) containing .25% (w/w) sodium saccharin-tap water solution (sacc) was attached to each cage for 1 h during 28

consecutive days. Nothing was given on Days 29-31. Saccharin was again available until Session 40, when 3 days of tap water were substituted for the more palatable sacc. Finally, sacc was again given during the remaining 6 days of testing.

Results and Discussion

Figure 1 displays the mean intake of sacc and water throughout the experimental period. Also shown are the daily ranges of intake. Sign tests compared the intake of the first postshift session to a mean of the intakes for the 3 days immediately preceding the shift. A sign test evaluating the shift to no solution was not significant ($N = 11$, $p > .10$). A sign test evaluating the shift to water was significant ($N = 11$, $p < .006$), indicating an increase in intake. A t test followed the significant sign test and indicated the statistical reliability of the increase ($t = 3.33$, $df = 10$, $p < .01$). The results of this experiment serve to replicate those reported earlier (Gandelman & Trowill, 1969) and indicate that Ss probably need to sample a second

substance to show increased intake when returned to the standard (sacc). In addition, although a between-S control was not included in the design, the criticism of nonasymptotic responding made by DiLollo & Meyer (1970), who failed to replicate Gandelman & Trowill (1969), would not seem to apply here, with a total of 36 preshift exposures to the standard sacc solution.

The second experiment examined the effects of deprivation upon this phenomenon.

EXPERIMENT 2

Subjects

Twelve 60-day-old female albino rats were selected and maintained as in Experiment 1 except that they were limited to 10 g of food daily, feeding occurring 1½ h after testing.

Procedure

Procedures were identical to those described in Experiment 1.

Results and Discussion

Figure 2 shows mean sacc and water intake throughout the sessions. A significant sign test, as performed in Experiment 1, indicated a *decrease* in intake following a shift to no solution ($N = 12$, $p < .003$). A t test was also significant ($t = 4.80$, $df = 11$, $p < .01$). Although we do not have a ready explanation for this apparent depression of responding, it may be of worth to note that the preshift mean, computed to give a baseline for the evaluation of a contrast effect, was inflated by 1 day of unusually high intake (Session 26). A sign test evaluation of the shift to water was not significant ($N = 11$, $p > .25$).

Of secondary interest is the fact that

Fig. 1. Mean intake and daily ranges of saccharin and water consumption over the entire experimental period expressed in milliliters (nondeprived animals).

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Fig. 2. Mean intake and daily ranges of saccharin and water consumption over the entire experimental period expressed in milliliters (deprived animals).

Fig. 3. Mean saccharin intake over entire experimental period expressed in milliliters.

sacc drinking is generally lower among food-deprived Ss, an observation reported by Capretta (1962).

With regard to the lack of elation following the no-solution condition, it was felt that perhaps the Ss failed to perceive the time differential, i.e., 24 h vs 72 h, particularly in view of the continuous illumination conditions present in the animal colony. Experiment 3 was designed to afford Ss a more adequate cue as to the absence of the sacc solution.

EXPERIMENT 3

Subjects and Procedure

Six albino rats of the age and sex of Experiment 1 were selected and maintained as described therein. Procedures were identical except that an empty water bottle was attached to each

cage during the no-solution period. This experiment was terminated after the 34th session.

Results and Discussion

Figure 3 shows mean sacc intake throughout the experiment. No elation was observed (sign test: $N=6$, $p>.30$), and the conclusion that Ss need sample (respond to) an interpolated substance was further strengthened.

DISCUSSION

The results of Experiments 1 and 2 taken together indicate that deprivation level does markedly attenuate the elation effect following a return to sacc after a temporary shift to water. Although the data do not provide an obvious mechanism to explain the findings, it seems plausible that Ss in the deprived group were

ingesting a near maximal amount of the nonnutritive saccharin solution, albeit a lesser amount than in the nondeprived condition, in view of their lesser need for fluids (Bolles, 1967, pp. 203-206). This would, in effect, set a ceiling on the amount of responding in the deprived group, thus negating the possibility of a postcomparison elation effect (see also Panksepp & Trowill, in press).

It is tempting to compare directly the elation effects observed here with those of the more conventional designs (see Dunham, 1968, for a review) except that certain aspects indicate a need for caution.

Operationally, the present design closely approximates the experiments demonstrating behavioral contrast. Since time out from reinforcement in one component of a multiple schedule will produce positive contrast effects (Reynolds, 1961), the three experiments reported here represent an attempt to create an analogous procedure where consummatory responding is under the control of the taste stimulus. However, it is difficult to say exactly what conditions within the present paradigm would most closely approximate the time out from reinforcement used with the pigeon key-peck response. Almost certainly, Experiments 1 and 2, which removed all solutions and the bottle cue, served only to remove the Ss from the experimental situation altogether. The question becomes: Which condition, the empty tube or the tap water, matches most closely a timeout from reward? If responding is under the control of the taste stimulus, as has been assumed, the question may be resolved in favor of the water, which means, in effect, that each situation that has produced the elation effect has employed a timeout procedure.

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