Determinants of polydipsia: III. Withholding food on a free-reinforcement schedule[1]

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Abstract

Two rats were given food every 90 sec. Both developed polydipsia. When the empty pellet dispenser operated every 90 sec., drinking gradually declined, remained below normal in a succeeding reinforcement session, and recovered to normal the next day.

Problem

This is the third in a series of papers refuting Stein's (1964) contention that schedule-induced polydipsia in rats is due solely to thirst. In the first paper (Segal & Oden, 1965) we showed that even food-reinforced drinking is disrupted by emptying the water bottle, refuting Stein's assumption that only thirst-controlled drinking would be so disrupted, and eliminating one means of distinguishing thirst from other controlling factors. In the next paper (Segal & Deadwyler, 1965) we showed that polydipsia on a DRL food schedule continued for a time during extinction sessions without food. Here we will show that dispenser clicks can control drinking on a free-reinforcement schedule, as they did on the DRL, and that such control is extinguishable and reconditionable.

Method

Two adult, male, albino rats, maintained at 80% of ad lib weight, were run over several months on free-reinforcement (F) schedules with inter-pellet intervals ranging from 30 to 240 sec. We report here data from the fourth series of F90 sessions, which followed F240.

The conditioning chamber had a bar, food cup and water nozzle, and was housed in a sound-insulated shell in a sound-resistant room containing white masking noise. Bar presses, food cup contacts (FCRs) and water licks were recorded. Reinforcers were 45 mg Noyes peanut pellets.

Drinking was allowed to stabilize on F90 for 6 days. Day 7 had two sessions: one in which the empty food dispenser operated every 90 sec., and an immediately following food session. Day 8 was a food session. Sessions were 50 pellets or dispenser clicks long, except that by error BC-1 got 66 dispenser clicks.

Results

O-2 drank in 86% of the inter-pellet intervals on Day 6; and 90% on Day 8. It drank in 42% of the inter-click intervals and 66% of the inter-pellet intervals on Day 7. BC-1 drank in 54% of the intervals on Day 6, and 62% on Day 8. It drank in 24% of the inter-click intervals and 12% of the inter-pellet intervals on Day 7. O-2 made 6,021 licks on Day 6, 6,667 on Day 8, and 7,118 on Day 7 (2,703 during 50 clicks and 4,415 during 50 pellets). BC-1 made 2,316 licks on Day 6, 2,986 on Day 8, and 2,042 on Day 7 (1,224 during 66 clicks and 818 during 50 pellets). BC-1's lower drinking incidence was typical, on F90.

Figures 1 and 2 show performances for Days 6-8. Records marked "licks" show cumulative licking between pellets or clicks; diagonal marks show passage of 2 sec. during a drink; marks on the event line below show pellets or clicks. Records marked "L,FCR,BP" show licking, food cup responses, and bar presses, indiscriminately; diagonal marks show pellets or clicks. A counter showed that bar pressing was very rare, so its contribution to the records can be dismissed. Licking always occurred at very high rates (especially on the time scale of the L,FCR,BP recorder, which ran half as fast as the licks recorder), so the high-rate portions of the records can be read as drinks. Food cup responses took two forms: discrete, irregularly-spaced contacts with the cup, and periods during which S made constant contact with it, e.g., right after a pellet arrived. So long as S made constant contact, a pulse was sent to the recorder every 2 sec. Thus, portions of the record showing very constant, low rates can be read as constant FCRing.

The first and last licking records show control drinking on Days 6 and 8. The two middle ones show the decline in licking when only clicks occurred and in the succeeding food session. Note that three of O-2's four sessions, and two of BC-1's, began with drinking.

The L,FCR,BP records for Day 6 are omitted: they were similar to Day 8. O-2's Day-8 record shows that pellets led to a brief period of constant FCRing followed by a long drink followed, often, by more FCRing. Its Day-7 record shows that the first several clicks led to the usual sequence, but gradually licking dropped out and FCRing became more irregular, occurring variously following or preceding clicks, in the middle of intervals, through entire intervals, or not at all. The first two pellets on Day 7 led to continuous FCRing through the succeeding intervals. Shortly after the third pellet licking began, but did not assume its normal frequency. Instead, many of the intervals continued to be filled with more-or-less constant FCRing.

BC-1's performances were similar, except for more FCRing and fewer drinks.

Discussion

The low frequency of drinks in the food session of Day 7 cannot be due to water satiation during the preceding click session: three earlier series of 100-pellet sessions on F90 gave percentages of pellet-followed-by-

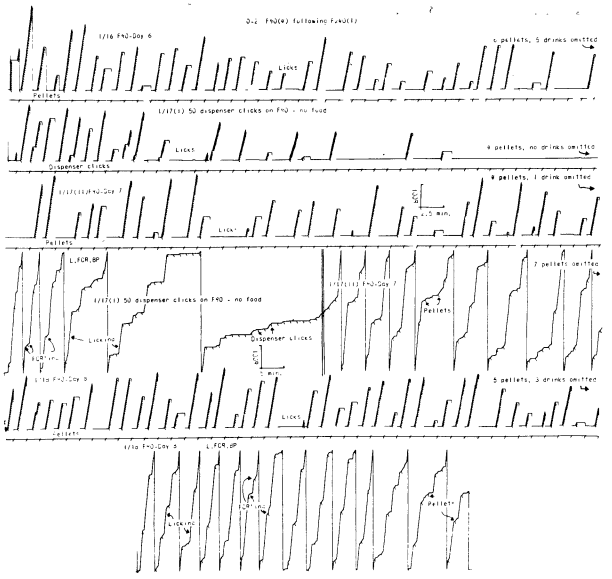

Fig. 1. Performance of O-2, Days 6-8 of F90: fourth series.

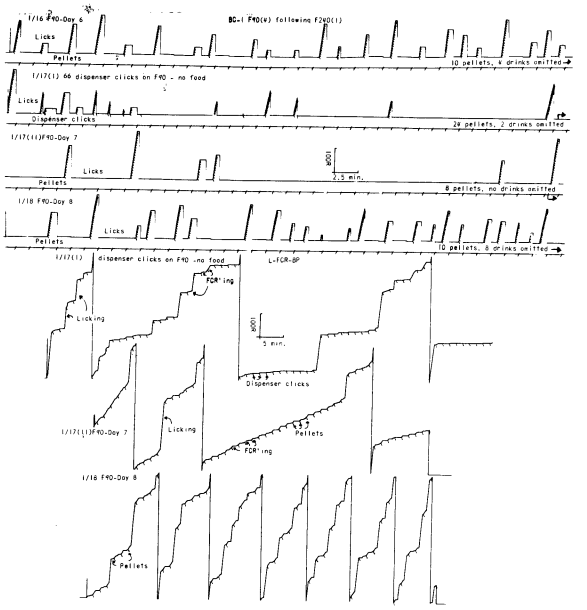

Fig. 2. Performance of BC-1, Days 6-8 of F90: fourth series.

drinks similar to the present shorter control sessions, showing that the Ss were capable of drinking more than they did here in the double-length Day 7.

The decline in drinking in the click session might represent the extinction of an adventitious chain; and its gradual recovery in the two next food sessions the relearning of the chain. We might reconstruct it as: Dispenser click was S^D for FCR, and food was S^D for more FCRing. FCR + food was S^D for licking, and licking was S^D for more FCRing. In the click session, FCRing, without food, retained discriminative control over licking for a time, but gradually that control was lost. Restoring food restored control not at once, but gradually.

That any licking occurred in the click session, and that drinking often initiated sessions, show that food was not a necessary condition of drinking. Nor was it a sufficient condition: there was little licking in the food session of Day 7. Similarly, the persistence of terminal FCRing in the click session beyond the disappearance of licking shows that licking was not a necessary S^D for terminal FCRing. Nor was it a sufficient S^D: not all inter-pellet intervals showed terminal FCRing after a drink. If we view the whole sequence as one continuous chain, we must conclude that we have not yet identified all the stimuli that linked together the elements of the chain. Nor do we know whether the reinforcer for licking was the next food pellet, or dissipation of thirst from the last one.

It is not surprising that FCRing lasted longer in the click session than licking did. Part of the normal S^D for licking was gone: food. And FCRing was followed more closely by food, and so might have been stronger: FCRing following pellets was reinforced by immediate access to food; FCRing late in the interval was reinforced, FI-fashion, by access to the next pellet.

References

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Note

1. Supported by NSF GB 1605, NIMH 8505, and an NSF Undergraduate Research Participation Grant.