

# Determinants of polydipsia: IV. Free-reinforcement schedules<sup>1</sup>

EVALYN F. SEGAL, DAVID L. ODEN AND SAM A. DEADWYLER  
SAN DIEGO STATE COLLEGE

## Abstract

Rats got pellets on free-reinforcement (F) schedules with inter-pellet intervals from 30 to 480 sec. As the interval lengthened, drink frequency increased to a maximum and then decreased, average latency between pellet arrival and drinking increased, average drink duration increased, and licking rate within drinks decreased.

## Problem

Stein (1964) argued that the fact that rats on FI bar-pressing schedules drank water shortly after arrival of pellet reinforcers, rather than shortly before the next pellet was due, proves that the drinking was controlled solely by thirst. He contended that if the drinking had been adventitiously reinforced by food, it should have occurred late in the fixed-interval, as bar pressing does. However, his argument neglects that bar pressing was the operant on which food was contingent, and so must have competed strongly with any tendency to drink late in the interval. Moreover, Segal's (1965) observation of what appeared to be a two-link adventitious chain of drinking and then bar pressing on a free-reinforcement schedule suggests that a response occurring early in the inter-pellet interval deserves as much to be called an adventitious operant as a response occurring late in the interval, provided that the two-response pattern is consistent over intervals.

Nevertheless, we accept Stein's (1964) reasoning that if drinking is adventitiously reinforced by food on an interval schedule, it ought to occur later in the interval as the interval is lengthened. Here we demonstrate that this is indeed the case.

## Method

Two adult, male, albino rats were maintained at 80% of ad lib weight and given 45 mg Noyes peanut pellets on F schedules in daily sessions in a sound-insulated chamber in a sound-resistant room containing white masking noise. The chamber had a bar, food cup and water nozzle, all electrically connected to counters and recorders. The order of the inter-pellet intervals, the number of sessions at each interval, and the lengths of sessions are indicated in Fig. 1. Starting with the second series of F60, and on occasion thereafter, other treatments were administered following the sequence of sessions indicated in Fig. 1, and before moving to the next F value. They included injection of amphetamine or pentobarbital, extinction sessions with or without the operation of the empty pellet dispenser, free-feeding of 45 mg or 4 gm food pellets

% Pellets Followed by Drinks - "Normal" days only

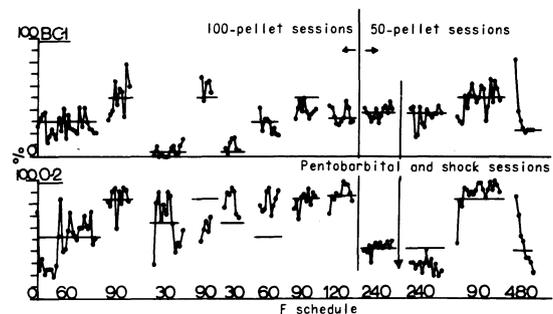


Fig. 1. Per cent of inter-pellet intervals that included drinking, for all days prior to drug or shock sessions.

in the chamber, and brief electric shock at the beginning of sessions. None of these data is reported here. All data reported here are based on the median of the last five days at a given F value, before any unusual (e.g., drug) treatments started. The data of Fig. 2 are means of the medians from all series at the same F value, for panel A; and means of the corresponding days for the other panels (i.e., days corresponding to median per cent pellets-followed-by-drinks).

## Results

The data of Fig. 1 and 2 speak for themselves. As inter-pellet interval lengthened, per cent of intervals including a drink increased to a maximum at 120 or 240 sec. and then decreased; pause between arrival of a pellet and initiation of a drink (computed only for intervals that included drinks) increased monotonically; drink duration increased monotonically, and the rate of licking within drinks fell, roughly monotonically.

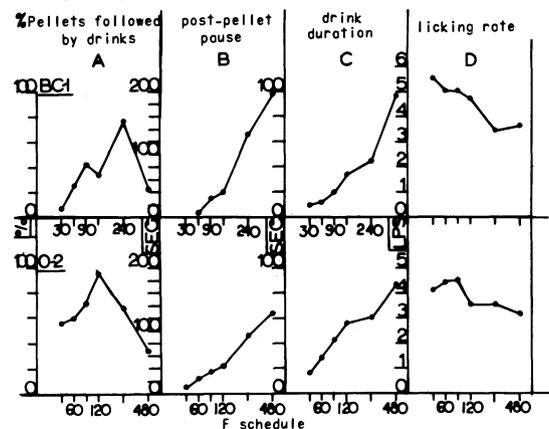


Fig. 2. Average data for the whole experiment. Explained in text.

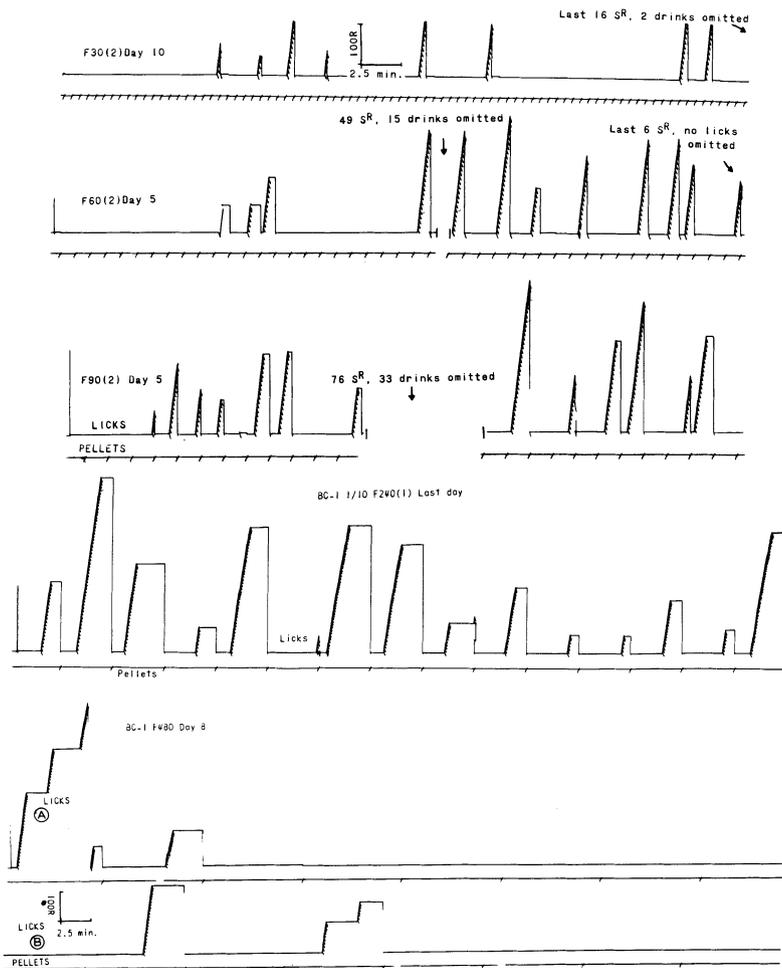


Fig. 3. BC-1's drinking on selected sessions at F30, 60, 90, 240 and 480. Initial portions of sessions only.

The horizontal lines drawn through connected sets of points in Fig. 1 are visually estimated approximate medians of all points of the first series at any given F value, and permit an estimate of the recoverability of data over the experiment. For example, both sets of points at F60 varied about the same median, for BC-1, but the data for the second F60 series were considerably above the median for the first series, for 0-2. Generally, BC-1 showed somewhat better recoverability than 0-2. Particularly interesting, but unexplained, is the reliable decline in F240 data for 0-2 following a sequence of sessions involving pentobarbital injection or electric shock.

Figure 3 shows drinks by BC-1 during portions of the last session (before drug, etc.) at a given F value (F120 is not shown). The data are from the second series at F30, F60 and F90, but the first series at F240 and F480. Pellets reset the licks pen, marks below show the delivery of pellets, and deflections in the licking records mark the passage of 2 sec. of drinking. Especially clear in the figure is the lengthening of the interval between pellet arrival and initiation of drinking, as the F value lengthened.

## Discussion

Records of food-cup contacts indicate that the reason for the low frequency of drinking at lower F values, especially F30, was competition from the behavior of remaining at the food cup throughout the inter-pellet interval. As the interval lengthened, this superstition gave way more and more often to drinking. At the longest F values, the drinking "superstition" (if such it was) was much weakened. It appears that the Ss were not able to adjust their licking rate, drink duration and post-pellet pausing sufficiently to maintain FI-like drinking through such long intervals. If the Ss are capable of drinking only so much per drink and no more, for physiological reasons, then drinking might have become slightly aversive at the long intervals, and so ceased long before pellet arrivals, and so broke the adventitious contingency between drinks and food.

## References

- Segal, Evalyn F. The development of water drinking on a dry-food free-reinforcement schedule. *Psychon. Sci.*, 1965, 2, 29-30.  
 Stein, L. Excessive drinking in the rat: Superstition or thirst? *J. comp. physiol. Psychol.*, 1964, 58, 237-242.

## Note

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