regulation of blood glucose levels, instead of electrolyte balance, as hypothesized by Grimsley & Fisher (1967), will not explain satisfactorily the unique results reported by Harriman (1955); his data remain the only report of a failure of rats to seek salt following adrenalectomy.

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The effect of pretraining on schedule induced polydipsia*

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In order to evaluate superstition and thirst explanations of psychogenic polydipsia, thirsty rats were allowed water from a burette in a test box. Later, when hungry, they were given food pellets on a 90-sec free fixed-interval schedule (FFI). This procedure was followed during daily 3-h sessions for 14 days, water being available in the home cage but not in the test box. They were then subjected to the same schedule but with water available during sessions. Their behavior with water available was compared to that of a control group which had not received the pretraining without water. The group which had been pretrained showed a retardation in their acquisition of polydipsia.

If a rat which is food deprived but not water deprived obtains food pellets on an interval schedule (by barpress or free delivery) and if a waterspout is in the delivery apparatus, relatively enormous quantities of water will be drunk (Falk, 1961). The animal drinks immediately after each food pellet (Burks, Hitzing, & Schaeffer, 1967). A strong controversy surrounds the

explanation of the phenomenon: Stein (1964) argues that it represents a form of thirst; others (e.g., Clark, 1962) argue that it is an example of adventitious reinforcement or superstition. The strongest argument against the superstition hypothesis is the timing of the drinking, since it always follows, rather than precedes, food delivery. Recently, Burks (1970) concluded that the effect was under the control of factors other than adventitious food reinforcement. Similarly, Segal & Oden (1969) found that, even if drinking delayed food delivery, polydipsia still appeared. Hymowitz & Koronakos (1968)

showed that a history of obtaining water and food always at separate times played no significant part in the development of polydipsia. Recently, an extensive review of the subject appeared (Falk, 1969).

The present experiment was designed to investigate the effect of previous experience upon the acquisition of polydipsia. If the drinking is in response to thirst produced by eating dry food, then experience in a test box of obtaining both water when food is absent and food when water is absent should, when both are available together, encourage the rapid appearance of polydipsia. On a thirst explanation, it might be argued that the reason polydipsia takes time to develop is that the animal's thirst is secondary to its hunger, and, therefore, activity is primarily directed to obtaining food. The interval schedule is such that, as the trials proceed, the animal learns that it can generally afford to be away from the food delivery area immediately after the delivery of a pellet with no harmful effect as far as obtaining food is concerned. The magnitude of the amount drunk during interval schedules may be explained by a transient dry-mouth thirst. Intermittent delivery schedules give full opportunity for this to be relieved, while under ad lib eating conditions the continuation of eating takes priority. The experiment was, therefore, primarily designed to allow early appearance of polydipsia, should the explanation in terms of thirst be true.

In contrast, if the drinking represents superstitious behavior, then allowing the animal to obtain food for some length of time, without association with drinking, should discourage a superstitious association from being formed or at least retard its development.

METHOD

The Ss were 14 male hooded rats of a mean weight of 366 g before deprivation. In their home cages, they had obtained water from a burette like the one in the test box. The test apparatus consisted of a metal box, 20 x 18 x 14 cm, with a lamp built into the roof. At one end was the food delivery tray and 10 cm away, when available, was the spout of a burette containing water. The food pellets were of commercial rat chow (Diet 41B obtained from Bradley and Bliss) and each weighed 54 mg. In the home cage, Spillers' Small Animal Diet was supplied to the extent necessary to maintain weight. All animals were run at 80% of their predeprivation body weights. The amount of water drunk was measured to the nearest 0.1 ml.

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Fig. 1. Water drunk in 3-h session for each day of test. Statistical significance for each day is as follows: 1, n.s.; 2, 3, and 4, < 0.05 ; 5, n.s.; 6, < 0.025 ; 7, 8, and 9, < 0.05 ; 10, 11, 12, 13, and 14, n.s.; 15, < 0.01 .

Seven experimental animals were food deprived until they reached 80% body weight, and then sufficient food was allowed each day for 4 days to enable the weight to stabilize. They were then deprived of water for 24 h and given 1 h in the test box with water but no food present. This was repeated for another 3 days, all food being given in the home cage approximately 2 h after the drinking test. The rats were then returned to ad lib water in the home cage.

For the next 14 days, the animals obtained food pellets in the test apparatus during 3-h sessions but with no water available during the session, water being available ad lib in the home cage. Food was delivered on a 90-sec fixed-interval free delivery schedule (FFI 90). On the 15th day, the waterspout was reintroduced, and the amount of water drunk during each 3-h session was measured for another 13 days. Two days of extinction were then given, during which the food pellets were not delivered, although the clicks associated with delivery did occur every 90 sec, as before.

A control group of seven rats had no pretraining, the development of polydipsia being observed with food and water present from the beginning. They were observed for 13 days, and this period was compared with the corresponding 13 days when the experimental group had water present. In order that the groups should be run at the same time of day, a control S

completed the test, and this was followed by an experimental S. All Ss were run in this alternate fashion.

RESULTS

Figure 1 shows the amount of water drunk by each group during the 3-h session in each day of the test. The control group became polydipsic faster than the group which had the experience of obtaining water and food separately. Both groups drank the same amount on the first day of the FFI schedule, but, with the exception of Day 5, the control group drank significantly more water on all of the next 8 days. As may be seen from Fig. 1, towards the end of the test, the difference between the groups becomes less marked and is not statistically significant. However, the pre-trained group shows a significantly greater resistance to extinction than the control group.

The mean result, as shown in Fig. 1, also represents the typical pattern for the individual animals, i.e., a day-by-day increase in intake which is slower for the pre-trained animals.

DISCUSSION

Since pretraining retards, rather than promotes, the appearance of polydipsia, the result is more in keeping with an interpretation in terms of adventitious reinforcement than with thirst. However, it is possible to advance a proposal which takes both factors into account.

The act of eating probably produces a dry-mouth thirst, which the animal has a strong tendency to relieve

immediately after eating a pellet; drinking, rather than any other activity, is then very likely to occupy the rat's behavior. The rat, therefore, develops a superstitious chain of behavior, with drinking coming immediately after the pellet, because this has been the situation which has most often occurred and has been reinforced.

There is the possibility that, in the present experiment, the 14 days of pretraining gave alternative superstitious chains an opportunity to develop. Such chains would then have to extinguish with the introduction of water.

It must be acknowledged, however, that there are serious objections to an interpretation in which adventitious reinforcement plays a major role, a number of researchers having argued against this explanation. The present experiment indicates that thirst produced by eating is also inadequate as an explanation, the experiment being designed to show rapid development of polydipsia if this were to be the basis of the phenomenon, and this did not occur.

In a similar experiment to this, Reynierse & Spanier (1968) failed to find a significant difference between pre-trained and control groups. This may have been due to the fact that they employed a shorter period of pretraining than that used in the present experiment.

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