INSTRUMENTATION & TECHNIQUES

Development and control of licking in the guinea pig (*Cavia porcellus*)

JACK ALVORD†, CARL CHENEY, and MARVIN DALEY††
Utah State University, Logan, Utah 84321

Guinea pigs were taught to lick an electronic lickometer by successive approximations brought about by a gradually receding lickerandum-liquid feeder mounted in their home cage. All Ss learned to lick and obtain their total liquid intake by tongue licking. An optimum deprivation schedule was determined, and the response was brought under schedule control comparable to that of the rat.

The guinea pig (like the rabbit) has a very high liquid intake. On the third day of a fast, for example, they may consume as much as 650% of their usual intake (Cizek, 1954). Such a high water intake suggests that the guinea pig should be ideally suited for behavioral research using a liquid reinforcer.

Most studies utilizing the licking response have used rats as Ss, although cats and hamsters have been tried (Schaeffer & Huff, 1965), as have infant albino rats (Schaeffer & Premack, 1963).

Guinea pigs probably have not been used because they rarely lick. In the laboratory, the animal is fed dry food and is supplied with a drinking tube similar to those used by rats. The guinea pig, however, merely puts his mouth around the tube and lets the water run through; he does not extend his tongue to lick. The animal's major source of liquid in a less restricted environment is lettuce or other succulent leaves.

The purpose of the present study was to investigate the possibility of developing licking behavior in the guinea pig. When experimental control over the behavior had been established, the effect of various schedules of reinforcement were determined, and stimulus discrimination was developed and demonstrated.

METHOD

The Ss in this study were four female albino guinea pigs between 60 and 90 days old.

A Lehigh-Valley Electronics lickometer was used to convert each lick into a 40-msec pulse which

operated the recording equipment, counters, and discriminative stimuli within the chamber.

A Plexiglas tube, 1.3 cm in diam and with a 2-mm fluid hole in its center, served as the lickandum. A piece of 1.9-mm brass rod served as a contact for the electronic relay. The rod press fitted through a second hole in the tube so that one end was flush with the beveled surface of the tube's tip and located 7.5 mm below the fluid hole. A Plexiglas shield with a 2.2 x 0.6 cm beveled slot was attached to one wall of the chamber. This shield

RAT

RL1

RAT

JUSTESSEN ET AL.
(1967)

G. PIG

S1

Fig. 1. Comparison of cumulative response records for a rat (RL1), guinea pig (S1), and a rat from the literature (Justesen, Levinson, & Daley, 1967). Reinforcement delivery was on an FR 50 licks for liquid reinforcement.

*Supported by a research grant to Marvin D. Daley.

†Now at Brandon Psychiatric Group, 415 East 63rd Street, Kansas City, Missouri 64110.

††Now at Upper Midwest Regional Education Laboratory, 1640 East 78th Street, Minneapolis, Minnesota 55423.

prevented the animal's nose from making the electrical contact with the brass rod. Current flowed when the circuit between the grid and the brass rod in the tube was closed. This happened when a tongue lick occurred. Since this system made fluid delivery directly contingent upon the occurrence of licking behavior, it provided a means of developing and using the tongue lick as an operant response. The apparatus is the same as that reported and pictured by Justesen, Levinson, and Daley (1967) and described by Hulse (1960). The lickerrandum tube mounted in the animal's home cage was gradually retracted behind the slot in the Plexiglas shield. This required that the animal obtain liquid by extending its tongue and licking the tube. Reinforcement was 0.2 cc of water delivered to the S's tongue.

When stable and consistent tongue licking was established on a continuous reinforcement schedule in the home cage, various ratio and interval schedules of reinforcement were put into effect. These schedules of water reinforcement were manipulated with individual animals in a single-animal operant chamber.

Fixed ratio 50 (FR 50) was established and maintained over 80 sessions with all four animals. At this point, two Ss were abruptly changed to a VI 30 and eventually to VI 60. Finally, one S was given discrimination training in which reinforcement (S+) and extinction (S-) periods were fixed

at 10 min and 15 sec, respectively, and alternated (multiple FR extinction). Reinforcement was available in S+ on an FR 5 schedule. The discriminative stimulus during S+ was a light ON over the tube; in S- the light was OFF and only the houselight was on. After each session, the Ss were provided with 200 ml of water in a bowl for a maximum of 30 min.

RESULTS

Within 3 weeks all four guinea pigs obtained their total home cage liquid intake solely by licking. The lickerrandum tube had been withdrawn 0.5 cm behind the Plexiglas shield. Data taken only during individual sessions are presented.

For species comparison, Fig. 1 shows records of a rat (run in the same apparatus as the guinea pigs), guinea pig, and rat data from Justesen et al (1967). The schedule in all three cases was FR 50. The rates for both species are comparable. A stable VI 30 rate resulted in a subsequent drop in rate with the onset of VI 60. Control was also exerted over licking behavior by discrimination training. Such control was accomplished within three sessions and was maintained for over 70 sessions. Licking was sustained at consistent and high rates on FR 5 in S+, with little or no responding in S-. Delivery of the reinforcer on FR 5 is actually continuous reinforcement, because generally about five licks are required to consume the liquid, and these licks are all counted in the next

ratio. Such postreinforcement responding accounts for what appears to be "run through" in the records of ratio discrimination responding. The optimum liquid deprivation time for a 50-min session wherein 100 to 120 reinforcers are delivered was determined to be about 22 h.

In conclusion, although guinea pigs do not ordinarily tongue-lick to obtain fluids, the response can be objectively defined, accurately counted, and precisely controlled. The response has also been shown to react characteristically to various schedules of reinforcement. Using the same procedure, it is possible that other nonlapping mammals could be taught to lick for experimental purposes.

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