Methods in Comparative Psychoacoustics
G. M. Klump, R. J. Dooling, R. R. Fay & W. C. Stebbins (eds)

Conditioned Avoidance

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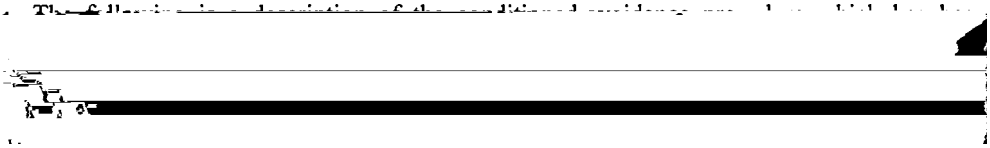
Summary. The procedure described here involves training an animal to make steady contact with a reward spout in order to receive food or water and then pairing a stimulus with mild electric shock delivered through the spout.

2 Conditioned Avoidance Procedure



2.2 The Test Cage

The design of the test cage is determined by the requirements of the stimulus as well as the species being tested. In auditory research where an animal is placed within a sound field, the cage is constructed of a sound-transparent material, such as wire mesh, and obstructions to sound are minimized (Fig. 1). An important feature of the test cage is the reward spout.

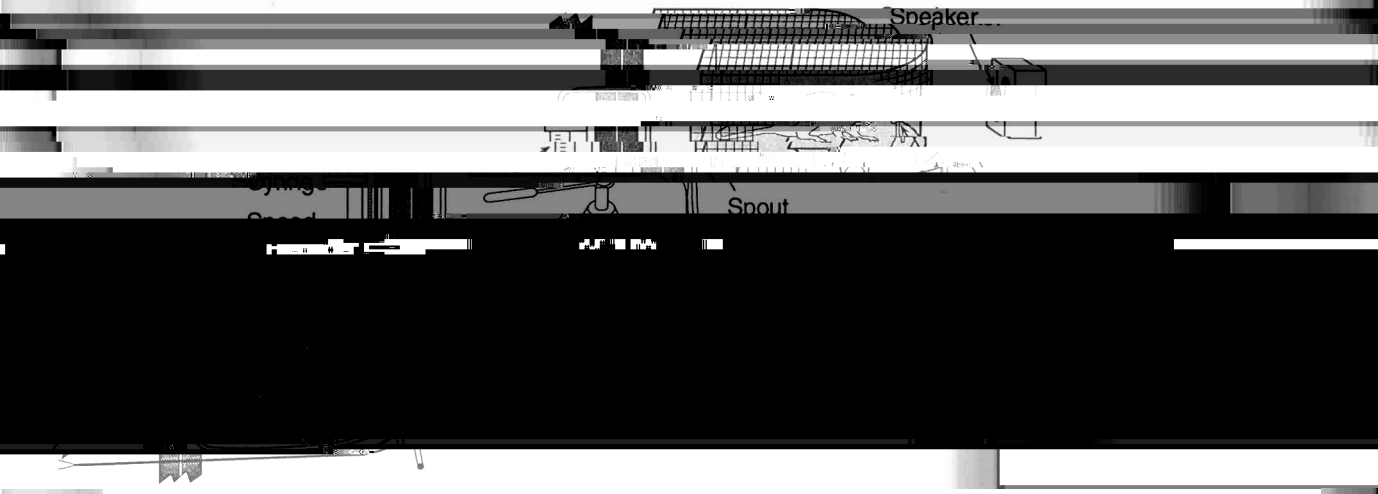


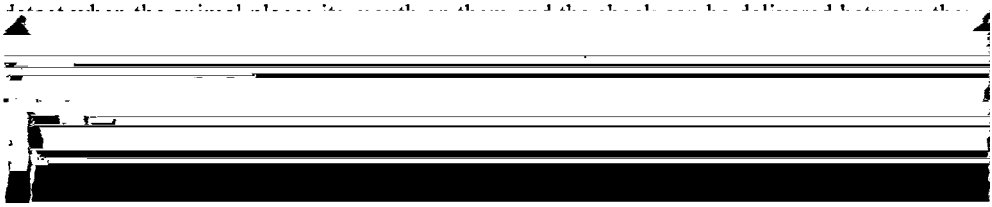
Figure 1. Semi-schematic drawing of a test cage and syringe pump.

Because the animal maintains contact with the spout, it can be used to position the animal precisely within the cage. In auditory testing, a reward spout which comes up through the bottom of the cage is preferred because it minimizes obstructions between the loudspeaker and the animal's ears. The spout can be made of copper or stainless-steel tubing with a small lick plate mounted on the top at an angle of approximately a 45°. The exact configuration of the spout depends on the species being tested—the goal is to construct a spout that requires an animal to hold its head in the desired position when making contact with the spout. In some cases, an animal may try to turn sideways while licking the spout, as when attending to sounds coming from one side. One way to prevent this is by placing shoulder-high wire mesh barriers within the cage to require the animal to face directly forward while licking the spout.

An animal's contact with the reward spout is detected with a contact switch connected between the spout and the cage floor (Fig. 1). Some animals, such as rabbits and least weasels, have fur on their feet which prevents them from making good electrical contact with the floor. This problem can be solved by wetting their feet or placing a damp sponge on the cage floor.

Larger animals, such as horses and other hoofed mammals, can be tested in a stall using a stainless steel bowl as a reward spout (Heffner and Heffner, 1984a). Contact with the reward bowl is detected by a contact switch connected between the bowl and a metal plate on the stall floor or an electrode taped to the animal's flank.

Primates are often tested in primate chairs, in which case the reward spout is mounted on the chair in front of the animal. One configuration consists of two drink tubes mounted parallel and close enough (1 cm apart) so that a monkey can comfortably place its mouth on both spouts. The spouts are electrically isolated from each other so that a contact switch can be used to

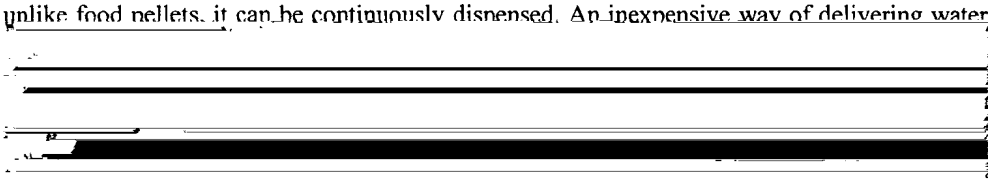


2.3 The Reward

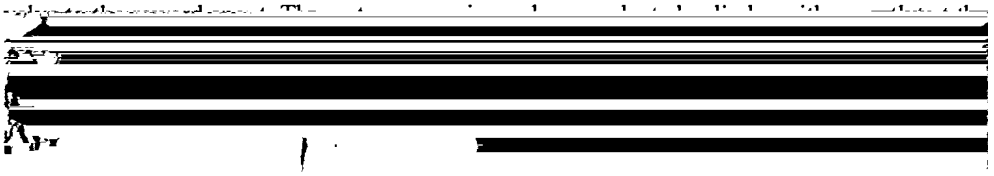
The purpose of the appetitive reward is to keep an animal in continuous contact with the

a) Water Reward

Water is an ideal reward for this procedure because most mammals readily work for it and, unlike food pellets, it can be continuously dispensed. An inexpensive way of delivering water

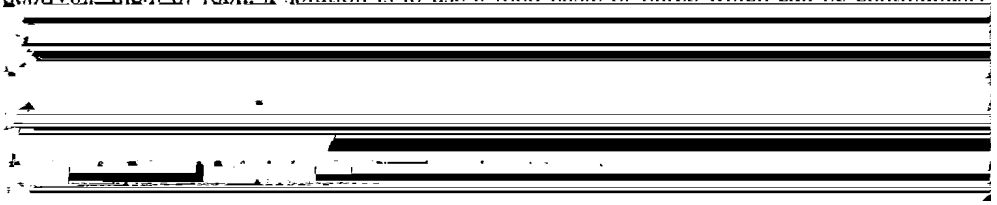


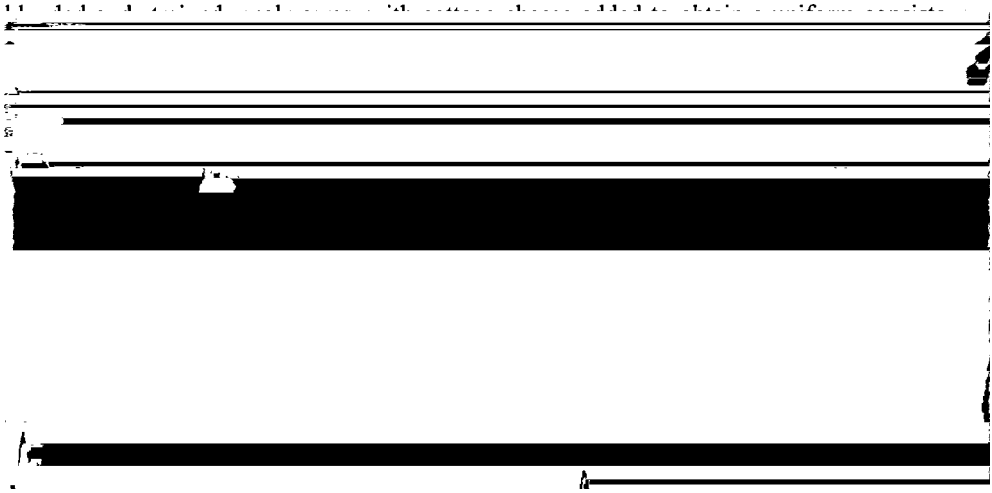
is to use a constant-pressure water reservoir that is connected via an electrically operated water



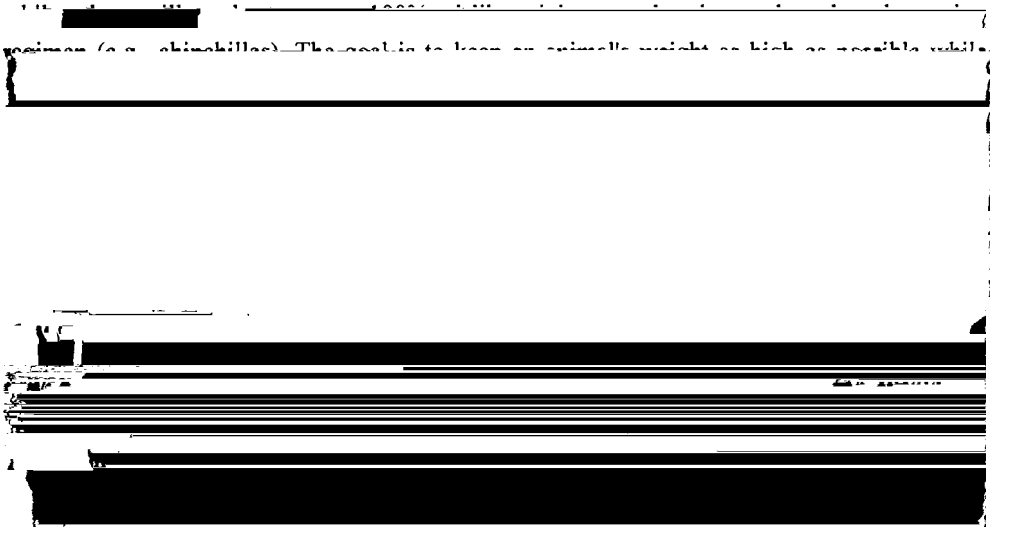
b) Food Reward

There are some animals for which food is the preferred reward. In general, these are animals that normally obtain most or all of their water from their food. They include desert rodents, such kangaroos rats and gerbils, which obtain metabolic water from dry food (Schmidt-Nielsen, 1979), and underground rodents, such as gophers and mole rats, which obtain water from the roots they consume. Because these animals cannot easily be deprived of water without also depriving them of food, a solution is to use a food paste or puree which can be continuously

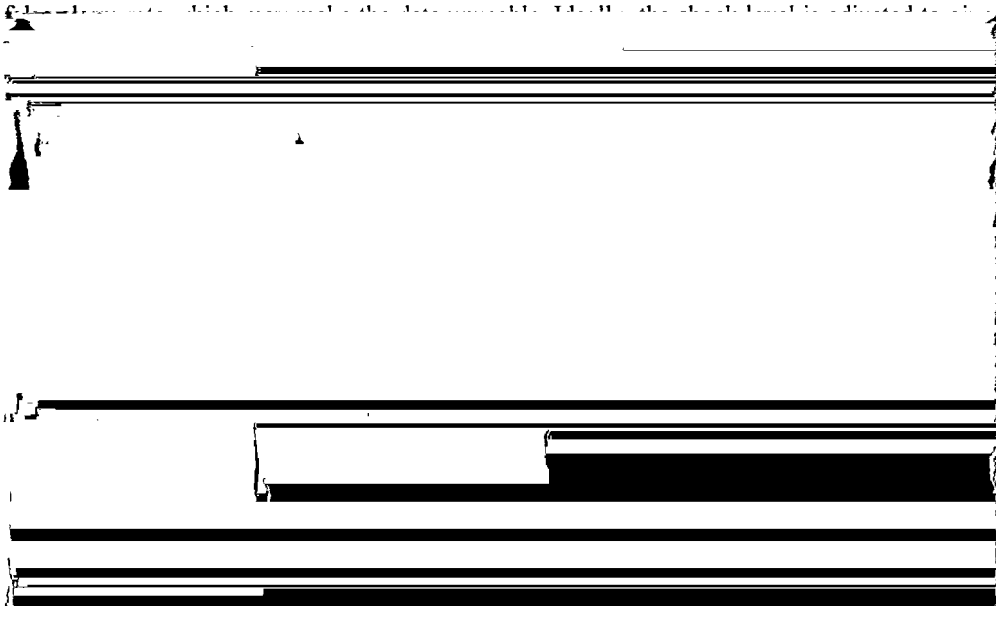


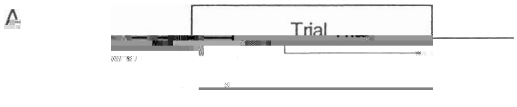


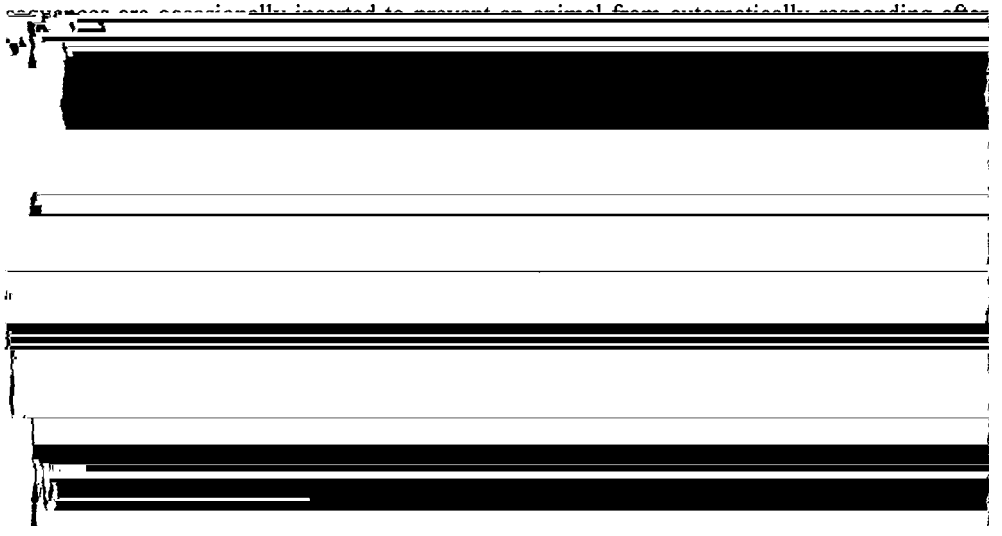
reduced to well below 80% before it is sufficiently motivated (Heffner and Heffner, 1992),



The shock is adjusted to the lowest level that produces reliable avoidance. Too low a level results in a low hit rate and underestimates an animal's ability; too high a level results in a high

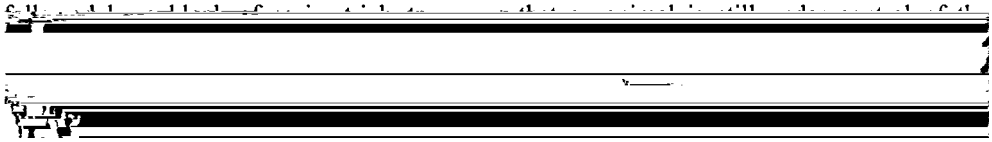




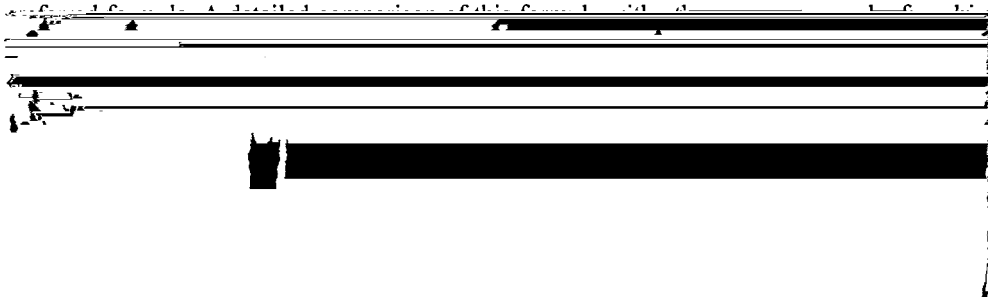


10	36	.217
8	28	.222
6	22	.214
5	17	.227
4	13	.235
3	10	.231
2	8	.200

initially estimated by gradually reducing the level of the stimulus until performance falls to chance. Next, detailed testing is conducted by presenting trials at levels just above, at, and below the estimated threshold. Typically, a block of trials involving a difficult discrimination is



.50). Because this formula works well for a wide range of hit and false alarm rates, it is the

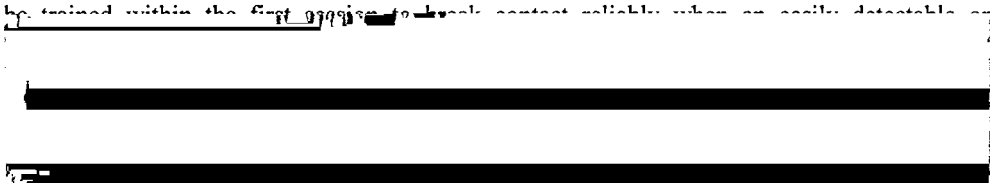


(1)

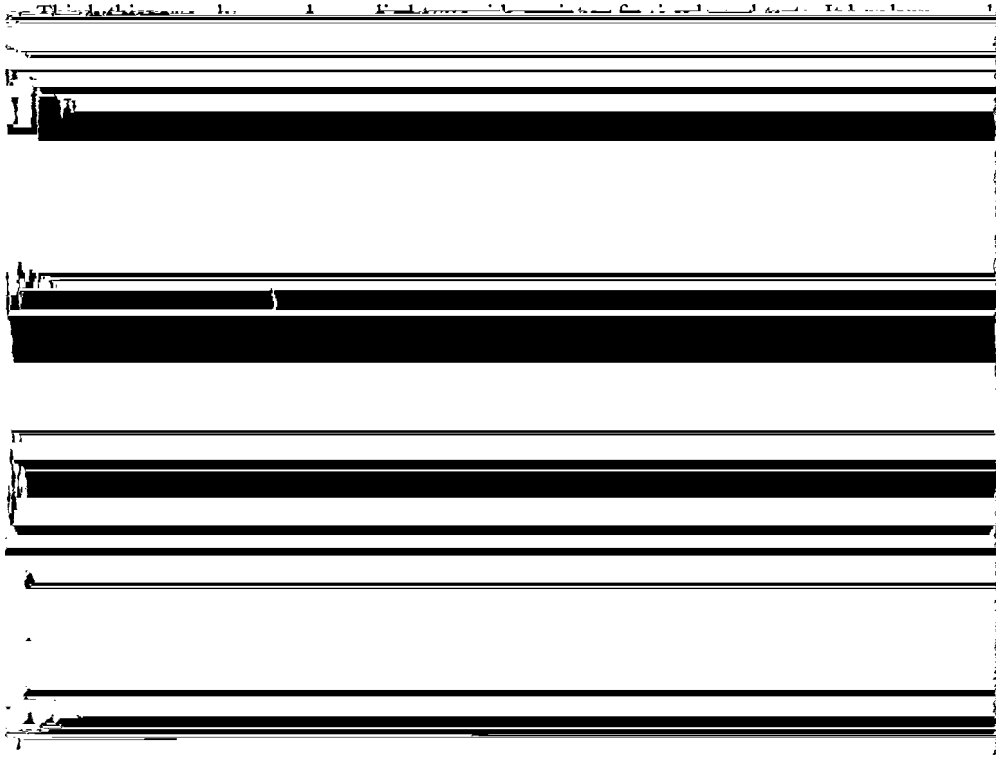
This formula gives the probability of observing a hit rate, X, equal to or greater than the observed hit rate, r, where N is the number of warning trials, p is the false alarm rate, and q is the *correct rejection* rate, i.e., 1-False Alarms. The result is the probability of obtaining a hit rate equal or greater than that observed, given the observed false alarm rate for that stimulus level.

3 Discussion

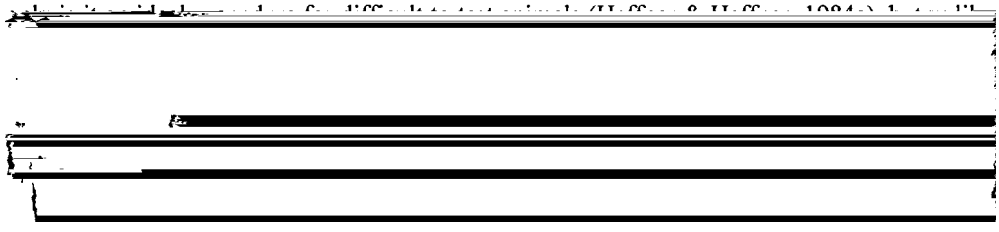
The following points can be made regarding the conditioned avoidance procedure. First, the basic training and conditioning can be accomplished in a relatively short time. Because licking is a natural response, mammals typically require no special training to maintain steady contact with the reward spout. Furthermore, once an animal is acclimated to the testing situation, it can



purely positive reward procedure (e.g., Heffner and Heffner, 1984a), but comparisons between data obtained by different laboratories show good agreement (cf., Heffner et al., 1994; Kelly and Masterton, 1977).



with over 30 species of mammals, as well as birds, to assess sensory, perceptual, and cognitive abilities in any test involving two choices (e.g., Heffner & Heffner, 1990b, Smith, 1970). Not



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