A TECHNIQUE FOR DELIVERING SHOCK TO PIGEONS[1]

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Since the pigeon has proven to be an excellent subject for positive-reinforcement studies, its use can be extended to studies involving aversive electrical stimulation. The pigeon presents a problem, however. Unlike the rat, it has no exposed fleshy surface on its feet to make adequate contact with an electrified grid. The scaly tissue presents a resistance of over 10 megohms, and necessitates the use of electrical stimulation of unusually high voltages and impractically long durations.

One solution has been to reduce the high resistance of the feet via graphite paste (Azrin, 1956; Ferster & Skinner, 1957), but large variability in resistance is still found to exist.

A satisfactory method of delivering shock to pigeons has been achieved by implanting two electrodes beneath the skin of the pigeon and connecting these electrodes to the source of stimulation via a loose-fitting harness-and-pulley arrangement. Such an arrangement has been used with twenty-five birds for several hundreds of hours with no apparent difficulties. Some of the advantages of using implanted electrodes over electrified grids include: (1) precise control of the amount and duration of electrical stimulation actually received by the animal; (2) elimination of incidental escape responses, such as jumping off the grid during shock presentation; (3) elimination of current variability caused by the degree of contact with the grid; (4) elimination of the need for a shock scrambler; and (5) elimination of shorting of the grid caused by feces.

Since the beak of the pigeon can reach almost any part of the body, the electrodes required firm implantation to prevent their removal. Best results were obtained when the electrode, consisting of a 2-inch length of 20-gauge gold wire, was looped around the pubis bone. (See Fig. 1.) The pubis bone can easily be seen as a narrow needle-like projection close to the skin surface in the lateral posterior part of the body (Levi, 1957). Implantation of the electrodes elsewhere beneath the skin frequently led to their loss after several weeks because of the outgrowth of feathers or because of a gradual tearing. Implantation in a muscle was sometimes secure, but often led to disturbances in movement and posture.

The electrodes are joined to a miniature AC plug fixed to the top of the harness. Stranded wire (about 26-gauge) served adequately in connecting a matching socket to the source of electrical stimulation and in withstanding the constant bending resulting from the subject's moving and turning within the experimental chamber. Minimal interference in movement results if the front of the jacket is not tied together.

The internal electrical resistance of the pigeon is in the order of 3000 ohms. Punishment effects were easily obtained by fairly low voltage AC (10 to 110 volts) at extremely short durations (0 02 to 0.10 second).

The above described arrangement has been found to produce very little interference with the subject's normal movements. Also, experimental performance seems only slightly affected following the addition of the harness and electrodes. Figure 2 shows the number of responses during consecutive daily sessions for one pigeon during exposure to an FR 25 schedule of food reinforcement. There is little or no change in the over-all rate of response

[1]This investigation was supported by a grant from the Psychiatric Training and Research Fund of the Illinois Department of Public Welfare.

[2]The assistance of R. Bittle and D. Sauerbrunn was invaluable in developing the present technique.

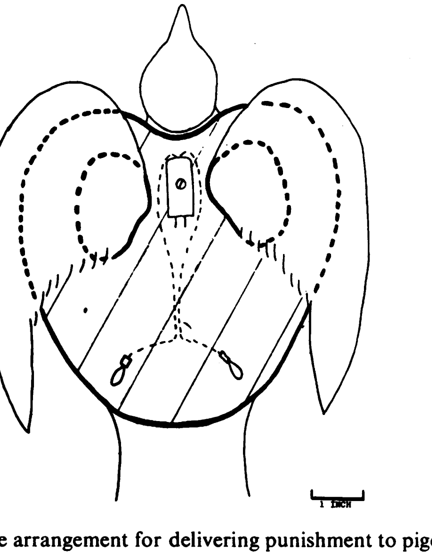

Figure 1. Harness and electrode arrangement for delivering punishment to pigeon via electric shock.

following the electrode implantation and harness fitting, as seen at the arrow in Fig. 2. When punishment was introduced in the form of a shock (110 volts AC and 0.05-second duration, through a 10,000-ohm resistance) following each response, the responding was reduced to zero. As lower shock intensities are used, more responding can be obtained than is seen in Fig. 2.

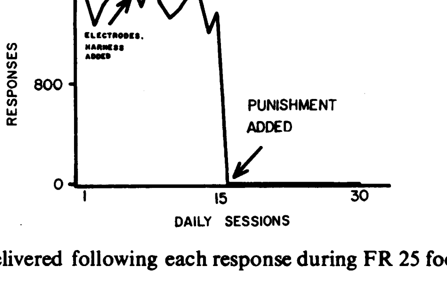

Figure 2. Effect of electric shock delivered following each response during FR 25 food reinforcement of one bird.

In addition to providing constant stimulation, the implanted electrodes serve the equally important function of eliminating undesirable and incidental escape behavior. The electrification of the bar or other manipulandum during punishment often produces a change in the response topography of the rat. Instead of depressing the bar with the paws, the rat often uses its teeth or some hairy nonconducting surface. The same difficulty exists, of course, in runway and maze experiments where one can readily observe that the electrified grid floor reinforces jumping, rapid running, and other incidental responses which minimize contact with the grid. This modification of response topography makes any statement about changes in response frequency difficult or impossible to interpret. Similarly, Dinsmoor (Dinsmoor & Campbell, 1956) has concluded that this type of uncontrolled reinforcement of incidental escape responses may account for large, and otherwise puzzling, changes in the behavior of rats. The shock delivered by the implanted electrodes is definitely unavoidable, except through contigencies explicitly arranged by the experimenter. Therefore, no unauthorized escape response can exist.

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Received June 5, 1959