*FIXED-RATIO ESCAPE PERFORMANCE WITH
A WHEEL-BAR¹*

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Behavior observed in an aversive conditioning situation sometimes fails to conform to the behavioral laws obtained in similar situations with positive reinforcement. Hendry and Hendry (1963), utilizing the standard telegraph key bar, report the inability to obtain stable performance in rats on low fixed ratio schedules, -FR 2, -FR 4, and -FR 8, of shock

escape. Only at -FR 2 were Ss able to perform consistently well. Pilot studies by the senior author utilizing low FR schedules with the conventional bar also met with frequent failure and unstable performance. Dinsmoor (1956) and Verhave (1959) have also encountered problems in avoidance situations using the conventional bar. Difficulties in obtaining reliable performance were felt to be due to problems inherent in the apparatus rather than limitations of the Ss to master such tasks. Subjects appeared to have great difficulty in

¹The authors wish to express their appreciation to Mr. James Ulmer who ran the subjects.

Fig. 1. Photograph of wheel-bar inside test chamber.

Fig. 2. Photograph of cam-operated points activated when wheel-bar is turned.

performing the response chain of alternately pressing and releasing the bar. The wheel-bar² shown in Fig. 1 and Fig. 2 overcame the previously encountered mechanical problems in FR shock escape problems.

The wheel-bar utilized was 2 in. in diameter, 2 in. wide, with evenly spaced rods across its width, 1 in. apart. Rotation of the bar through 30 degrees in either direction caused a set of automobile points mounted on the wall of the test chamber (Fig. 2) to be opened

²The authors are indebted to H. D. Kimmel, Univ. of Fla., for his suggestion that a wheel be used instead of a lever.

and closed. An arc of 30 degrees was chosen because of its approximation to the distance required for usual depressions of a bar. The tension on the spring holding the points closed was adjusted by means of a set screw. Thus, the S was prevented from spinning the wheel with only one push. Attachment of a ground wire to a terminal near the points enabled the experimenter to deliver shock through the wheel as well as the grid, if desired. The wheel was not energized during this study.

Four male albino rats, approximately 120 days old, served as Ss. The apparatus was a standard Foringer test chamber with the previously described wheel-bar modification. Shock was delivered through a 200 K ohm series resistor to the animal by means of a stainless steel grid floor.

Each S was given 22 trials daily (approximately 1 hr session) and trained on a CRF schedule. A tone came on 1 sec before the shock and was terminated with the shock whenever the wheel was rotated through a 30 degree turn. Responses occurring between the onset of the tone and the shock did not count as part of the required number of necessary responses. Another trial occurred after 2 min, 45 sec. After three days, all Ss were placed on -FR 2, three days later on -FR 4, and after four days on this schedule were placed on -FR 10.

Early in training Ss tended to continue turning the wheel after termination of the shock. This tendency decreased with further trials and there was very little responding during the inter-trial interval on the FR schedules later in training. Typical performance on each of the FR schedules is shown in Fig. 3. The results show that previous difficulties encountered in FR escape situations can be overcome using a manipulandum such as the one described.

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Fig. 3. Graph of typical performance on different schedules of fixed-ratio shock escape.