The effects of bar-holding training and rapid ratio shaping on fixed-ratio escape responding

RON NORTON AND MARVIN F. DALEY, DEPARTMENT OF PSYCHOLOGY, UTAH STATE UNIVERSITY, Logan, Utah 84321, AND PETER C. WOLFF, STATE UNIVERSITY COLLEGE, NEW YORK

Three guinea pigs and three rats were trained to escape scrambled electric foot shock on fixed ratio schedules. One pair was trained by a standard procedure, one pair was given bar holding training during the 30 sec time out from shock period and one pair was given bar holding training plus rapid increases in the fixed ratio requirements within a session. The bar holding training increased FR schedules from FR30 to FR45; the additional rapid training procedure increased FR schedules to over 200:1.

Fixed ratio (FR) schedules maintained by positive reinforcement typically report high response rates and the development of long response trains (Ferster & Skinner, 1957). These schedules have been difficult to generate with escape procedures using continuous aversive stimuli. Hendry & Hendry (1963) using rats with subcutaneously implanted, back electrodes reported fixed ratio 8:1. Kaplan (1965) reported fixed ratios of up to 20:1 using a wheel turning response. Winograd (1963) produced trains of 30:1 using a scrambled electrical floor grid. The present study attempts to generate high fixed ratio escape schedules using different training procedures.

The Ss used in this study were three sexually mature male guinea pigs and three Long Evans hooded rats. During each 1 h daily session, each S was placed in a Grason-Stadler operant conditioning chamber into which scrambled 1.0 mA ac electrical shock was programmed via a floor grid. Electrical shock terminated when the S depressed a Gerbrand's rat lever. Lever responses were tabulated on a Gerbrand's cumulative recorder.

Three different escape conditioning procedures were compared.

Standard fixed ratio escape training was attempted with one guinea pig and one rat. The Ss were initially trained to respond on a lever for FR 5:1 in order to obtain 30 sec time out from the 1.0 mA shock. Once a fixed ratio of 5:1 was achieved for three consecutive 1-h sessions, the Ss were required to make progressively more responses in order to escape the continuous shock. A session by session progressive increase of 7:1, 8:1, 10:1, 20:1 was continued until the escape behavior broke down and the response rate fell below one response for every 4 sec.

Another guinea pig and another rat were trained in an identical fashion with the additional variable of special bar training during the 30 sec time out from shock period. During training to the FR 5:1 these Ss received a brief 1 mA electrical shock each time they removed a forepaw from the bar.

Next, one guinea pig and one rat were trained as the bar training group with the additional variable of rapid within session increases of the FR requirement. Once FR 5:1 was established, the FR requirement was raised arithmetically three times per session. The first increase came after 20 min to avoid contamination with warm-up variables. The FR schedule used each day to begin a session was identical to the final FR schedule achieved the previous day.

Figures 1 and 2 illustrate the results of the different escape conditioning procedures for the two species. The data points for both figures were obtained by averaging the 2nd and 5th FR trial after each schedule increase. Results were similar for the two species. The procedure which trained the Ss to remain on the bar during time out from shock led to more escape responses. The behavior remained above a one response in 4 sec rate until an FR 45 schedule was attempted. This supports the findings of Campbell (1962) and Dinsmoor, Mutsuoka, & Winograd (1958) for the rat.

The rapid within-session training procedure also greatly enhanced fixed ratio escape behavior. Both species remained above the criterion rate until well over a 200:1 FR schedule. Attempts to

Fig. 1. Rat escape training performance in responses per second as a function of training procedure and fixed ratio requirement.

Fig. 2. Guinea pigs escape training performance in responses per second as a function of training procedure and fixed ratio requirement.

recondition these Ss after breakdown of FR behavior were successful. FRs of 200:1 were again achieved. However, analysis of the cumulative records indicated that the reconditioned FR behavior had more pauses and breaks than the originally shaped FR behavior. Our interpretation of the results would be that the rapid training procedure was successful because it did not allow much time for the development of incompatible behavior.

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