Effects of increasing punishment frequency on Sidman avoidance behavior[1]

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Marmoset monkeys, trained to bar press in a Sidman avoidance procedure were punished with decreased, response-contingent shock ratios. Initial increases in response frequencies were rapidly replaced by reduced rates. Avoidance percentages were not appreciably altered, even when every other response was punished. Eventually, an optimal balance was established between adequate avoidance responding and minimal exposure to the punishment contingencies.

Several studies have demonstrated that bar press avoidance behavior will increase under exposure to punishing contingencies (Appel, 1960a; Sandler et al, in press; Sidman, 1958; Sidman et al, 1957). The current study analyzes the effects of increasing punishment frequencies on Sidman avoidance behavior.

Method

Four naive male marmoset monkeys (*tamarinus nigricollis*) served as Ss. Although the exact age of the animals was not known, all four were sexually mature and laboratory adapted at the start of the experiment. The apparatus was an operant conditioning chamber enclosed in a light-proof, sound-attenuating compartment and containing a lever mounted on the front panel. The floor consisted of 12 stainless steel rods. Shock was delivered via a Foringer 1153 M1 shock generator and scrambler. The shock supply was modified to enable the immediate delivery of a shock produced by a response which could be calibrated to any value of the available shock voltage. A more detailed description of the apparatus has been described elsewhere (Sandler et al, in press).

Each S was trained in 1 hr. daily sessions to bar press to escape and avoid a shock of .33 sec. duration. The shock occurred every 10 sec. if no response was produced (S-S interval). Each bar press postponed the shock for 60 sec. (R-S interval). Shock intensities were increased until bar press rates stabilized for at least 20 sessions within a range of 4 to 6 responses per min., and avoidance performance was 90% or better. The final mean shock intensity required to achieve these effects was 1.20 ma (range = 1.14 to 1.26 ma). Two Ss (C 10 and C 11) were then shocked for making the bar press response. The punishment shock was 75% of the avoidance shock intensity (Mean = .83 ma) and of the same duration. Initially, the punishment was delivered on an FR 12 schedule. This was subsequently decreased to FR 6, FR 4, and FR 2. Each new condition was maintained until avoidance rates had stabilized at 90% or better efficiency, and total bar press rates revealed less than 5% variation for five consecutive sessions. The remaining two Ss (C 13 and 601) were avoidance trained without punishment for an equal number of sessions. During FR 2, C 11 became debilitated and was withdrawn from the experiment.

Results

Bar press rates for the first and last five sessions of the experimental conditions are presented in Fig. 1. The introduction of punishment (response shock) resulted in a marked increase in bar press activity for the two punished Ss. This rapidly declined and was replaced by a suppressed rate during the remainder of the experiment. Each subsequent increase in response shock frequency (decreased ratio) was also accompanied by an increase in bar press rate, although this effect diminished and was barely observed under FR 2 punishment. The two animals trained without punishment continued to function at about the same bar press rate throughout training.

These changes are graphically illustrated in Fig. 2. Cumulative records for three critical sessions for C 10 are depicted. Each small arrow represents the delivery of an unavoided shock, and each short oblique pip indicates the delivery of response shock punishment. In the last pre-punishment session, C 10 displayed effective avoidance performance, although the overall rate far exceeded the minimum necessary to maintain 100% shock avoidance. The top curve reveals the increased rate of bar press activity on the first punishment session. As a consequence of the high rate, only

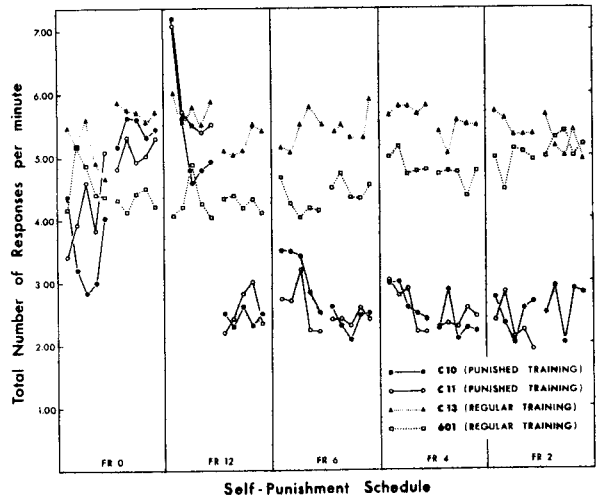

Fig. 1. Response rates for each S during the first five and last sessions of each condition.

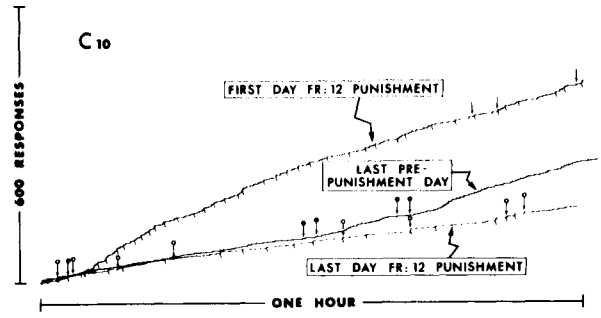

Fig. 2. Cumulative records for three critical sessions for C10. Each small arrow indicates the delivery of an unavoided shock. The short, oblique pip represents the occurrence of response shock.

three avoidance shocks were delivered, although S experienced a considerable number of response shocks. In the final session of FR 12 punishment (bottom curve) the bar press rate had decreased considerably, resulting in fewer response shocks, but high avoidance efficiency was still maintained. Similar effects were revealed in the records for C 11.

The increased activity which occurred during the first punishment session consisted of a burst of responses following response shock, often leading to an additional response shock, and another burst of responses. This is revealed in Fig. 3 which presents an enlarged portion of the record for the first punishment session for C 10. The second 10 min. of the session is depicted. Post-response shock bursting is evident following each short, oblique pip. This cyclical process was also observed in the record for C 11.

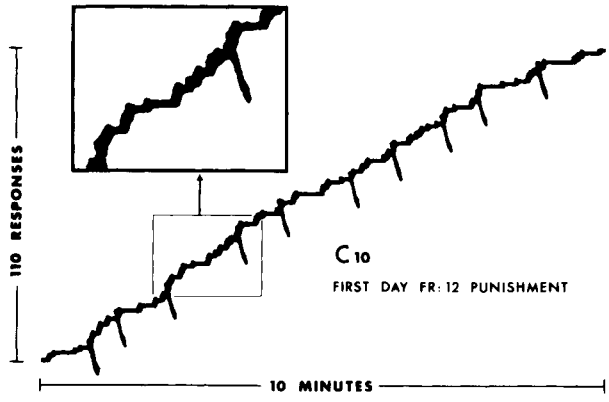

Fig. 3. Enlarged portion of the second 10 min. of the cumulative record for C 10 during the first day of FR 12 response shock. The insert encompasses approximately 2 min.

Discussion

Superimposing punishment in the form of response shock on avoidance behavior resulted in a temporary increase in bar press activity followed, shortly thereafter, by a stable reduced rate. These findings confirm those reported by Sidman et al (1957) in which response independent shocks were superimposed on an avoidance baseline while the avoidance contingency was maintained, and by Sidman (1958) in which the avoidance contingency was withdrawn. Appel also observed a temporary increase in bar press rates during extinction as a consequence of response independent shocks (1960a) and response contingent shocks (1960b). Sandler et al (in press) found that such increased bar press rates were related to response shock intensity, where the avoidance contingency was maintained in a signal avoidance situation. Increasing the frequency of punishment serves to reinstitute the effect, but to a diminishing degree.

In avoidance behavior, the organism's history usually includes a period of escape learning. This influence may be assumed to prevail even during avoidance training and is reinforced by occasional exposure to unavoided shocks. Superimposing punishment, therefore, may reinstate escape conditions and thus results in S's attempt to repeat the escape response. Rapid responding, however, brings the organism into contact with another shock, thus accounting for the bursting cycle. As training continues, in those procedures involving extinction, discriminative control is exercised and the animal ceases to respond. Where the avoidance contingency is maintained, the rate is reduced to the point where an optimal balance is established between an adequate avoidance level and minimum exposure to the punishment contingency.

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Note

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