EFFECT OF CER ON DRL RESPONDING

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The effect of CER on DRL 16 was studied in four rats. All Ss showed complete CER suppression after five CER trials, together with some unconditioned post-shock suppression. This post-shock suppression showed complete recovery in all Ss after 10 days of five CER trials per day, but complete CER suppression continued throughout.

Free shock reinforcements, and the CER to a stimulus paired with such shocks, suppress many varieties of ongoing positively reinforced operant behavior (Estes and Skinner, 1941; Brady, 1955). Such suppression depends on baseline reinforcement rate (Carlton and Didamo, 1960), and the rate and duration of shock and CER presentations (Stein, Sidman and Brady, 1958). When CER stimuli and shocks are superimposed on operant shock avoidance baselines, the opposite result is obtained. Responding is increased during the CER period, and after the CER shock, rather than being suppressed (Sidman, Herrnstein and Conrad, 1957).

The facilitating effect of the CER on Sidman avoidance responding may be due to the fact that this behavior is reinforced by shock avoidance. But it may also be due to other contingencies that such avoidance schedules imposed on operant response emission. To evaluate this latter possibility, the effect was studied of a CER procedure on positively reinforced operant behavior that was maintained by a DRL schedule of reinforcement. DRL schedules of reinforcement have several similarities to commonly used Sidman avoidance schedules: (1) both schedules involve fixed "timing" contingencies imposed on IRTs, (2) both avoidance and DRL schedules produce situations in which time-out presentations can function as reinforcers (Ferster, 1958; Sidman, 1962; Verhave, 1962), and (3) both DRL and Sidman schedule response rates can be increased by procedures that

decrease rates for most other schedules (Herrnstein and Morse, 1957; Sidman *et al.*, 1957).

METHOD

Subjects

Four male albino rats, weighing from 300-350 g, were obtained from Camm Research Institute, Wayne, New Jersey.

Apparatus

An LVE 1316 (Lehigh Valley Electronics, Fogelsville, Pa.) two-lever rat chamber, equipped with a dipper with a .1 cc cup, was used. Relay-operated programming equipment was housed in another room. A masking white noise was present in the room containing the chamber.

Procedure

Subjects were given daily access to water for 1 hr and *ad libitum* access to food. Experimental sessions were run daily, except weekends and holidays. On experimental days, water was made available immediately after the experimental session; it was given at approximately the same time of day on non-experimental days.

Subjects were given nine weeks of 1.5 hr acquisition sessions on DRL 16 sec after a single 1.5-hr session of magazine training and a single 1.5-hr session on CRF. The animals received occasional injections of drugs during some sessions preceding the last week of this acquisition period.

CER acquisition was begun during the 47th experimental session, at a time when daily performance of all Ss was reasonably stable. Five CER periods were presented daily begin-

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Fig. 1. Cumulative record segments showing pre-CER, CER, and post-CER period responding of four Ss during the first, sixth, and fifty-first presentations of CER stimuli.

ning at 19.5, 34.5, 49.5, 64.5 and 79.5 min after the session began. Auditory clicks, at 12 cps, were presented for 3 min and terminated with a 0.5 sec, inescapable shock.

RESULTS

All Ss quickly developed complete suppression of operant responding during the CER clicker period. The introduction of CER shocks, in Session 47, produced some depression of baseline rate. This depression, due to non-response periods of several minutes following shock, gradually recovered with continued CER training. Figure 1 shows cumulative records for each S for approximately the 15th-30th min of Sessions 47, 48, and 57. These records indicate that every S responded during the first presentation of the CER clicker, beginning 19.5 min after Session 47 began. After five reinforced CER presentations in Session 47, every S showed complete response suppression to the CER clicker during its first presentation in Session 48. Post-shock responding had recovered in all Ss before Session 57.

DISCUSSION

The effect of CERs on positively reinforced DRL responding is response suppression, the result usually observed with other schedules of positive reinforcement. CER facilitations of positively reinforced responding have been reported (Brimer and Kamin, 1963), but such exceptional results require shock-induced baseline rate depression prior to CER acqui-

sition. The results of the present study suggest that the facilitating effects of CER on Sidman avoidance responding are not due to the timing requirements such schedules impose on IRTs or to a low baseline rate. Timing requirements imposed on DRL Ss and their low baseline rates do not prevent response suppression by the CER.²

²A report by B. Migler and J. V. Brady (Timing behavior and conditioned fear. *J. exp. Anal. Behav.*, 1964, 7, 247-251.), which appeared after preparation of our paper, describes the effect of CER on a DRL terminal component of a two response chain. Our results are somewhat different from theirs, and from unpublished data of Finocchio's cited by them. A possible reason for the differences is that the other investigators employed a 5-min on, 5-min off stimulus presentation procedure that produced only partial suppression, as well as the use of a two-response chain by Migler and Brady. In general, however, the conclusions of all three studies are in substantial agreement that well established CERs suppress the initiation of DRL responding.

REFERENCES

- Brady, J. V. Extinction of a conditioned "fear" response as a function of reinforcement schedules for competing behavior. *J. Psychol.*, 1955, 40, 25-34.
- Brimer, C. J. and Kamin, L. J. Disinhibition, habituation, sensitization, and the conditioned emotional response. *J. comp. physiol. Psychol.*, 1963, 56, 508-516.
- Carlton, P. L. and Didamo, P. Some notes on the control of conditioned suppression. *J. exp. Anal. Behav.*, 1960, 3, 255-258.
- Estes, W. K. and Skinner, B. F. Some quantitative properties of anxiety. *J. exp. Psychol.*, 1941, 29, 390-400.
- Ferster, C. B. Control of behavior in chimpanzees

- and pigeons by time out from positive reinforcement. *Psychol. Monogr.*, 1958, 72, No. 461.
- Herrnstein, R. J. and Morse, W. H. The effects of response-independent positive reinforcement on maintained operant behavior. *J. comp. physiol. Psychol.*, 1957, 50, 461-467.
- Sidman, M. Time out from avoidance as a reinforcer: a study of response interaction. *J. exp. Anal. Behav.*, 1962, 5, 423-434.
- Sidman, M., Herrnstein, R. J., and Conrad, D. G. Maintenance of avoidance behavior by unavoidable shocks. *J. comp. physiol. Psychol.*, 1957, 50, 553-557.
- Stein, L., Sidman, M., and Brady, J. V. Some effects of two temporal variables on conditioned suppression. *J. exp. Anal. Behav.*, 1958, 1, 151-162.
- Verhave, T. The functional properties of a time out from an avoidance schedule. *J. exp. Anal. Behav.*, 1962, 5, 391-422.

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