transferring factors to which recipients may be subject, it is difficult to find a weighting of such factors which would result in the obtained ranking of performances among the groups.

Although the possibility of negatively and positively transferring factors is manifest in discrimination tasks, these factors, more subtly present, may account for some failures to demonstrate either transfer effect in other studies. As in the present study, combined negative and positive transfer may result in no overall differences between donors and recipients.

Evidence that any activation effect in this experiment was not of the simple motor sort, but perhaps of a general alerting nature, is found in the latencies, which actually increased in all recipient groups. Furthermore, the significant negative correlation of latency with errors illustrates the importance of multiple measures of the dependent variable and the limited comparability of studies using different measures.

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NOTE

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Time-out from a short mean-interval variable-interval reinforcement schedule¹

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Within the conditioned suppression paradigm, the lever-press behavior of rats was attenuated in the presence of a tone which preceded a 10-min time-out (lever retraction) from VI 30-sec reinforcement. The degree of response suppression controlled by the pre-time-out stimulus was only slight and did not occur for a second group when time-out was accompanied by a

decrease in ambient illumination.

Positively reinforced operant behavior will be attenuated by a signal which precedes electric shock. First demonstrated by Estes & Skinner (1941), conditioned suppression is often attributed to the incompatibility of "fear" respondents and on-going operant behavior. Time-out (TO) from positive reinforcement may, under certain conditions, have accelerative effects upon

behavior during a stimulus which precedes it (Leitenberg, 1966).

Although differences in methodology make comparisons and interpretations difficult to integrate at present (cf. Herrnstein, 1955; Leitenberg, 1966; Pliskoff, 1961), the view expressed by Herrnstein (1955) has established a basis for the prediction of various TO effects. In general, operant behavior will be accelerated during a stimulus which precedes TO from a schedule of infrequent reinforcement potential. Operant suppression usually occasions a stimulus which precedes TO from a schedule of frequent reinforcement. A notable exception was the recent report (Leitenberg, Bertsch, & Coughlin, 1968) of response suppression for rats during a stimulus signaling TO from a schedule of infrequent reinforcement potential (VI 7). The Leitenberg et al (1968) study employed the conditioned suppression paradigm and TO was retraction of the response lever from the experimental chamber. The present study employed the same TO technique within the conditioned suppression paradigm, but investigated the effect of TO upon performance during a stimulus which signaled the interruption of a frequent (VI 30-sec) reinforcement maintenance schedule.

METHOD

Six male hooded rats, 120 days of age, were reduced to and maintained at 85% ad lib body weight through the experiment. Individual experimental sessions were preceded by 18-23 h food deprivation. The experimental chamber was a Scientific Prototype rodent test cage equipped with a retractable response lever and enclosed in a sound attenuated box.

All Ss were shaped to lever-press under CRF and gradually shifted to a VI 30-sec reinforcement schedule for 1½-h daily sessions. Ss were then divided into two groups, A and B. On Day 3 of the VI 30-sec training, Ss of both groups were exposed to four 1-min presentations of a 1000-Hz tone, 32 dB above a 50-dB white noise background. Response rates during the tone pre-TO stimulus (P-TOS) and during the preceding 1-min interval, comparison interval (CI), were recorded. The VI 30-sec reinforcement schedule remained in effect during these and all CI and P-TOS periods. Following P-TOS adaptation, Ss of Group A were given the following training for 14 days. Fourteen minutes after S was placed in the experimental chamber the P-TOS was presented for 1 min and terminated coincident with the retraction of the lever from the experimental chamber for a 10-min period. During the 10-min TO ambient illumination was decreased from approximately 10 c/m² to virtual darkness (stimulus change, SC). The TO and SC terminated

Fig. 1. Block mean CI and P-TOS response rates.

with the return of the lever to the chamber and the reinstatement of previous illumination. This sequence was presented at 15-min intervals to each S of Group A four times during each daily session. Training for Group B Ss was identical to that of Group A except that no SC condition accompanied TO. For each 105-min daily session, TO periods reflect a potential reinforcement loss of approximately 40%.

RESULTS

Figure 1 depicts mean response rates for Group A and Group B Ss during CI and P-TOS periods. Figure 2 compares the P-TOS rate changes, relative to their respective CI rates, for Ss of both groups. The P-TOS rate changes are expressed as ratios derived by dividing block mean P-TOS response rates by the corresponding block mean CI rates. Ratios above and below 1.00 indicate P-TOS rate acceleration and depression, respectively. Data points preceding Block 1 result from the P-TOS adaptation session. Considerable ratio variation may be noted for Group A Ss across training block. The ratios for Group B Ss are considerably less variable and indicate initial

Fig. 2. Block mean P-TOS rate changes expressed as P-TOS/CI ratios.

P-TOS acceleration followed by rate depression. Analysis of variance (Edwards, 1963, p. 226) failed to reveal any overall TO effect for either Group A or Group B ($F = 1.40$, $df = 6/12$, and $F = 1.12$, $df = 6/12$, respectively; $p > .25$). An analysis for trend indicated no linear or quadratic effects for Group A ($F = .002$, $df = 1/12$, and $F = .04$, $df = 1/12$, respectively; $p > .25$). The linear effect for Group B Ss was reliable ($F = 8.60$, $df = 1/12$, $p < .025$), but no quadratic curvature was indicated ($F = .055$, $df = 1/12$, $p > .25$).

DISCUSSION

The behavior of Group B Ss suggests that under certain conditions TO from a schedule of frequent reinforcement may have behavioral effects, for the rat, similar to those of electric shock in the CER paradigm. This finding compliments previous reports of response acceleration during a signal which precedes TO from a schedule of infrequent reinforcement (Ferster, 1958; Herrnstein, 1955; Leitenberg, 1966) and parallels those reports of response suppression resulting from TO from a schedule of frequent reinforcement (Azrin, 1961; Ferster, 1957, 1960; Herrnstein, 1955).

The lack of a TO effect upon P-TOS rates for Group A Ss is of interest. Observation of the gross behavior of Group A and Group B Ss during the training sessions revealed marked similarities. All Ss grasped and bit the lever during its retraction from the experimental chamber. During the 10-min TO similar agitated behaviors were directed to the shutter which covered the retraction aperture. Upon termination of TO Ss would resume lever-pressing with increased vigor, but this activity was not quantified. The CI and P-TOS rates, ratios, and observed gross behavior of Group A Ss during lever retraction, TO, and lever reinsertion suggests that the P-TOS may have controlled a reduced rate of responding had TO not been accompanied by a decrease in illumination. Time-out for Group A Ss was confounded with a visual stimulus complex which had no reinforcement history. Thus, the suppressive effect of TO upon the P-TOS rate may have been masked by the absence of visual cues which surrounded the maintenance of the VI 30-sec behavior. An alternative explanation could be made in terms of the possible reinforcing properties of darkness for the rat. This effect also could mask the negative properties of TO. Previous research indirectly suggests, however, that illumination change should exert no control (Azrin, 1961) or facilitate P-TOS suppression (Appel, 1963; Zimmerman & Ferster, 1964) rather than cancel a possible TO effect. These considerations are, of course, relative

to the marginal significance of the suppressive trend for Group B Ss. Although the trend suggests a reliable P-TOS rate depression, the effect of TO is very slight and develops quite slowly.

The results of the present study suggest that a stimulus preceding TO from a schedule of frequent reinforcement may come to control a reduced rate of responding. Whether such reduced responding might reflect the conditioned aversive properties of the P-TOS (Herrnstein, 1955) or an "emotional" competing respondent (Pliskoff, 1961; Azrin & Hake, 1969) cannot be answered at present. Research currently in progress should clarify this possible TO effect as well as that of illumination change and lever retraction as TO within the conditioned suppression paradigm.

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NOTE

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