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Prefood stimulus effects on an operant discrimination

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The effects of superimposing a 60-sec prefood stimulus on a multiple variable-interval extinction schedule of reinforcement were examined with a rat. Response rates in both components increased during the stimulus. There was no evidence of an impairment in discrimination performance, as has been reported with a similar procedure involving a preshock stimulus instead of a prefood stimulus.

The change in the rate of positively reinforced operant responding during a superimposed stimulus preceding unavoidable shock was first described by Estes and Skinner (1941), and has since been the focus of many parametric investigations (see review by Henton & Iverson, 1978). The familiar terms *conditioned emotional response* and *negative conditioned suppression* identify this line of research. Nearly as old (see Estes, 1943) but less familiar is the term *positive conditioned suppression*, which is used to identify the change in responding during a stimulus preceding response-independent food (see review by Henton & Iverson, 1978). As the term *suppression* implies, the effect of the stimuli on responding is in both cases reductive, although numerous exceptions exist (e.g., Blackman, 1968; Kelly, 1973).

Studies of positive and negative conditioned suppression have historically paralleled each other, thus permitting parametric comparisons to be made between the two phenomena (e.g., Azrin & Hake, 1969). A comparison yet to be drawn is how a prefood stimulus affects a simple discriminated operant. As is typically the case, the literature on negative conditioned suppression provides the comparison studies. Hearst (1965) reported that when a 60-sec preshock stimulus was occasionally superimposed on the variable-interval (VI) component of a multiple (MULT) VI extinction (EXT) baseline schedule of responding, rates in the EXT component increased. This increase in unreinforced responding, together with the decrease in food-reinforced responding in the presence and absence of the preshock stimulus, had the net effect of disrupting control by the MULT schedule (i.e, a breakdown in discrimination resulted). Two subsequent experiments failed, however, to replicate Hearst's (1965) findings. In a series of three experiments, Weiss (1968) was unable to produce an increase in EXT responding as a consequence of superimposing a preshock stimulus on the VI portion of his MULT schedule. Weiss also failed to find evidence for deteriorated discrimination. Likewise, Blackman and Scruton (1973) reported no increase in EXT responding and no disruption of the discrimination on their MULT VI EXT schedule.

The studies by Weiss (1968) and by Blackman and Scruton (1973) may therefore be considered as failing to substantiate Hearst's (1965) claims that EXT responding would be disinhibited by a preshock stimulus occurring during VI periods, and that this same stimulus would disrupt established multiple schedule control. Unfortunately, the reasons for these potentially important inconsistencies between experiments are as yet unclarified.

The purpose of the present study was not to investigate these inconsistencies, but instead to address another question raised by them: namely, whether a prefood stimulus can induce the effect reported by Hearst (1965).

METHOD

Subject

One experimentally naive male albino rat (Simonsen Laboratories, Inc.), about 120 days old at the start of the experiment, was maintained at approximately 80% of its free-feeding weight throughout the experiment.

Apparatus

A Lehigh Valley two-lever (one lever removed) rat chamber contained within a ventilated, light- and sound-attenuating enclosure was used. A downward force of at least 10 g (.10 N) was required to operate the lever. Pellets of food weighing 45-mg (Bioserv, Inc.) were used as reinforcers.

A 10-W light, shielded by a yellow jewel and located midway between the food hopper and the chamber roof, illuminated the chamber throughout each experimental session. A 15-W unshielded light located above the lever on the outside of the translucent Plexiglas chamber roof enabled additional illumination of the entire chamber. An exhaust fan at the side of the chamber provided an ambient noise level of approximately 60 dB. A Foringer Model 1166-4 noise/click generator permitted delivery of auditory stimuli via a speaker located within the chamber enclosure. Conventional electromechanical equipment, located in an adjacent area, scheduled stimulus events and recorded responses.

Procedure

Following preliminary periods of food deprivation, magazine training, and shaping the leverpress, the rat was exposed to a continuous reinforcement schedule that, over the course of 30 consecutive daily sessions, was changed to a MULT VI 30-sec EXT schedule. A con-

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tinuous 70-dB tone served as the VI discriminative stimulus. In the absence of the tone, leverpressing had no programmed consequence (EXT). There were four VI periods and four EXT periods, each lasting for 7 min and sequenced in the following way: VI-EXT-VI-EXT-EXT-VI-VI-EXT.

After the MULT VI 30-sec EXT schedule had been operating for 24 sessions, the following procedures were introduced successively:

Adaptation. A 60-sec stimulus (total chamber illumination by the 15-W light) was introduced 3 min after the beginning of each VI and EXT component. This was continued for 18 consecutive daily sessions.

S^+ VI EXT. The same 60-sec stimulus continued to occur as described above, but now terminated with a single, response-independent 45-mg food pellet. This procedure continued for 30 consecutive daily sessions.

S^+ VI. The 60-sec prefood stimulus was removed from the extinction components and now occurred only during the VI components. This was continued for 12 consecutive daily sessions.

S^+ VI EXT. The 60-sec prefood stimulus was reinstated on the EXT component. This constituted a return to the previous S^+ VI EXT condition, and continued for 12 consecutive daily sessions.

S^+ EXT. The 60-sec prefood stimulus was removed from the VI components, and now occurred only during each EXT component. This was continued for 15 consecutive daily sessions.

S^+ VI EXT. The 60-sec prefood stimulus was reinstated on the VI component, thus constituting a second return to this condition. This continued for 12 consecutive daily sessions.

RESULTS

The data are presented in Figure 1. Response rates were determined daily by dividing the total number of responses emitted during VI and EXT periods, and, when appropriate, during adaptation and S^+ periods, by the total time spent in each period. The response rates from three consecutive sessions were then averaged to form a single point. Blocks of sessions correspond to treatment conditions which were changed when behavior appeared stable.

The first panel of Figure 1 shows that a discrimination was established between VI and EXT periods, with the latter occasioning far fewer responses than the former. The addition of the 60-sec stimulus alone during adaptation (the second panel) had little effect on responding in its presence, and appeared to have no effect on the discrimination between VI and EXT periods.

The third panel shows the effects of the prefood stimulus (stimulus plus food) on response rates during VI and EXT periods. Rates during the stimulus increased, relative to rates in the absence of the stimulus, for both VI and EXT components. The discrimination did not appear to be greatly affected.

The fourth panel shows that removing the prefood stimulus from EXT and presenting it during VI periods only had the effect of increasing VI response rates during the stimulus, relative to its absence. There was no increase in EXT responding, and again, the discrimination remained uninfluenced.

The fifth panel shows the effects of the prefood stimulus when it was again superimposed on both VI and EXT baselines. As before, the stimulus produced an increase in baseline response rates in its presence, and no effect on the discrimination was seen.

The sixth panel shows the effects of the prefood stimulus when it occurred during EXT periods only. Response rates during the stimulus increased, relative to the near-zero rates in the absence of the stimulus. Again, there was no effect on the discrimination.

The final panel shows the effects on response rates when the prefood stimulus was once again superimposed on both VI and EXT baselines. As in previous conditions, an increase in rates during the stimulus was observed, but relatively no change in the discrimination was evident.

DISCUSSION

Hearst (1965) reported that a preshock stimulus superimposed on the VI portion of a MULT VI EXT schedule increased EXT response rates. This effect, combined with a general decline in VI response rates

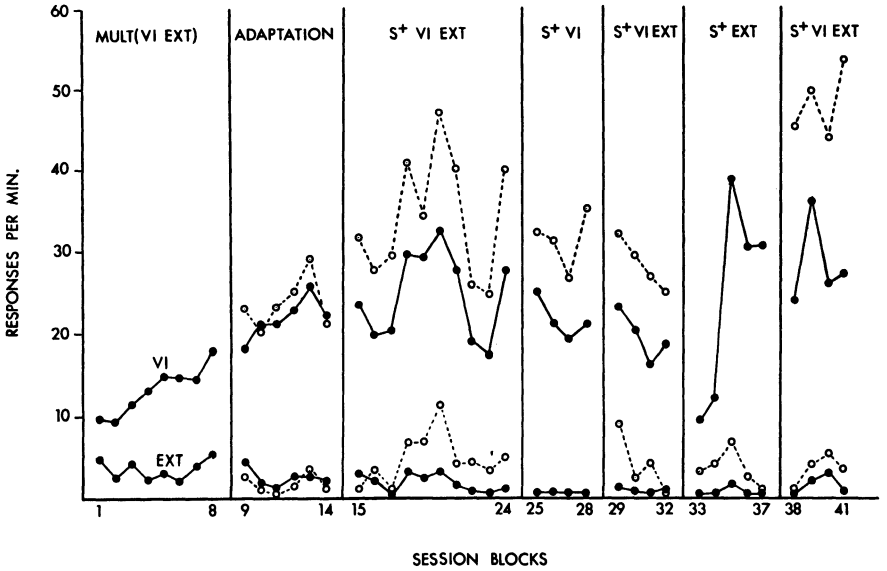

Figure 1. Response rates obtained during each experimental condition. Each data point represents the mean of three consecutive sessions. Filled, continuously connected data points represent responding in the absence of the prefood stimulus. Open, discontinuously connected data points represent responding in the presence of the prefood stimulus.

produced by the stimulus, served to disrupt the discrimination between periods of reinforcement and nonreinforcement.

The present experiment has shown that when a prefood stimulus is superimposed on one or both components of a MULT VI EXT schedule, the principal effect is response facilitation during components containing the stimulus. There was no disruption of the baselines in the absence of the stimulus (Panels 4 and 6), and there was no evidence of deteriorated discrimination throughout any condition.

The present data (given a single subject) lead to the conclusions that a prefood stimulus does not produce the effect on an operant discrimination, reported by Hearst (1965) with a preshock stimulus. Indeed, the effects noted by Hearst are themselves rather elusive, as shown by Weiss (1968) and by Blackman and Scruton (1973).

There is certainly no a priori reason to suppose that a prefood stimulus would affect responding in the same way that a preshock stimulus would. However, there are numerous studies that indicate that they can produce similar behavioral effects (e.g., Barrett, 1975).

The finding that VI response rates increased during the prefood stimulus is in accord with several other studies that have shown a similar facilitation of VI-maintained responding (e.g., Edgar, Hall, & Pearce, 1981; Meltzer & Hamm, 1978). As for the modest increase in EXT response rates during the prefood stimulus, Estes (1948) and Reid (1958) have shown clearly that such a stimulus, when present, does induce responding.

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