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FACILITATION AND SUPPRESSION OF HUMAN LOSS-AVOIDANCE BY SIGNALED, UNAVOIDABLE LOSS[1]

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A 15-sec stimulus followed by unavoidable monetary loss was presented to human subjects who were avoiding loss on a free-operant schedule. As has been observed in studies where shock is the aversive event, initial reactions to the pre-loss stimulus were transient increases in overall and stimulus rates. Unlike shock studies, continued training produced decreased rates, in the presence of the 15-sec stimulus, which were maintained in two of three subjects. Subsequent observations indicated that lowered rates were a function of the subject's rate of avoidance responding, the duration of the stimulus, and the scheduling of avoidable losses. Increasing the duration of the stimulus eliminated lowered rates in the presence of the stimulus and subsequent exposures to conditions which previously produced lowered rates did not result in recovery of the phenomenon. Introduction of the pre-loss stimulus on an extinction baseline (avoidable losses were omitted), however, reinstituted lowered rates. It is proposed that the pre-loss stimulus assumed discriminative control over low rates because responding in the presence of the stimulus was ineffective in avoiding the unavoidable loss. Recovery from lowered rates is attributed to the occurrence of avoidable losses during the stimulus period, and maintenance of lowered rates on the extinction schedule to the omission of such avoidable losses.

Free-operant avoidance behavior of human subjects can be effectively maintained by "loss" of or "timeout" from positive reinforcement. Stone (1961), for example, trained subjects to avoid the disappearance of pennies from a magazine displayed before them. If the subject did not respond, pennies disappeared at a fixed rate; each response postponed the next disappearance of a penny for a fixed time period. In a similar manner, Baron and Kaufman (1966) studied the aversive properties of timeout from monetary reinforcement using a schedule in which each response postponed termination of a payment signal. Other experiments have demonstrated the aversive properties of such events as loss of points (Weiner, 1963) and timeout from a cartoon movie for nursery school children (Baer, 1960).

These studies represent preliminary efforts to develop methodologies for studying free-operant avoidance behavior with humans rather than animals, and with loss or timeout, rather than electric shock, as the aversive event. For this reason, they provide relatively little systematic information about the variables controlling human avoidance of loss or timeout. A notable exception, however, is the finding that avoidance rates increase as an inverse function of the interval by which loss or timeout is postponed (Baron and Kaufman, 1966; Stone, 1961).

The present study was designed to identify other variables controlling loss-avoidance by human subjects. The procedures were suggested by studies in which animal subjects were trained to avoid shock, in particular, a study by Sidman, Herrnstein, and Conrad (1957). In that experiment, while monkeys were avoiding electric shock, a stimulus was concurrently presented and followed by unavoidable shock. Heightened rates of avoidance behavior resulted with the most marked increases occurring in the presence of the preshock stimulus. Similar findings also were observed by Waller and Waller (1963). The present experiment, with human subjects, used the parallel procedure of presenting a stimulus followed by unavoidable loss while subjects were avoiding loss. Subsequent phases of the experiment examined the effects of varying

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the duration of the pre-loss stimulus, and of omitting the programming of avoidable losses.

METHOD

Subjects

Three female college students were paid for a series of from five to ten 50-min sessions each week. Participation in the experiment was described as a work situation, payment to depend upon performance.

Apparatus

The apparatus, located in a small sound-attenuated room, has been described previously (Baron and Kaufman, 1966). In brief, the subject sat before a table to which was attached a sloping panel. Mounted on the panel were two ground-glass screens, which could be illuminated with colored lights from the rear. Situated between the two screens was a plastic push-button. Programming and recording equipment were located in an adjacent room.

Instructions

The subject was met initially by one of two female research assistants and given a typewritten information sheet to read. It provided the following information: (a) no information could be given about the nature or purpose of the research project; (b) average earning for each 50-min work session varied between $1.00 and $1.50; (c) the work would not be painful or embarrassing; (d) the work must not be discussed with others; (e) a record would be kept of the amount earned during each session, but payment would be made at the end of the experiment; (f) a fine of $1.00 would be imposed for each absence without prior notice and excuse; (g) all earnings would be forfeited if the subject did not continue until the end of the experiment.

The subject was then escorted to the experimental room, seated before the table and given the following additional typewritten instructions to read:[2]

The panel on the left signals how much money you are earning during each session. When the panel is illuminated with a GREEN LIGHT it means that you are earning money at the rate of $1.80 for a 50-minute session. Figured in smaller units that would be 18 cents every five minutes, or 3.6 cents every minute and so on.

Throughout the session I will keep an accurate record of how long the green light has been on. At the end of each session I will tell you to the nearest penny how much money you have earned depending upon how long the green light was on during the session.

The only time you can earn money is when the green light is on.

Sometimes, the green light will go off and the left-hand panel will light up with a RED LIGHT for about a second. You will not be earning money when the light on the panel is not green. But, in addition, the presentation of the red light is a signal that you have lost money. Each time the red light comes on it means that 5 cents will be deducted from however much you have earned.

For example, suppose that the red light comes on six times during a session. A total of 30 cents would be deducted from your earnings. When the red light comes on you will hear a low-intensity sound to make sure that you know when you are losing money.

There is something you can do to keep the red light from coming on. Notice the round, white, plastic button located below the glass panels. Each time you press the button and release it you keep the red light off for a period of 30 seconds; that is, if you press the button once, 30 seconds later the red light will go on. But if you make a second press before 30 seconds are up, you will keep the red light off for another 30 seconds, and so on. All you really have to do then to keep the red light from coming on is to press the button once every 30 seconds or so. That way you will keep postponing the occurrence of the red light. But if you wait too long, that is, if you should wait more than 30 seconds, then the red light will come on and you will lose money.

Later on the conditions may change. If the conditions change, do not think that the apparatus is broken or not functioning properly. If the apparatus does break,

[2]For the sake of brevity repetitive sections have been omitted.

I will come in and tell you that such is the case.

The panel to the right can also light up. When this panel is illuminated, it will be colored YELLOW. The yellow light will serve as a signal to you.

While you are in the room you can do whatever you like. But your pay will depend on what you do. If you should go to sleep, for example, your earnings for that session would amount to nothing. If you are interested in earning money, it is to your advantage to stay alert.

No further information was provided. Questions were responded to by asking the subject to reread the instructions, which remained in the experimental room throughout the experiment. The purpose of the instructions was to establish a stable avoidance response as rapidly as possible (*cf.* Baron and Kaufman, 1966).

Training

Initial training. A free-operant avoidance schedule was programmed in which the aversive event was a 1-sec red light presented on the left-hand panel, accompanied by a low-intensity white noise. As indicated by the instructions, each appearance of this stimulus signified the loss of five cents. Throughout the experiment, the loss stimulus appeared at intervals of 10 sec when the subject did not respond, *i.e.*, the loss-loss interval was 10 sec. Each response postponed the loss stimulus by 30 sec, *i.e.*, the response-loss interval was 30 sec. The left-hand panel was continuously illuminated with a green light except during the 1-sec loss period. As indicated by the instructions, the green light signaled continuous monetary payment at the rate of $1.80 per 50-min session.

Initial training continued until avoidance responding stabilized. The number of initial training sessions for the three subjects was, respectively, 12, 10, and 23, not including the first session which lasted for only 15 min.

Signaled, unavoidable loss on a loss-avoidance baseline. After avoidance responding had stabilized, signaled, unavoidable losses were programmed concurrently with the free-operant avoidance schedule described above. A yellow light was presented on the right-hand screen for 15 sec and terminated with the 1-sec loss stimulus. Fifteen such presentations occurred at irregular intervals during each session except during the first 4 min and the last minute of the 50-min session.

After 13 sessions with the 15-sec pre-loss stimulus, other durations of the stimulus were studied. As before, there were 15 stimulus presentations per session. For Subject 1, the durations investigated and their order were: 15 sec and 5 sec; for Subject 2: 15 sec, 45 sec, 15 sec, and 5 sec; for Subject 3: 15 sec, 45 sec, 90 sec, 15 sec, and 5 sec.

Training with each duration of the pre-loss stimulus was continued until reasonably stable performances were observed. At least two sessions without presentation of the pre-loss stimulus or unavoidable loss preceded the shift to each new interval. Table 1 summarizes the durations studied with each subject and the number of sessions conducted at each duration.

Table 1

Number of sessions under each experimental condition

Condition	Subject 1	Subject 2	Subject 3
Initial training	12 (a)	10 (a)	23 (a)
15 sec	13 (b)	13 (b)	13 (b)
45 sec	—	6 (c)	6 (c)
90 sec	—	—	5 (d)
15 sec	—	5 (d)	18 (e)
5 sec	14 (c)	13 (e)	8 (f)
Avoidance extinction	—	—	62 (g)
15 sec	—	—	7 (h)
90 sec	—	—	10 (i)
15 min	—	—	8 (j)

Note: Letters identify corresponding sessions in Fig. 1-6.

The subjects' first encounter with the yellow light stimulus was as a signal of unavoidable loss. This procedure was adopted because preliminary work with other subjects suggested that for some subjects, at least, superimposing a neutral stimulus on a loss-avoidance baseline may reduce subsequent differential reactions to that stimulus when it is used as a signal of unavoidable loss. However, a procedure which omits a pre-exposure series does raise the question of the extent to which any reactions to the pre-loss stimulus as a signal of loss may be reactions to the stimulus *per se*. The work referred to above provided justification for the

present procedure insofar as it strongly indicated that subjects do not react differentially to a 15-sec yellow light stimulus superimposed on an avoidance baseline. In this other work, six subjects were given at least 75 and as many as 315 yellow light presentations (15 per 50-min session) superimposed on a loss-avoidance baseline (loss-loss interval = 5 sec; response-loss interval = 5 sec). Reactions to the stimulus were assessed in terms of "suppression ratios" (Annau and Kamin, 1961) calculated according to the formula B/A + B with B representing average rates in the presence of the stimulus and A average rates in its absence. Since this index expresses the ratio of stimulus rates (B) to rates during the entire session (A + B), it varies from 0.50 toward limits of 1.00 and 0.00 depending upon the extent of rate increases or decreases in reaction to the stimulus. In the work referred to, all daily ratios of the six subjects during Sessions 1 to 5 fell within the range of 0.48 and 0.53 with 0.50 as the modal value. Over the total of 77 sessions conducted with these six subjects, 75 of the 77 daily ratios also fell within this range.

Signaled, unavoidable loss on an avoidance-extinction baseline. During this phase reactions of Subject 3 to the pre-loss stimulus were observed when avoidable losses were not programmed on the baseline schedule. For a total of sixty-two 50-min sessions, all avoidable losses were omitted (avoidance-extinction), as was the pre-loss stimulus and unavoidable losses. This procedure began immediately after the previous phase and the subject was not told of the change. When it appeared that no further changes in response rate would occur, the stimulus and unavoidable loss were presented again. As summarized in Table 1, pre-loss stimulus durations of 15 sec, 90 sec, and finally 15 min were superimposed on the avoidance-extinction baseline with 7, 10, and 8 sessions, respectively, at each stimulus duration. There were 15 trials per session with the 15- and 90-sec durations and two trials per session with the 15-min duration.

RESULTS

Figure 1 shows each of the subject's response rates in the presence and absence of the pre-loss stimulus during the various phases of the experiment. Figures 2, 3, and 4 present selected cumulative records. Letters on the figures and cumulative records correspond to the various phases of training for each subject as indicated in Table 1. While the stimulus was not actually presented during initial training (Fig. 1-4, section *a*), rates of response were recorded for 15-sec periods which corresponded to those portions of the session when signaled-unavoidable loss presentations subsequently were programmed.

By the end of initial training (Fig. 1-4, section *a*), response rates were fairly constant from session to session and regular within sessions. In addition, rates during those portions of the sessions when the stimulus later was to be presented were the same as rates during other portions of the session.

Introduction of the 15-sec pre-loss stimulus (Fig. 1-4, section *b*) was accompanied by temporary increases in response rates both in the presence and absence of the stimulus. These increases in overall response rates are seen in the cumulative records of all three subjects, although they were of considerably lesser magnitude in Subject 2 than in Subjects 1 and 3. In addition to increased overall rates during the initial sessions, Subjects 1 and 3 responded

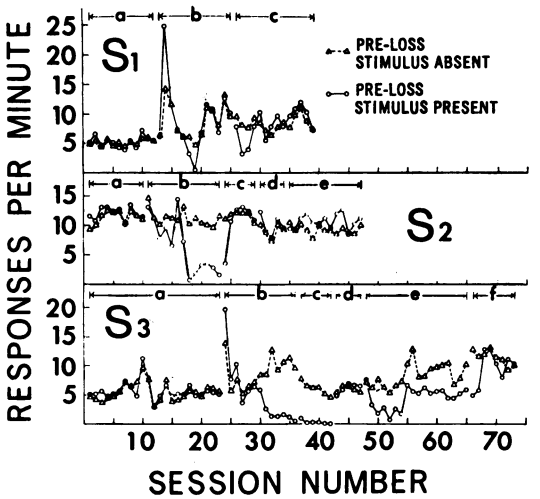

Fig. 1. Response rates per session in the presence and absence of pre-loss stimuli of various durations. For all subjects: (a) initial training, (b) training with the 15-sec stimulus. For Subject 1: (c) training with the 5-sec stimulus. For Subject 2: (c) training with the 45-sec stimulus, (d) the 15-sec stimulus, and (e) the 5-sec stimulus. For Subject 3: (c) training with the 45-sec stimulus, (d) the 90-sec stimulus, (e) the 15-sec stimulus, and (f) the 5-sec stimulus. During initial training, the stimulus was not actually presented, but rates were measured for those parts of the session when it was subsequently programmed.

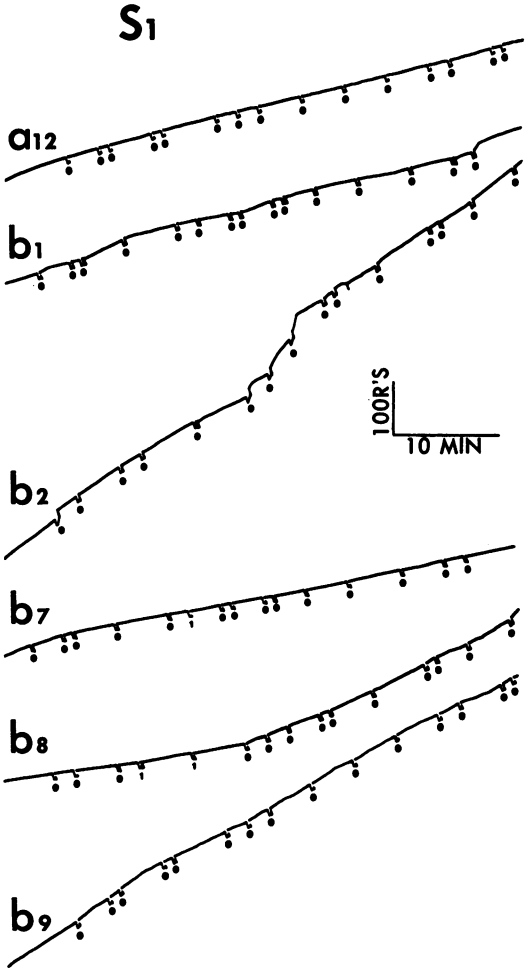

Fig. 2. Cumulative records of Subject 1: (a) during Session 12 of initial training, (b) during Sessions 1, 2, 7, 8, and 9 with the 15-sec pre-loss stimulus. The cumulative recorder pen deflected for the duration of the pre-loss stimulus, or, in initial training, during those portions of the session in which the pre-loss stimulus was later presented. Avoidable losses are marked by momentary deflections of the pen, except during the stimulus periods, where they are indicated numerically beneath the curves.

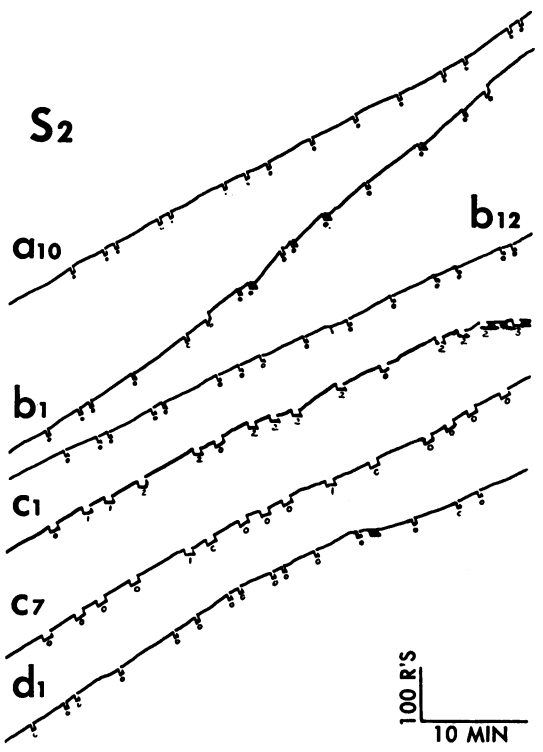

Fig. 3. Cumulative records of Subject 2: (a) during Session 10 of initial training, (b) during Sessions 1 and 12 with the 15-sec pre-loss stimulus, (c) during Sessions 1 and 7 with the 45-sec pre-loss stimulus, (d) during Session 1 of the second training series with the 15-sec pre-loss stimulus. The cumulative recorder pen deflected for the duration of the pre-loss stimulus, or, in initial training during those portions of the session in which the pre-loss stimulus was later presented. Avoidable losses are marked by momentary deflections of the pen, except during the stimulus periods where they are indicated numerically beneath the curves.

at higher rates when the stimulus was present than when it was absent. The figures make it apparent, however, that rate increases in the presence of the pre-loss stimulus were limited to the first three sessions and, as the cumulative records show, (Fig. 2-4, section *b*) did not appear consistently from trial to trial.

Continued exposure to the 15-sec pre-loss stimulus eventually produced marked reductions in response rates in its presence. As Fig. 1-4 (section *b*) show, this effect was considerably more pronounced in Subjects 2 and 3 than in Subject 1. In the cases of Subjects 2 and 3, lowered response rates in the presence of the stimulus appeared consistently from Session 8 on, and, as may be seen in Fig. 3 (b_{12}) and Fig. 4 (b_{13}), also appeared consistently from presentation to presentation within the sessions. Subject 1, by comparison, while showing lowered rates in the presence of the pre-loss stimulus during Sessions 6 and 7, did not maintain this pattern during subsequent sessions.

Despite the extremely low rates of response by Subjects 2 and 3 in the presence of the 15-sec stimulus, neither subject encountered any avoidable losses in the presence of the stimulus during the 13 sessions. With the 30-sec response-loss interval programmed on the base-

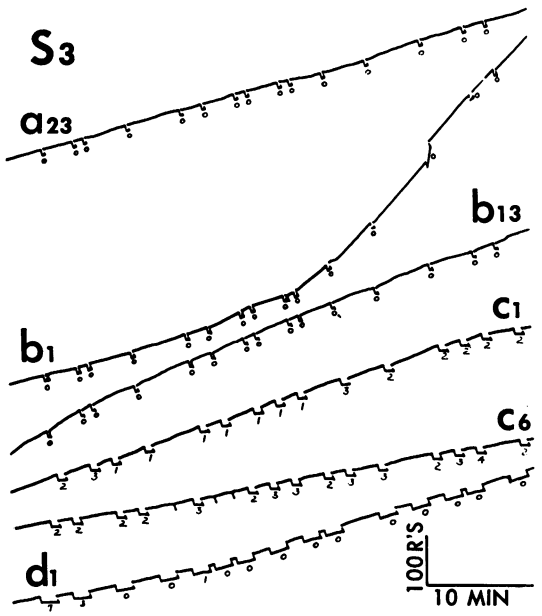

Fig. 4. Cumulative records of Subject 3: (a) during Session 23 of initial training, (b) during Sessions 1 and 13 with the 15-sec stimulus, (c) during Session 1 with the 90-sec stimulus. The cumulative recorder pen deflected for the duration of the pre-loss stimulus, or, in initial training, during those portions of the session in which the pre-loss stimulus was later presented. Avoidable losses are marked by momentary deflections of the pen, except during the stimulus periods where they are indicated numerically beneath the curves.

line avoidance schedule, their response rates were sufficiently high and regular so that the 15-sec stimulus period always occurred within the confines of a response-loss interval. By comparison, avoidance rates of Subject 1 were sufficiently low during Sessions 7 and 8 so that rate reductions in the presence of the pre-loss stimulus were accompanied by the appearance of avoidable losses; as a consequence, rate increased both in the presence and absence of the stimulus. The details of this change may be seen in the cumulative records of Subject 1 (Fig. 2, sections b_7, b_8, and b_9). During Session 7 of exposure to the 15-sec stimulus (b_7), the combination of a low baseline rate and infrequent responding when the stimulus was present resulted in an avoidable loss during the sixth stimulus presentation of the session. This was the first time that an avoidable loss occurred in the presence of the stimulus for Subject 1 and there was no immediate change in behavior. During the next session (b_8) avoidable losses again were encountered during the fourth and fifth stimulus presentations (an avoidable loss also occurred shortly after the fourth stimulus presentation), and a discernable increase in rates followed, both in the presence and absence of the stimulus. During Session 9 (b_9), and during subsequent sessions with the 15-sec stimulus, the rates of Subject 1 remained sufficiently elevated that all avoidable losses were avoided, and response rates in the presence and absence of the stimulus were approximately equal.

The remainder of Fig. 1-4 summarizes behavioral effects when the pre-loss stimulus duration was varied from its original duration of 15 sec. In the cases of Subjects 2 and 3, who had shown consistent rate reductions in reaction to the 15-sec duration, increases in the duration to 45 sec produced continued lowered rates by Subject 3 (Fig. 1 and 4, section *c*) but recovery of rates within two sessions by Subject 2 (Fig. 1 and 3, section *c*). Further extension of the stimulus duration from 45 to 90 sec for Subject 3 (Fig. 1 and 4, section *d*) rapidly eliminated differential responding to the stimulus.

Examination of the cumulative records of Subjects 2 and 3 suggests that, as had been the case with Subject 1, elimination of lowered rates in reaction to the pre-loss stimulus followed the occurrence of avoidable losses during the stimulus period. During the first session with the 45-sec stimulus duration, Subject 2 (Fig. 3, c_1) encountered avoidable losses on most of the trials but increased stimulus rates during subsequent sessions (Fig. 3, c_7) avoided most of these losses. By comparison, continued lowered rates by Subject 3 in reaction to the 45-sec stimulus resulted in as many as four avoidable losses during a given presentation of the stimulus (Fig. 4, c_1, c_6) and during most of these sessions, Subject 3 lost as much money as she earned. When the stimulus duration was extended further to 90 sec for Subject 3, seven avoidable losses were encountered during the very first stimulus presentation (Fig. 4, d_1); after three additional losses during the second 90-sec presentation, she began to respond during the stimulus period and did not show lowered rates of response to the 90-sec stimulus thereafter.

Efforts to recover lowered rates in reaction to the pre-loss stimulus by reducing the duration of the stimulus generally were unsuccessful. In the case of Subject 3, lowered rates occurred during re-exposure to the 15-sec du-

ration (Fig. 1, section *e*) and during initial exposure to a 5-sec stimulus (Fig. 1, section *f*). But reactions were of smaller magnitude than previously observed in this subject, and they eventually disappeared. In the cases of Subjects 1 and 2 there was little or no tendency for lowered stimulus rates when further series were run with 15 and 5 sec for Subject 2 (Fig. 1, sections *d* and *e*), and with 5 sec for Subject 1 (Fig. 1, section *c*).

Figures 5 and 6 summarize data obtained from Subject 3 during the series of avoidance-extinction sessions and when pre-loss stimulus presentations were superimposed on the avoidance-extinction baseline. When the 15-sec pre-loss stimulus was reintroduced on the avoidance-extinction baseline (Fig. 5 and 6, section *h*) reduced response rates to the stimulus reappeared, although the rate reductions were not of the same magnitude observed in initial reactions to the 15-sec stimulus. With extension of the stimulus duration, first to 90 sec (Fig. 5 and 6, section *i*) and then to 15 min (Fig. 5 and 6, section *j*), virtually all responding during the stimulus periods dropped out, although the baseline rates of response still were maintained.

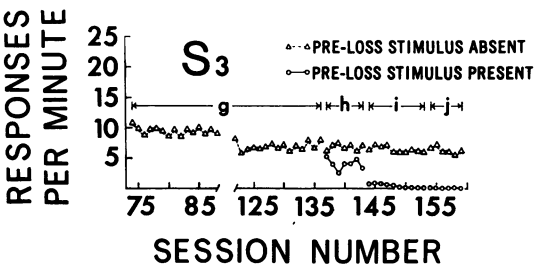

Fig. 5. Response rates per session by Subject 3: (g) extinction training, (h) training with the 15-sec stimulus on the extinction baseline, (i) the 90-sec stimulus on the extinction baseline, and (j) the 15-min stimulus on the extinction baseline.

With respect to the general effects of the avoidance-extinction procedure on response rates, it is apparent that this procedure decreased rates to some extent (Fig. 5 and 6, section *g*) but also that the avoidance response still had considerable strength after extended exposure to the schedule. The present study was not planned to investigate systematically the factors maintaining avoidance behavior when avoidable losses were no longer programmed. However, one potential factor is indicated in the cumulative record obtained on

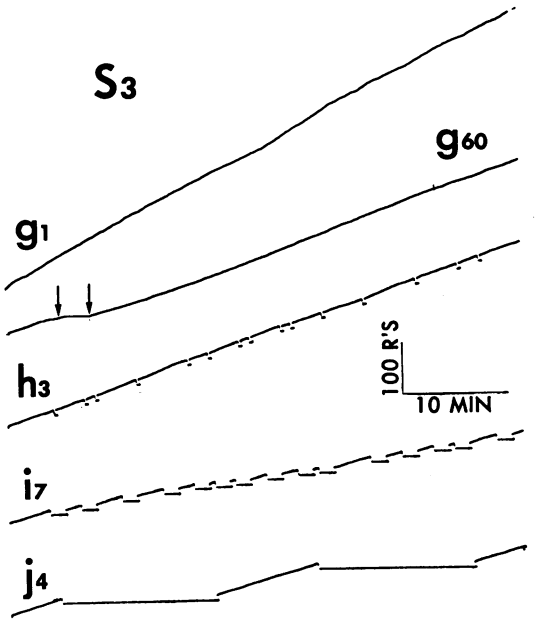

Fig. 6. Cumulative records of Subject 3: (g) during Sessions 1 and 60 of extinction training, (h) during Session 3 with the 15-sec stimulus, (i) during Session 7 with the 90-sec stimulus, (j) during Session 4 with the 15-min stimulus. In record g_{60} the green payment light was turned off during the period marked by the arrows.

the 60th day of avoidance-extinction training (Fig. 6, g_{60}); during the period defined by the arrows, the green payment signal from which losses were deducted was turned off. It is apparent that avoidance responding ceased as a consequence.

DISCUSSION

The present results are similar to those of the Sidman *et al.* study (1957, phase I) in which signaled shocks were superimposed on a shock-avoidance baseline. In both studies, response facilitation was the initial reaction to the stimulus, but this reaction diminished with continued training. A further finding unique to the present study was that continued training produced decreased rates in the presence of a signal of unavoidable loss.

Sidman's (1966) analysis of the influence of unavoidable shocks on avoidance behavior suggests a basis for the differential reactions to pre-loss signals observed in the present study. According to Sidman, unavoidable shocks initially may increase response rates by creating shortened response-shock intervals, and by serving as discriminative stimuli for

the avoidance response. But, "when the animal does learn that the shocks are, in fact, unavoidable, the shocks take on the opposite function; they then indicate to the animal that the situation is one in which avoidance is impossible" (Sidman, 1966, p. 492). Sidman's analysis suggests the following account of the present results: initially, programming of unavoidable losses produced unscheduled response-loss intervals shorter than those originally maintaining loss-avoidance behavior. As a consequence, rates adjusted upwards. But this facilitative effect was not maintained because there was not a contingent relationship between responding and programming of unavoidable losses. With continued training, the pre-loss stimulus, a stimulus in whose presence unavoidable losses repeatedly occurred, came to define for the subject a period when avoidance was impossible, and, on this basis the stimulus assumed control over non-responding. Avoidance responding was maintained in the absence of the stimulus, however, since in the absence of the stimulus all losses still were avoidable.

It follows from this interpretation that establishment and maintenance of lowered rates in the presence of a pre-loss stimulus depends in large measure upon the frequency of avoidable losses occurring during the stimulus period. Any avoidable losses occurring because of lowered rates obviously weaken the control of the pre-loss stimulus as a signal that avoidance is impossible. The findings of the present study bear out this interpretation. Whether decreased responding initially developed as a stable reaction to the 15-sec stimulus depended on whether avoidance rates just before the stimulus were high enough to avoid all avoidable losses in its presence. To be emphasized in this regard is that the response-loss interval (30 sec) was longer than the pre-loss stimulus duration (15 sec), thus permitting lowered rates without concomitant increases in numbers of avoidable losses. That lowered rates were not maintained when the stimulus duration was extended to exceed the response-loss interval also may be attributed to the occurrence of avoidable losses in the presence of the stimulus. Low rates in the presence of stimuli of 45- and 90-sec durations were accompanied by the loss stimulus upon completion of the 30-sec response-loss interval, and, in addition, by subsequent losses at the rate of once every 10 sec (the loss-loss interval) until a response occurred. Sidman *et al.* (1957, phase I) also did not observe lowered rates in the presence of a pre-shock stimulus when the stimulus interval of 5 min considerably exceeded the response-shock interval of 20 sec. Elimination of lowered rates by increases in the duration of a pre-loss stimulus also resembles the finding that suppression of positively reinforced behavior is reduced by increases in the duration of a pre-shock stimulus (Stein, Sidman, and Brady, 1958). Stein *et al.* concluded that suppressive reactions on a positively reinforced baseline are maintained only to the extent that they do not markedly reduce opportunities for positive reinforcement. The present results suggest the parallel conclusion that reductions in response rates on a loss-avoidance baseline are maintained only to the extent that they do not markedly increase occurrences of the aversive event.

The avoidance-extinction phase of the experiment provided further evidence about the relationship between lowered stimulus rates and avoidable losses. When the pre-loss stimulus was reintroduced on the extinction baseline, the lowered rates which initially occurred on the avoidance baseline, but which subsequently recovered with increased stimulus durations, reappeared. Moreover, lowered rates were maintained on the extinction baseline when stimulus durations were as long as 15 min. Unlike the loss-avoidance baseline, the extinction baseline excluded the occurrence of avoidable losses when rates were lowered in the presence of the stimulus; thus, lowered rates were possible without incurring additional losses. The fact that avoidable losses could not occur outside the stimulus periods also may have contributed to the re-establishment and maintenance of lowered rates. In previous phases of the experiment when the avoidance schedule was in effect, lowered stimulus rates, once eliminated, could not be recovered, regardless of the duration of the pre-loss stimulus.

The results of the avoidance-extinction phases may be compared to a second part of the Sidman *et al.* experiment (1957, phase II) in which signaled shock was superimposed on an extinction baseline, and where increases, rather than decreases, in responding resulted. This difference in outcome may be attributed to the following differences in the experimen-

tal histories of the subjects of the two studies. In the present experiment, despite extended exposure to the avoidance-extinction baseline, the avoidance response possessed substantial strength when stimulus presentations were resumed. Since responding in the presence of the stimulus continued to be ineffective in avoiding unavoidable losses, the conditions were appropriate for resumption of control over non-responding by the stimulus. By comparison, in the Sidman *et al.* experiment, the response was substantially weakened by the extinction procedure when stimulus presentations were resumed. Since the subjects had not yet discriminated that the unavoidable shock was, in fact, unavoidable, the conditions were appropriate for control of increased rates by the stimulus in conjunction with the spurious response-shock intervals created by the unavoidable shocks. A further observation by Sidman *et al.* was that increased rates diminished with continued training. This finding suggests the eventual development of the discrimination presumed to be at the basis of lowered stimulus rates in the present study.

The relatively small influence in the present study of the avoidance-extinction procedure is not easily explained and is limited to observations with a single subject. However, this finding, when viewed together with the other results, suggests the hypothesis that human loss-avoidance behavior may be more readily weakened by making previously avoidable losses unavoidable than by no longer programming avoidable losses.

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