ELIMINATION OF BEHAVIOR OF MENTAL PATIENTS BY RESPONSE-PRODUCED EXTINCTION[1]

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Mental hospital patients were conditioned to respond at a high rate. Then an attempt was made to eliminate the response by means of a mild punishment consisting of a period of time-out from reinforcement (response-produced extinction). When only one response was available for obtaining the reinforcement, the mild punishment was not effective in eliminating that response. When an alternative response was also made available for obtaining the reinforcement, the mild punishment was completely effective. It appears that even very mild punishment may be effective if the over-all frequency of reinforcement can be maintained by means of an alternative unpunished response.

When reinforcement is discontinued, responses typically decrease during the ensuing extinction period. If a stimulus has been selectively associated with the extinction period, then responding decreases when this stimulus occurs. Such extinction periods, which are associated with a distinctive stimulus, have been designated as time-out periods. Ordinarily, the introduction of time-out periods leads to an increase in responding in the absence of the time-out stimulus (Ferster and Skinner, 1957, Reynolds, 1961). If the time-out periods result as a consequence of responses, however, then a reduction of responses results in the absence of the time-out stimulus (Herrnstein, 1955, Ferster, 1958). This latter procedure may be designated as punishment by time-out.

The present experiment attempts to ascertain the extent to which time-out periods can be used as a punishment to eliminate human behavior. The experimental investigation of time-out as punishment has special relevance for the practical control of human behavior since time-out periods, such as social rejection, physical isolation, job dismissal, etc., are among the most widely available techniques of social control.

METHOD

Subjects

Four, male, mental hospital patients were used. All of the subjects had psychiatric classification of psychosis (three were diagnosed as schizophrenic reactions, the other, S #24 as undifferentiated psychosis with mental deficiency). The subjects had some obvious peculiar mannerisms, but in no case was their behavioral disruption severe. All of the subjects were under phenothiazine medication throughout the experiment which may have mitigated the gross display of behavioral disturbance.

The subjects were selected from the chronic hospital population; they received no visitors and were not engaged in psychotherapy. Besides residence on a chronic ward, the other criteria for selection of the subjects were that they be ambulatory, that the hospital records give no indication of a recognized organic disorder, and that cigarette reinforcers maintain a sufficiently high rate of response so that a reduction could be clearly determined. The subjects' age and duration of hospitalization at the beginning of the experiment is given in Table 1.

Apparatus

(a) *Experimental Room.* The experimental sessions were conducted in a sound-attenuating room 7 × 10 ft. The room contained a wall-mounted, electrically-operated vending apparatus, a chair, cigarette lighter, and an

Table 1
Characteristics of the Experimental Subjects

Subject Designation	Age	Duration of Hospitalization	Duration of Preliminary Procedure	Reinforcement Schedule
#24	23	3 yr	43 sessions	1.5 min VI
#22	38	13 yr	45 sessions	1.5 min VI
#42	19	1 yr	15 sessions	.5 min VI
#20	41	19 yr	32 sessions	.5 min VI

ash tray. The vending apparatus appeared to be self-contained, but was connected by a cable in the wall to electrical control apparatus in another room. Stimulus lights on the vending apparatus were illuminated for the duration of the experimental session.

(b) *Manipulanda.* The vending apparatus included a response manipulandum of the type designed by Lindsley (1956). This manipulandum consisted of a brass knob which could be pulled a distance of 1 cm by a force of 1 kg. When the knob was pulled a distance of 3 mm, a switch was closed and a response was recorded. A second response manipulandum was a push-button switch located to one side of the knob. Activation of the switch required that it be depressed by one of the fingers through a distance of 5 mm by a force of 400 g. The knob will be referred to as R-1, the push-button as R-2. Each response produced a brief buzz, thereby providing feed-back.

(c) *Control Apparatus.* Control apparatus, located in another room, automatically recorded all activations of the response switches and programmed all of the stimuli. When the cigarette dispensing mechanism was operated, a cigarette dropped through a chute within a fraction of a second. A buzzer and a light in the chute were activated immediately by this response and served to bridge the slight delay in the cigarette dispensing mechanism.

Procedure

(a) *General Procedure.* The patients were studied according to the general method developed by Lindsley (1956). Restrictions were placed upon the interaction between the subjects of the experiment and the investigator in order to minimize the possibility of inadvertant biasing of the results by the investigator. The subjects were escorted to and from the experimental sessions by one of the laboratory personnel; the investigator never

encountered the subjects personally. The laboratory personnel were not informed of the purpose of the experiment. Minimal conversation occurred between the subjects and the personnel, and information about the experiment was given to the subjects only in the form of standard instructions which were memorized and recited verbatim.

A subject was brought to the room and seated before the apparatus. The attendant then demonstrated the operation of the manipulandum. It was found that this demonstration eliminated a major portion of the variability of performance that otherwise resulted. The attendant told the subject to await his return, and left the room. The door to the room was closed securely, but never locked. If a subject prematurely left the experimental room, the attendant escorted him to a waiting room where he remained for 1 hr before being returned to his ward (ordinarily the subjects were returned immediately after a session). Premature termination of a session by the subject also caused forfeiture of a fixed number of cigarettes that were ordinarily given immediately following the sessions. These procedures were initiated because it had been found that subjects frequently walked out of experimental sessions, especially when they were obtaining few reinforcements as during extinction. These procedures were apparently successful; by the time the experiment proper began, all subjects remained in the room for the entire session.

During the initial sessions every response produced a cigarette. The session was terminated by the delivery of the 20th cigarette or 30 min, whichever occurred first. Previous experience (Hutchinson and Azrin, 1961) had shown that in some cases initial conditioning required several sessions. Hence, the present procedure provided continuous reinforcement for the first few days after which a fixed-ratio schedule of reinforcement was provided

until the subjects responded consistently at a high rate. After performance was stable on an FR 10 schedule, a variable interval reinforcement schedule was introduced. At first, a 7.5 sec VI was used but the average duration between reinforcements was increased gradually. The final VI schedule, which was used throughout the remainder of the experiment, was a .5 min VI for two subjects and 1.5 min VI for the other two.

It has been observed before, by us and by other investigators (Lindsley, 1960), that in some instances a subject will continue to respond even though no cigarette reinforcement resulted (nor any other apparent consequence). Such responding, which is not under the control of an identifiable reinforcer, would be unsuitable for the present experiment. A punishment by time-out from positive reinforcement implies that the reinforcing stimulus can be controlled and manipulated. In order to assess the effectiveness of the cigarettes as reinforcers, periods of extinction were introduced into the experimental sessions. Distinctive stimuli accompanied the periods of extinction so that they could be distinguished from periods of reinforcement (multiple VI, extinction). The lights on the vending apparatus were turned off and the response buzz was omitted during the extinction period. When reinforcement could occur, the lights on the vending machine were turned on, and every response produced the distinctive response buzz.

The extinction periods were ordinarily 2 min in duration but were extended 30 sec by every response during the extinction period. Under these conditions, responding dropped to a near zero rate during the extinction periods, but remained high during the reinforcement periods. For all subjects, responses during the extinction period were virtually eliminated within 10 sessions. Table 1 shows the total time each subject spent on the preliminary procedures.

(b) *Experimental Procedure.* After the preliminary procedures had been completed, the experiment proper began. One manipulandum (R-1) was available to the subject. (The second manipulandum, R-2, was present but immovable.) Responses on R-1 were reinforced according to the VI schedule (see Table 1) for at least 10 sessions. The equipment was then arranged so that every

10th response on that manipulandum produced a 30-sec time-out from positive reinforcement. The time-out consisted of the extinction periods which had been established during the preliminary procedure. At least 10 sessions and usually more were allowed on this procedure, and then the time-out contingency was removed. Responding on the VI schedule alone was observed for an additional three to 10 sessions.

Next, the second manipulandum was made available (unlocked) and the following instructions were given before each session: "You can either push the button or pull the knob or both." From four to 10 sessions were provided in which the reinforcement resulted for either response (the same VI schedule remained in effect). The response manipulandum on which the subject had the highest response rate was determined. In all cases R-1 was the preferred response. The equipment was then arranged so that every 10th response on R-1 produced a 30-sec period of time-out for both responses. After six to 15 sessions of this procedure, the time-out contingency was changed to the other manipulandum. Under this procedure, one of the response classes was punished with a time-out, but the other was not punished. One subject did not emit even one response on the alternative manipulandum. In the absence of these alternative responses, of course, no effect could be expected of having this alternative manipulandum available. Hence, it was necessary to instruct this subject on one day that "You don't have to keep pushing or pulling the same one all of the time."

RESULTS

Table 2 shows the response rate for each subject before and during the punishment procedure. The response rates were higher than the rates typically obtained during variable interval reinforcement with patients as subjects (Lindsley, 1960). These higher rates of response may have been due to the earlier exposure to fixed-ratio reinforcement. Prior to punishment, the rate varied from about 108 to 230 responses per min for different patients. When no alternative response was available, the addition of punishment produced little or no suppression for two of the patients. For the other two, re-

sponses were reduced to about 20% and 10% respectively of the original rate. It may be noted that greater response reduction was obtained with the two patients who had a higher frequency of reinforcement (see Table 1).

Table 2

Response Suppression During Punishment by Time-Out from Positive Reinforcement: (1) When only one reinforced response is available, and (2) when an alternative unpunished response is available. Computation of response rates excluded the time-out periods.

	Before Punishment (Resp/Min)		During Punishment (Resp/Min)			
			No Alternative Response		Alternative Response	
	Mean	Avg. Dev.	Mean	Avg. Dev.	Mean	Avg. Dev.
S#24	113	± 8	125	± 23	0.2	± .1
S#22	134	± 14	149	± 27	0.0	± 0
S#42	230	± 30	51	± 21	0.3	± .1
S#20	108	± 5	10	± 3	0.0	± 0

When the alternative response (R-2) was available, the punished responses were reduced to a near zero level for all patients. Almost all of the responses now were emitted on the alternative manipulandum. The rate of response on this alternative manipulandum was about the same (± 10%) as had been obtained on the original manipulandum prior to punishment.

The punishment procedure altered the number of reinforcements as well as the number of responses. When no alternative response was available, punishment reduced the number of reinforcements that were delivered. For two of the patients (S-22 and S-24) the reduction of reinforcements was about 90%. For the other two patients the reduction of reinforcements was about 20%. When the responses shifted to the alternative response, this reduction of reinforcement was eliminated.

Segments from the cumulative response records of one subject illustrate the major changes in responding from the addition of the punishment procedure (Fig. 1). The performance shown in this figure is from the final stage of each of the designated procedures. It can be seen that the responses

occurred at a high and uniform rate prior to punishment. When punishment was delivered for every 10th response, the rate was reduced for this subject but the responses were still fairly uniformly distributed. This same uniform rate characterized the performance of all subjects before, as well as during, the punishment procedure. When the alternative response was available, the punished responses were eliminated for the duration of the session.

When no alternative response was available, punishment did not produce an immediate effect. Two of the subjects failed to show any suppression during the 10 to 12 day period of punishment. The other two subjects showed no suppression for the first two to three days following the introduction of punishment. A progressive reduction of responses resulted after the third day until the rate was reduced to the low rates seen in Table 1. When an alternative response was available, the introduction of punishment produced an immediate reduction of punished responses. For three of the subjects, this reduction occurred within 5 min after the first reinforcement on the unpunished manipulandum. Punishment, also, produced a complete reduction of responses for the fourth subject once the subject had been encouraged to make responses on both manipulanda (see procedure section).

DISCUSSION

When an undesired response is to be eliminated, physical punishment has been found to provide an extremely effective method of achieving this elimination (Holz and Azrin, in press). In the practical control of human behavior, physically injurious events are often prohibited. One frequent alternative is to use a mildly aversive event such as a period of time-out from positive reinforcement. Yet, the very mildness of this form of punishment rendered it ineffective as a means of totally eliminating responses in this study. Herrnstein (1955) and Ferster (1958) also have found that punishment by time-out does not completely eliminate the punished responses. It was noted in this study that the two patients who showed suppression by time-out were the same two patients who had the higher rate of reinforcement. Al-
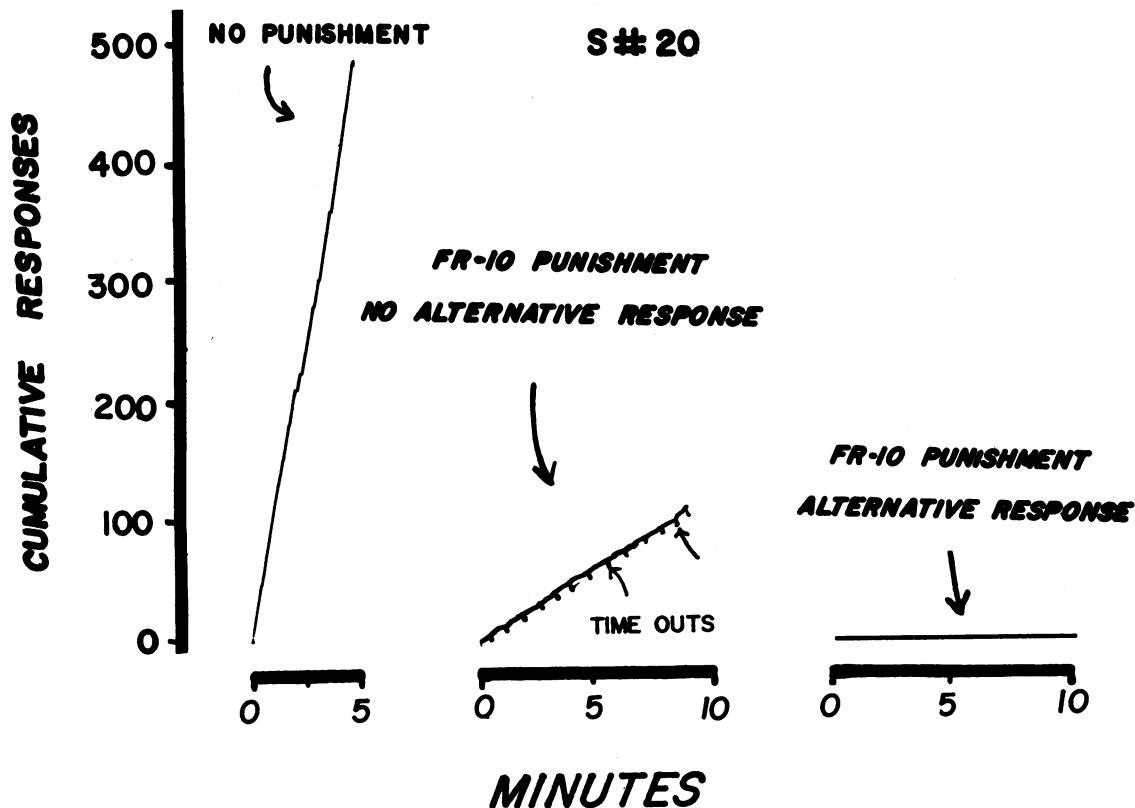
Fig. 1. Comparison of the effectiveness of time-out from reinforcement as punishment with and without the availability of an alternative response for securing reinforcement. Left curve shows responding maintained by a .5 min VI schedule of cigarette reinforcement (reinforcements not indicated). Center curve shows the moderate level of responses which ultimately resulted when 30-sec time-outs were scheduled as punishment for every 10th response. The same VI reinforcement schedule remained in effect. Right curve shows the absence of punished responses during the same time-out punishment schedule when an unpunished alternative response was made available.

though the small number of subjects in this study make intersubject comparisons tenuous, these results are in agreement with Herrnstein's findings that a period of time-out becomes more effective when the reinforcement frequency is greatest.

When the patients were provided with an alternative means of obtaining reinforcement, this same mild punishment produced a complete reduction of the punished responses. It would appear that punishment may be generally less effective when the punished response constitutes the sole means of producing a reinforcement. Undesired behavior would seem to be eliminated most quickly by teaching the organism an alternative unpunished response in addition to punishing the undesired response. As noted in a previous study (Holz and Azrin, in press), punishment appears to have its greatest effect on responses that were least necessary for reinforcement.

In the single response situation, the period of time-out appeared to differ from other types of punishment such as electric shock or intense noise. A distinctive difference was the gradualness with which time-out produced suppression in contrast with the immediate suppression produced by even mild intensities of shock (Azrin, 1959) and noise (Holz and Azrin, in press).

In a previous study, (Azrin, Holz, and Hake, in press) electric shock was delivered for every nth response. This fixed-ratio schedule of shock punishment is analogous to the present use of a fixed-ratio (10) schedule of time-out punishment. In both studies a uniform response rate was maintained between successive punishment deliveries irrespective

of the degree of suppression. Thus, time-out seems to differ from shock or noise in terms of its initial effect as a punisher but appears similar in terms of the uniformity of response rate between punishments.

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