Self-punitive behavior in the rat: A free-operant demonstration¹

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In an attempt to generalize alleyway findings to another stimulus situation, this experiment was designed to produce self-punitive behavior in an operant conditioning chamber using procedures which were, as nearly as possible, analogous to the alleyway problem. Rats were trained to press a lever on a fixed ratio (FR) schedule to terminate foot shock. After the pressing response had been conditioned to FR 12, Ss were randomly divided into experimental and control groups and an extinction test was given. Control Ss received no shock during extinction trials; experimental Ss received no shock unless they pressed the bar four times, at which time shock came on and continued until S pressed eight more times. Two measures, total number of responses during extinction, and total latencies for the first four responses, reflected the facilitative effect of punishment on responding. It was concluded that self-punitive behavior can be produced in the rat using a lever-pressing procedure.

Self-punitive behavior was first observed by Mowrer (1950), who proposed the term "vicious circle phenomenon" in reference to the self-perpetuating effects of conditioned fear. Since that time a number of other investigators have observed the facilitative effects of punishment on running responses in an alley under certain conditions (Beecroft & Brown, 1967; Beecroft, Bouska, & Fisher, 1967; Brown, Anderson, & Weiss, 1965; Brown, Martin, & Morrow, 1964; Gwinn, 1949; Martin & Moon, 1968; Whiteis, 1956; and others). Brown (1964) has defended the application of the terms "self-punitive" or "masochistic-like" to describe this behavior, arguing that the noxious or rewarding qualities of a stimulus must be defined in terms of an organism's response to that stimulus. Hence, approach behavior indicates pleasure, and avoidance indicates pain. Masochism, or self-punitive behavior, then, must be defined in terms of two independent events, one in which the stimulus is rejected, and another in which the same stimulus is accepted or tolerated.

In the animal studies cited above, self-punitive behavior was defined by S's continuing to perform a response which produced a normally aversive stimulus. Some investigators, however, have failed to produce the self-punitive effect (Seward & Raskin, 1960; Seligman & Campbell, 1967). If the phenomenon cannot be demonstrated in a number of situations other than those reported by Brown and his associates, one might question its generality for explaining analogous human behavior.

The purpose of this experiment was to demonstrate that the self-punitive phenomenon could be extended to stimulus complexes other than the straight alley. Brown et al's (1964) procedure was partially replicated in an operant conditioning chamber using procedures which were, as nearly as possible, analogous to the alleyway problem.

METHOD

Twelve naive male Long-Evans rats weighing 211-300 g were used. Ss were housed individually and maintained on 14-16 g of food per day with free access to water.

Subjects were trained and tested in a Gerbrands Model C rat chamber housed inside a modified trailer refrigerator shell. A Lehigh Valley retractable lever was mounted in one wall of the rat chamber. Scrambled electric shock was delivered to the grid floor of the chamber from an adjustable transformer

generating 0-800 V of 60 Hz ac through a 330,000-ohm resistor wired in series with S. Trial onset was signalled by the output of a Grason-Stadler Model 901b white noise generator set at -7 dB and wired to a 3.2-ohm speaker mounted on the wall of the refrigerator shell.

Subjects were handled and weighed daily for 1 month, and then trained to press the lever to escape from foot shock. Throughout the training period each S received 15 trials per day, separated by intertrial intervals of 30 sec during which the lever was retracted. Lever pressing was shaped to a fixed ratio (FR) schedule in which S was required to press a fixed number of times to terminate the foot shock. The ratio was gradually increased from FR 1 to FR 12, and shock intensity was gradually raised from .50 mA to .85 mA to offset adaptation effects (cf. Brown et al, 1964). A trial was signalled by the onset of white noise, followed 8 sec later by the simultaneous onset of shock and insertion of the lever into the chamber. The white noise and shock continued until S pressed the lever the required number of times, whereupon white noise and shock terminated, the lever was retracted, and the intertrial interval began.

Subjects were shaped to the FR 12 schedule during Days 1-13 and stabilized on FR 12 during Days 14-20. On Day 21, following Brown et al's (1964) suggestion that the transition from acquisition to extinction should be gradual, the shock intensity was reduced by one-half during the first four responses of the FR 12 sequence. On Day 21 the 12 Ss were randomly divided into a no-shock control and an experimental group and tested. All Ss were given five trials of escape responding on the FR 12 as on Day 20, followed by 10 extinction trials, during which shock was not presented at any time for the control Ss, and only for the last eight responses of the FR 12 sequence for the experimental Ss. In other words, the experimental group received no shock unless they pressed four times. If an experimental S did press into shock it remained on until S completed the FR 12 and terminated the trial. If any S remained in the presence of the lever for 120 sec without completing the FR 12, the lever automatically retracted and the intertrial interval began. The total number of responses during the extinction trials, and the total latency for the first four responses of the FR 12, were recorded.

RESULTS

One experimental S exhibited self-punitive behavior throughout all the extinction trials by pressing into shock and then completing the FR 12. All of the other experimental Ss exhibited the same behavior during the first two or three trials. Only one of the control Ss completed the FR 12 on the first extinction trial, and all had completely extinguished by the second trial. The experimental group made a significantly greater total number of responses during the extinction trials (Mann-Whitney $U = 2.0$, $p < .008$).

Table 1
Total Number of Responses and Total Latency Scores to Extinction

Subject	1	2	3	4	5	6
Responses						
Controls	13	4	4	16	6	0
Experimentals	24	53	24	120	12	24
Latencies (sec)						
Controls	1024	1122	1200	1095	1200	1200
Experimentals	1006	922	1082	294	1094	1100

The self-punitive effect was also demonstrated by the significantly shorter total latency score for the experimental group (Mann-Whitney $U = 4.0$, $p < .013$). The results are summarized in Table 1.

DISCUSSION

The data indicate that the self-punitive phenomenon can be obtained in a free operant situation. The significantly shorter latencies for experimental Ss to complete the initial four presses, as well as the significantly larger number of responses by the experimental Ss, reflected the facilitating effect of shock upon the lever-pressing response.

It should be noted, however, that the effect obtained in this study is largely the result of the performance of one or two Ss, as all of the experimental Ss did not show a clear self-punitive effect. The reason for this appears to be that fear interfered with, rather than facilitated, responding in some Ss. It was expected that the complex CS consisting of white-noise onset, the noises associated with the extension of the lever, and the extension of the lever itself would serve to arouse fear which would motivate lever pressing. This fear, then, would have been analogous to that supposedly aroused in the start box in alley experiments (cf. Brown et al. 1964; Melvin & Stenmark, 1968). Direct observation of Ss suggested that this process was indeed occurring, but in the lever-pressing situation the fear apparently produced responses which competed with, rather than motivated, lever pressing. During training, Ss commonly retreated from the lever area when the white noise came on, and then ran rapidly to the lever and pressed it, often by attacking and biting it rather than pressing with their paws, as soon as the shock came on. During extinction trials, Ss would show the same pattern of behavior, except that when the lever extended they would approach it briefly, then withdraw, then approach, then withdraw, etc., in a classical approach-avoidance conflict pattern, without ever actually touching or pressing the lever. Subsequent research with Ss who were given the opportunity to avoid shock by making the bar active as soon as it started out (i.e., pressing the bar counted down the ratio), but delaying shock onset either until the bar was fully extended or until 5 sec after the bar started out, indicated that shock onset, rather than CS onset, was the discriminative stimulus controlling responding. One of these Ss was given extensive training on such a schedule, after first being shaped on an escape schedule similar to that used in this experiment, and never once pressed before shock onset, even though given several thousand trials. This S also showed no evidence of self-punitive behavior when tested on the punishment-extinction procedure. Although exact measurements were not taken of just when the experimental Ss began pressing in the experiment reported above, the procedure was set up so that Ss could only escape, and could not avoid, and thus the presence of shock could easily have become the most important stimulus controlling responding. Hence, during extinction trials, the absence of shock would be a more potent stimulus than the presence of the fear-arousing stimuli. These

difficulties are identical to those reported by other investigators utilizing lever-pressing avoidance or escape situations (cf. Hoffman, 1966; Meyer, Cho, & Weseman, 1960).

In conclusion, it would appear that although the conditions inherent in the lever-press-escape situation are not fully compatible with the development of the self-punitive phenomenon, self-punitive behavior, as defined by Mowrer (1950) and Brown (1964), can be produced using a lever-press response in an operant conditioning chamber. Further research is necessary, however, to establish the contingencies which will produce the effect more reliably and consistently in this situation.

REFERENCES

- BEECROFT, R. S., & BROWN, J. S. Punishment following escape and avoidance training. *Psychonomic Science*, 1967, 8, 349-350.
- BEECROFT, R. S., BOUSKA, S. A., & FISHER, B. G. Punishment intensity and self-punitive behavior. *Psychonomic Science*, 1967, 8, 351-352.
- BROWN, J. S. A behavioral analysis of masochism. *Journal of Experimental Research in Personality*, 1964, 1, 65-70.
- BROWN, J. S., ANDERSON, D. C., & WEISS, C. G. Self-punitive behavior under conditions of massed practice. *Journal of Comparative & Physiological Psychology*, 1965, 60, 451-453.
- BROWN, J. S., MARTIN, R. C., & MORROW, M. W. Self-punitive behavior in the rat: Facilitative effects of punishment on resistance to extinction. *Journal of Comparative & Physiological Psychology*, 1964, 57, 127-133.
- GWINN, G. T. The effects of punishment on acts motivated by fear. *Journal of Experimental Psychology*, 1949, 39, 260-269.
- HOFFMAN, H. S. The analysis of discriminated avoidance. In W. K. Honig (Ed.), *Operant behavior: Areas of research and application*. New York: Appleton-Century-Crofts, 1966. Pp. 499-530.
- MARTIN, R. C., & MOON, T. L. Self-punitive behavior and periodic punishment. *Psychonomic Science*, 1968, 10, 245-246.
- MELVIN, K. B., & STENMARK, D. E. Facilitative effects of punishment or establishment of a fear motivated response. *Journal of Comparative & Physiological Psychology*, 1968, 63, 517-519.
- MEYER, D. R., CHO, C., & WESEMAN, A. F. On problems of discriminated lever-press avoidance responses. *Psychological Review*, 1960, 67, 224-228.
- MOWRER, O. H. *Learning theory and personality dynamics*. New York: Ronald Press, 1950.
- SELIGMAN, M. E. P., & CAMPBELL, B. A. Effect of intensity and duration of punishment on extinction of an avoidance response. *Journal of Comparative & Physiological Psychology*, 1965, 58, 295-297.
- SEWARD, J. P., & RASKIN, D. C. The role of fear in aversive behavior. *Journal of Comparative & Physiological Psychology*, 1960, 53, 328-335.

NOTES

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