Sensory preconditioning of a conditioned emotional response[1]

STANLEY R. PARKINSON, *DEPARTMENT OF PSYCHOLOGY, UNIVERSITY OF CALIFORNIA, DAVIS, Davis, California*

Twenty male rats were trained to bar-press for food reinforcement. One group (N = 10) received paired presentations of white noise and light (sensory preconditioning), while the other (N = 10) received only noise presentations. A conditioned emotional response was established to the light in both groups. Finally, generalization tests of this response were conducted. Only the group that received sensory preconditioning exhibited transfer of the conditioned emotional response.

The sensory preconditioning (SPC) paradigm consists of three phases: (a) repeated, contiguous, unreinforced presentations of two stimuli, (b) establishing a response to one of the stimuli, and (c) testing for transfer of the response to the other stimulus.

The response in phase two of the SPC paradigm has typically been shock avoidance. The conditioned emotional response (CER) of Estes & Skinner (1941) might be a propitious behavior pattern for the measurement of SPC. The parameters of the CER have been relatively well documented (Kamin, 1965), and the phenomenon has appeared in all species tested, and is stable over time (Brady, 1960). More importantly, the CER allows bi-directional measurement (suppression or enhancement) of a response pattern already established in the behavior repertoire of the animal.

Method. The Ss were 20 naive male Sprague-Dawley rats, 90-100 days old, obtained from the Berkeley Pacific Laboratory.

The experiment was conducted in four Gebrands operant conditioning boxes enclosed in sound reduction chambers. SPC and CER stimuli were provided by miniature lamps and 12 in. speakers.

The Ss were shaped on a bar pressing response and then placed on a 45 sec VI schedule for daily 1 h sessions. After a 45 sec VI performance was established, Ss were given 14 days of additional VI training to stabilize their response rates. SPC occurred in the operant conditioning boxes with the addition of three gray plywood panels. The panels were placed so that they blocked the bar and food cup, thus preventing bar pressing during this period. The bar pressing response was blocked in order to eliminate the possibility of reinforced bar presses in the presence of the test stimulus, and to change the stimulus complex presented to the Ss, thus increasing the probability of their "attending" to the SPC stimuli (Seidel, 1959). The Ss were randomly assigned to one of two treatment groups for SPC training: Experimental (E) and Noise-Only Control (C). During the SPC exposure Group E received 200 presentations of a 6 sec white noise overlapped in the final 2 sec by a 2 sec light. Group C received 200 presentations of a 6 sec white noise. For both groups white noise was set at 70 dB (re .0002 dynes/cm^2).

Testing for unconditioned effects of the CS was accomplished by presenting two pulsating light stimuli (2 sec on; 1 sec off) of 4-min duration during a 1 h session. Responses were recorded during each CS presentation (CS) and during the 4 min period immediately preceding the CS period (Pre CS). Response suppression was measured by the following formula: Suppression Ratio = No. responses in Pre CS/No. responses in Pre CS + No. responses in CS. A suppression ratio of 1.00 indicated complete response suppression. A ratio of .50 indicated no suppression and values less than .50 indicated enhancement. No reliable suppression was found during the CS (mean suppression ratio = .51); thus, this criterion of the CER paradigm (Kamin, 1965) and of the SPC paradigm (Brogden, 1939) was met.

CER training was superimposed on the regular operant conditioning sessions. Four min pulsating light stimuli (2 sec on; 1 sec off) were presented twice during the daily 1 h sessions. A 1-mA shock was administered for 0.5 sec during the final 0.5 sec portion of each light stimulus. CER training was continued until Ss reached a suppression criterion of .80 or greater for two successive presentations in one day.

SPC testing was started on the day following attainment of the CER criterion. These tests were conducted during the regular operant conditioning sessions by presenting two white noise stimuli with no shock. These extinction trials to white noise were conducted for four days (eight presentations total per animal).

Results. The results of an analysis of variance on the suppression ratios between Groups E and C for SPC Test 1 indicated that the groups were significantly different ($F = 5.90$, $df = 1/18$, $p \cong .025$). No significant differences were found between the two groups during SPC Test 2 or for any of the remaining six SPC Tests. Comparison of the response rates during the Pre CS and CS periods of SPC Test 1 indicated that seven of the Ss in the experimental group suppressed responding during the CS, two increased their response rates, and one responded an equal number of times in both periods. The mean number of responses for experimental Ss during the Pre CS (37.9) and CS (25.7) periods of SPC Test 1 were significantly different at the .05 level ($t = 2.21$, $df = 9$). During SPC Test 1, on the other hand, eight control Ss increased their response rates, one suppressed, and one remained the same. The mean number of responses for control Ss during the Pre CS (30.1) and CS (49.8) periods of SPC Test 1 were not significantly different ($t = 1.69$, $df = 9$, $p = .10$).

Discussion. The response suppression found in the experimental group during SPC Test 1 was indicative of SPC. In accord with previous investigations the magnitude of SPC was weak and transient, however, the phenomenon as found in this experimental paradigm appeared to be more consistent between Ss than has typically been exhibited when shock avoidance methods have been used as the measuring instrument.

The performance of Ss in the control group might be explained by the disinhibition phenomenon reported by Brimer & Kamin (1963). They found that Ss which had previously been exposed to shock with no CS present responded with an increased rate or "supernormal ratios" during the first CS presentation. Although their results were obtained when a novel stimulus was used as the CS, there is a possibility that the same effect would be found with a neutral stimulus which had previously been presented to the Ss.

REFERENCES

BRIMER, C. J., & KAMIN, L. J. Disinhibition, habituation, sensitization, and the conditioned emotional response. *J. comp. physiol. Psychol.*, 1963, 56, 508-516.

BRADY, J. V. Emotional behavior. In J. Field (Ed.), *Handbook of physiology*. Vol. III. Washington, D. C.: *Amer. Physiol. Soc.*, 1960, 1529-1552.

BROGDEN, W. J. Sensory preconditioning. *J. exp. Psychol.*, 1939, 25, 323-332.

ESTES, W. K., & SKINNER, B. F. Some quantitative properties of anxiety. *J. exp. Psychol.*, 1941, 29, 390-400.

KAMIN, L. J: Temporal and intensity characteristics of the conditioned stimulus. In W. F. Prokasy (Ed.), *Classical conditioning*. New York: Appleton-Century-Crofts, 1965, 118-147.

SEIDEL, R. J. A review of sensory preconditioning. *Psychol. Bull.*, 1959, 56, 58-73.

NOTE

1. This study is based in part on a Thesis submitted by the author in partial fulfillment of the requirements for the M.A. degree at the University of California, Davis, and was supported in part by National Science Foundation Grant GB-3328 awarded to G. Bermant. Members of the Thesis Committee were G. Bermant and D. Lott with T. Parks serving as Chairman. The author is indebted to M. H. Kellicutt for technical guidance throughout the experiment.