The effects of avoidability and unavailability of punishment on stimulus selection¹

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Forty volunteers were tested to assess the effects of avoidable and unavoidable punishment (shock) on stimulus selection. Half of the Ss learned to avoid the shocks which followed presentation of a given stimulus while the other half were unable to avoid the shock. Results indicated that opposing selective tendencies were established toward that stimulus, the former group displaying increased selection and the latter group, decreased selection. These results were discussed with reference to the previously contradictory findings on the effect of (unavoidable) punishment on stimulus selection.

One of the objectives of stimulus selection research is to evaluate the effects of those variables which determine to what the S will attend. The typical procedure involves S's selection of one stimulus object or feature from several competing objects or features which have been differentially treated.

Studies in which punished stimuli compete with non-punished stimuli yielded equivocal results. Smith & Hochberg (1954) and Dulany (1957) found that stimuli paired with shock are apperceived significantly less often than stimuli not paired with shock. No such difference was observed by Sommer (1956, 1957) but it is questionable whether his punishment procedure, withdrawal of a few cents, was adequate for the purpose intended. Still other investigators (Ayllon & Sommer, 1956; Pustell, 1957) have reported that punished stimuli may be selected either more frequently or less frequently than nonpunished stimuli.

It was suggested in both of the latter studies that the degree of punishment experienced by S during training will determine whether or not S will later select the punished stimulus in preference to unpunished stimuli. Although they disagreed on the relationship between the degree of punishment experienced and tendency to select the punished stimulus, the disagreement possibly reflects procedural differences in choice of shock intensity. Ayllon and Sommer employed a single intensity for all Ss while Pustell employed the highest intensity each individual would permit. Whatever the form of this relationship, it is interesting that under the same training procedure and with (at least in Pustell's study) an apparently subjectively equal shock intensity, opposing response tendencies were established with respect to the punished stimulus. Specifically, it was observed in both studies that those Ss who exhibited the higher activity and verbalization levels during training also tended to select the punished stimulus; those Ss remaining passive and silent tended to select the nonpunishment stimuli.

One is led to suspect that the responses emitted by the active Ss were somehow "avoidant." To the extent that perception of a stimulus afforded S an opportunity to avoid or attenuate punishment, an increasing tendency to select that stimulus would be expected. On the other hand, if a stimulus was inevitably followed by unattenuated punishment, the frequency of selecting that stimulus should decrease. The analogy to a response selection paradigm is obvious.

Therefore, the purpose of the present experiment was to demonstrate directly the effects of avoidability and nonavoidability of punishment on stimulus selection. In doing so it was hoped that previous findings would be clarified.

METHOD

The Ss were forty volunteers from the Tucson City Fire Department. Their mean age was about 31 and ranged from 24 to 53. Several other firemen had had sufficient experience with shock that no "truly painful" shock level could be obtained with the apparatus used and they were thus dropped from the study.

Stimulus objects were four geometric figures (circle, square, diamond, and triangle). They were prepared on black and white slides, appearing as light (22.0 ft-L) on a dark (4.54 ft-L) background. They were equated for area, 9 sq. in. projected on a screen. Two sets of slides were required. One consisted of 48 slides, each slide containing all four figures with one figure in each of the four "quadrants"; this set was used in the baseline and test phases. The training set consisted of 32 slides, each containing a single figure in one of the quadrants. In both sets all figures appeared an equal number of times in each quadrant. On all slides the center of each figure was equidistant from the (focal) center of the slide. Order of slide presentation was random.

The slides were presented by means of a Carousel projector, presentation time limited to 1/100 sec by a tachistoscope mounted on the lens. Stimulus duration and illumination were set at a level which made difficult apperception of more than one of the figures.

Subjects were seated at approximate eye level with focal center on the screen and 66 in. from it. A response key for initiating and terminating the shock was mounted on the arm of the chair. Two-second shock was administered through leg electrodes by a 1½-V battery-operated inductorium.

Subjects were randomly assigned to either the nonavoidance (NV) group or the avoidance (AV) group, each numbering 20. Each geometric figure served as the "shock stimulus" for five Ss in each of the two groups.

The experiment consisted of three phases: baseline, training, and test. During baseline S was required to fixate at focal center and, following presentation of each slide, to designate which quadrant contained the figure that appeared most clear to him.

For the training phase, electrodes were secured to S's calf; shock intensity was then determined individually, each S being coaxed into accepting a "truly painful" level. Instructions for this phase were to press the response key at least once following each slide presentation, although Ss were informed that they could press more than once if they wished. Each time S's respective shock stimulus was presented a single key press activated the shock. The NV group was required to endure the full duration of all eight shock instances, regardless of the number of responses made. The AV group, on the other hand, was afforded the opportunity to learn to avoid the shock. A slight temporal delay between the initial key press and shock onset permitted avoidance of the shock when a rapid second press was made, as well as keeping S unaware that his own response activated the shock. A less rapid second press terminated the shock once it had begun. Key presses following presentation of nonshock stimuli did not activate the shock.

Upon completion of training, the electrodes were removed and S told that no further shock would be used. The test phase was then carried out. Except for presentation order of the slides, procedure in this phase duplicated that of the baseline phase.

RESULTS

The primary response measure consisted of the change in frequency, from baseline to test, with which S selected his shock stimulus. The mean selection frequencies for the NV group were 12.1 and 7.55 for the baseline and test phases, respectively; analysis of these data by *t* test for correlated means revealed that the difference between these means was significant ($t = 6.14$, $df = 19$, $p < .001$). For AV Ss, the difference between the mean frequencies of 14.45 and 18.70 was also found to be significant ($t = 2.74$, $df = 19$, $p < .01$).

DISCUSSION

The results of the present experiment show directly that in stimulus selection, as in response selection, avoidability of punishment is a determining factor. Where a given stimulus has been associated with unavoidable punishment, selection of that stimulus from among nonpunished stimuli is decreased. On the other hand, stimuli associated with the avoidance of punishment are increasingly selected.

In view of these findings, it is argued that the opposing tendencies of punished Ss, some to be active and verbal and others to be silent and passive, were responsible for the previously contradictory results regarding the effect of (unavoidable) punishment on stimulus selection. Further support for this position derives from the demonstration (Freeman & Pathman, 1942) that even activity which appears to be maladaptive is associated with more rapid recovery from stress than is complete immobility.

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Each S was given a brief explanation of the nature and purpose of the recording of bodily functions. It was strongly emphasized to the S that he would not be shocked or hurt in any way. Maximum tension was determined and the appropriate amount of weight was attached to the handle of the apparatus. The S was told, if he had been assigned to a tension group, that when asked to do so he was to pull down on the handle, continue to hold it down, and not to let up on it until told to do so. Ss in the no-tension group were told to place their left hand on a mark on the table top under the handle. While Ss either pulled down on the handle or maintained their left hand on the table top, they performed various tasks. Physiological measures were monitored for 10 sec prior to commencement of the tasks and for 10 sec after their completion.

RESULTS

The results on both physiological indicants show physiological activity commensurate with changes in amount of IMT. Figure 1 graphically presents the relationship obtained between tension level and HR and that obtained between tension level and GSR spontaneous responses.

A distribution-free *k*-sample test against ordered alternatives (Jonckheere, 1954) was computed because it is especially sensitive to both the differences between group means and the order in which they occur. For HR, a $Z = 1.64$ was computed with $p < 0.05$. A Z of 5.12 was computed for GSR with $p < 0.001$.

DISCUSSION

An increasing monotonic function between IMT and physiological activity, as represented by GSR and HR, supports the conclusion of Pinneo (1961). That investigator concluded that IMT was an effective and reliable method for

Coupled with the Ayllon & Sommer (1956) and Pustell (1957) studies, the present results appear to contain a practical implication for research involving shock training, namely that each S should be observed for his responsiveness to the shock. The reason for this is that it is possible, in spite of E's intention, to obtain "avoidance" results when these are undesirable.

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NOTE

1. This research was the basis of the author's M.A. thesis at the University of Arizona, 1967. The author wishes to express his appreciation to Dr. Dorothy I. Marquart for her guidance.

systematically varying activation level. In this study the between-Ss design was used and the HR and GSR functions correspond very closely with those of Pinneo who employed a within-Ss design. These results suggest that IMT may be a method of manipulating activation which overcomes the effects of idiosyncratic patterns of activation within individuals.

An important implication of these findings when considered with those of Pinneo (1961) is that an E might be justified in assuming that he has varied activation effectively if he has used the IMT technique even when corroboration by electro-physiological measures is not available. This implication should be validated by replication of the methodological procedures used in this study with an extended range of activation levels.

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NOTES

1. This report is a portion of a paper presented at the annual meeting of the Rocky Mountain Psychological Association, Albuquerque, N.M., 1966. It is part of a M.A. thesis submitted to the faculty, at the University of Denver by the first author under the direction of the second and third authors.

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