Differential GSR conditioning with a complex CS

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As a first step in the investigation of the effect of stimulus information on differential conditioning, the present experiment was performed using geometrical figures with one relevant and one irrelevant bit of information as CSs. Differential conditioning was indeed possible. Furthermore, conditioning was rapid, indicating the influence of concept formation or language. The effect of several control variables was also studied. These had minimal influence on conditioning.

That words can be used as conditioned stimuli (CSs) in human classical conditioning was shown by Russian investigators early in this century. Moreover, Razran (1939), through generalization tests, demonstrated quite early that not only was the word per se as a stimulus conditioned but that its meaning was also. Verification and amplification of this finding has come from a number of sources, among them experiments by Baxter (1962), Hartman (1963), Lang, Geer, & Hnatiow (1963), and Acker & Edwards (1964), all of which made use of generalization or transfer tests across some dimension of meaning.

The first phase of these experiments generally involves some differential conditioning procedure in which one or more words serve as the positive stimuli (CS +) and others as the negative, or unreinforced, stimuli (CS -). A problem which exists both with this first phase and the transfer phase of these experiments is that any word has values on a number of dimensions of meaning and that the number of these is not the same for all words. It is thus impossiple to specify the amount of information carried by a particular stimulus, how much is relevant and how much is irrelevant information, how much conditioning occurs to any one of these dimensions, what the exact similarity relationship is between CS + and CS -, and how much transfer or generalization is attributable to each of these dimensions separately. It is clear that if these factors are to be more exactly specified, stimuli other than English words need be used. In human discrimination and concept formation studies, this problem has been solved by the use of complex geometrical figures which differ from each other in specifiable dimensions such as size, form, color, or number. (See e.g., Archer, Bourne, & Brown, 1955). One or more of these dimensions is made relevant to S's response while the others remain irrelevant. It is proposed here that differential conditioning be investigated in a similar manner and that semantic transfer and generalization studies involve quantification of input information corresponding to S's responding.

As a first step in this direction, the present experiment was performed simply to ask whether Ss can be differentially conditioned when the CSs are geometrical figures containing some irrelevant information. Specifically, they contained one bit of relevant and one bit of irrelevant information. The experiment further investigated the effect of several variables which were manipulated simply for experimental control through counterbalancing.

Method

The stimuli were geometrical figures that were either a square or a triangle and these were colored either blue or yellow. Form was the relevant dimension for all Ss and color irrelevant. For half the Ss the squares were CS + and the triangles were CS + for the other half. There were four blocks of 10 experimental trials. In these, the first eight were conditioning trials and these were followed by two test trials—one with the CS + and one with the CS -. Half the Ss were first tested with the CS +, the other half with the CS -. The color of the figures on the eight conditioning trials was BBYYYBYB, where B stands for blue and Y for yellow. Both tests were made with yellow figures. For half the Ss the order of the figures was STTSTSST for the eight conditioning trials, where S stands for square and T for triangle. For the other half of the Ss, S and T were interchanged. The three variables—positive stimulus form, test series order, and training series order—were factorially combined giving a total of eight independent groups of Ss.

The Ss were 40 introductory psychology students. Twelve additional Ss were run but dropped due to excessively high skin resistance, apparatus malfunction or unwillingness to remain for the entire session. The Ss were randomly assigned to the eight conditions, in order of appearance, in five replications of 8 Ss each.

The CSs were presented for 1.9 sec and on reinforced trials the UCS was presented for the last 1.0 sec of this interval. The UCS was a white noise 95 dB SPL in intensity. The intertrial interval varied randomly between 33 sec and 57 sec.

The Ss sat in a plywood booth, the inside of which was covered with acoustical tile. The booth was lit by a standard 15 W light bulb. To further reduce extraneous noises, Ss wore ear phones. These also provided opportunity for communication with S and were used to deliver the UCS. The S sat in an arm chair facing a ground glass window on which the CSs were projected by a film strip projector. The CSs were 1¼ in. in height.

The GSR was recorded visually from a Fels dermohmeter using standard Fels electrodes and jelly. The electrodes were attached to the palm and back of the left hand.

After S was seated in the booth, electrodes and earphones were attached to him and his left arm was loosely strapped to the chair arm. Instructions were given him which merely implied that his reactions (GSR) to stimuli would be recorded and that these stimuli would be pictures and a noise. They were further told that certain pictures would sometimes be followed by the noise and others never.

Prior to experimental trials, Ss were given 12 adaptation trials. These were presentations of the figures in the same order as during the conditioning trials except that the white noise was presented three times between the fourth and fifth figure and once between the sixth and seventh figure. The CS + was, of course, not reinforced. The intensity of the UCS was 80, 85, 90, and 95 dB SPL for the four presentations, respectively.

Results and Discussion

A GSR was defined as a response occurring within approximately 2 sec following stimulus onset. The GSR was measured in units obtained by the formula:

$$\log [10^8 (C_a - C_b)+1]$$

where C_b is the conductance at the moment of response initiation and C_a is the conductance at the peak of the response.

Over all four trials, the mean GSR to CS + was 1.89 and to CS -, 1.58. $F(1,128) = 24.15$, $p < .001$. This difference indicates that indeed Ss can be differentially conditioned when the CSs are geometrical figures containing some irrelevant information.

Overall response level (CS + and CS - responding combined) was not affected by any of the control variables but did vary according to trial block. The mean GSR for the four trials was 1.93, 1.73, 1.71, and 1.57, respectively. $F(3,96) = 4.84$, $p < .05$, indicating some habituation through the training period. Differential responding was not affected by trial block—$F(3,128) = .10$—indicating rapid differential conditioning.

Only training series order affected differential conditioning. In that order in which training began with CS + and the trial preceding the test trials was a CS - the mean difference in responding to CS + and CS - was .15. In that order in which training began with CS - and the trial preceding the test trials was a CS +, this mean difference was .48. $F(1,128) = 6.31$, $p < .05$. It is not possible to tell which aspect of the series order was responsible for this difference, though the recency of a reinforced trial seems a plausible explanation. No other variable affected differential responding.

The fact that differential conditioning was possible can be explained by classical theories of discrimination extended to complex stimuli. Tendencies to respond to irrelevant color cues are both reinforced and extinguished on successive trials. However, the rapidity of differential conditioning suggests that concept learning or language influences conditioning to a considerable

extent. The degree to which concept learning enters into differential conditioning could be determined by a comparison of the effects of amount of relevant and irrelevant information in the stimuli on differential conditioning with these effects on concept formation. That such differential conditiong experiments are possible is indicated by the results of the present experiment.

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