Perceptual distortion of paired stimuli[1]

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Pairing two discriminably different tones with intense shock and mild shock, respectively, caused a perceptual distortion of shock intensity. Magnitude of the distortion was related to the interval between tone and shock.

In the literature on classical conditioning there have been few attempts to ascertain the effect of pairing on the perception of the conditioned and unconditioned stimuli. Ellson (1941a, b, 1942), in studying hallucinations produced by sensory conditioning, paired a light as conditioned stimulus (CS) with a tone, gradually increasing in intensity, as unconditioned stimulus (US) and found that 32 of 40 Ss reported hearing a tone when the light was presented alone. Brogden (1950) showed that repeated pairing of a light with a near threshold sound led to a "conditioned facilitation" of auditory acuity. On test trials, with a light, Ss reported hearing a tone 2 dB lower, on the average, than on no light trials.

The purpose of the present experiment was to determine the effect of discrimination training on perception of shock intensity and to discover whether there is an optimal CS-US interval for demonstrating the predicted alteration in perception. The hypothesis was that the intensity of two identical electric shocks would be perceived differently as a result of differentially pairing them with discriminably different stimuli, i.e., high and low tones. It was further hypothesized that there should be some systematic relationship between the perceptual distortion and CS-US interval.

Method

Ss were 50 college undergraduates randomly assigned to five groups of 10 each. Each group was treated identically except for differences in CS-US intervals. The CS-US intervals employed were 0.5 sec. backward, 0.5, 2, 5, and 8 sec. Instructions were as follows:

> "This is an experiment involving estimation of shock intensity. First we are going to administer shocks of low intensity and then gradually increase them. Each time you feel a shock please indicate it by saying 'Now.' [Threshold for electric shock administered to the forearm thus was determined by ascending and descending series of intensities.]
>
> "Now we will gradually increase the shock until you feel it is definitely annoying. Say 'Now' each time you feel the shock and say 'Annoying' when it is definitely annoying. [Threshold for annoyance was thus determined.]
>
> "Now you will receive some shocks of various intensities. Please rate these shocks on a scale from 0 to 10. The first shock you felt, that is, the weakest one, we shall call Number 1. The last one, the one you said was definitely annoying, we shall call Number 10. The rest of the shocks will be between 0 and 10. They will be accompanied by tones. After each shock, call out the number from 0 to 10 to correspond to your best estimation of the shock intensity."

For half the Ss in each group, a high pitched tone (CS+) was always paired with a high intensity shock (US+), and a low pitched tone (CS-) with a low intensity shock (US-). For the other half, CS+ was a low pitched tone and CS- a high pitched tone. An Eico code practice oscillator was used to deliver the tones through earphones. The shocks were from a Grass Model S 5 stimulator. Duration of and intervals between stimuli were controlled automatically by timers and relays.

Ss were given a random sequence of 15 high pitched and 15 low pitched tones, each accompanied by the appropriate intensity shock. Duration of each stimulus was 0.4 sec., and the intertrial interval was a random sequence of 15, 20, and 25 sec. The actual intensity of each shock was determined on the basis of S's report of the preceding shock intensities. The intensity of each shock was adjusted up or down as necessary to assure that S continued to report numbers from 1 to 4 for low shocks, and from 6 to 10 for high shocks.

Three pairs of test trials were interspersed during training. These were Trials 7 and 8, 14 and 15, and 22 and 23. Each pair consisted of a CS+ and a CS-, each paired with an identical US at an intensity estimated to elicit a rating of 5. After the thirtieth trial, the shock intensity was set at this individually determined intensity and remained at that level for 20 more presentations of low and high tones.

Results

For each pair of test trials the perceived intensity of the shock associated with the tone which had been paired with low shock was subtracted from the perceived intensity of the other (identical) shock. Figure 1 shows the mean difference in perceived intensity of identical pairs of shocks as a function of interstimulus interval. The expected value of this difference is zero at each interval. This value is closely approximated at the backward interval, and at the longest and shortest intervals. Of the intervals employed, 5 sec. was optimal. An analysis of variance done on the four forward intervals revealed a positive quadratic component significant at the 5% level. This analysis was done in two ways: first, a comparison

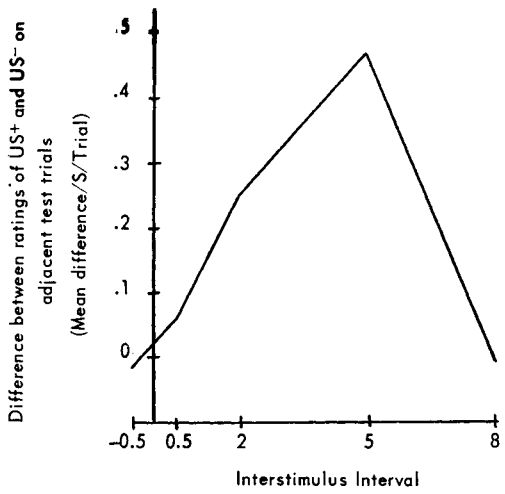

Fig. 1. Difference between ratings of US^+ and US^- on adjacent test trials as a function of interstimulus interval.

of the middle two means against the end two, and second, a comparison of the highest mean against the other three. Both Fs were significant at the 5% level. Additional analyses showed that the mean for the 5 sec. group is significantly greater than the mean for either the 0.5 sec. or 8.0 sec. groups. These differences were also significant at the 5% level.

Discussion

The results of the study indicate that the perception of US can be altered by a procedure similar to the classical conditioning paradigm. This is interpreted as a learned alteration in perception resulting from the pairing of stimuli. It is conceivable that this effect was mediated through the conditioned GSR. The tone paired with a more intense shock might elicit a larger GSR which would allow a larger current to pass through the skin. This possibility cannot be ruled out, since constant current shocks were not used. Additional studies in which the perceived intensity of white noise is the dependent variable are in progress, and indicate that the occurrence of perceptual distortion in a discrimination paradigm is not solely dependent on the GSR.

Another possible explanation for these results is that Ss tended to expect a more intense shock following CS+ and therefore to rate it higher than they actually perceived it, or that their expectancy altered their perception. The existence of an interstimulus interval function, however, is not consistent with such a view. There does not seem to be any particular reason for a S to "expect" an intense shock 5 sec., but not 8 sec., after a CS.

References

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Note

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