Expectancy, anxiety, and the GSR¹

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Traditionally, CR magnitude in classical conditioning was thought to be dependent only upon properties of the CS and UCS. This study investigated the cognitive factor of S's expectancy of shock and his anxiety on GSR amplitude. Each S received 20 conditioning trials on a 50% random reinforcement schedule and had to state his expectation of shock before each trial. There was a significant correlation between verbalized expectancy and CR amplitude. High anxious Ss extinguished more slowly than low anxious Ss and had greater mean shock expectancies during acquisition.

In the traditional conception of classical conditioning, the magnitude of the conditioned response (CR) is dependent only upon the number of paired presentations of the conditioned stimulus (CS) with the unconditioned stimulus (UCS), the intensity of the UCS, and the CS-UCS interval (Hilgard & Marquis, 1940). Any response which occurred as a function of the S's perception of a relationship between the CS and UCS was seen either as unfortunate error which should be minimized through proper instructions, or as perceptual learning rather than true conditioning (Razran, 1955). Increasingly, however, experimenters have begun to realize that not only is it impossible to prevent human Ss from developing hypotheses about the experiment, but that it may very well be impossible to talk about human conditioning at all without taking these cognitive factors into account (Fuhrer & Baer, 1965; Grings, 1965). Chatterjee & Eriksen (1962), for example, report a direct relationship between verbalized expectancies of shock and heart rate conditioning. The present study is an attempt to investigate the relationships between the expectation of shock, anxiety level, and the amplitude of the galvanic skin response (GSR).

Method

Subjects. The Mandler & Sarason Test Anxiety Scale (TAS) was administered to all students in the introductory psychology classes at Syracuse University. Twenty-six high-anxious (HA) males were selected from the upper 25% of the scores, and 30 low-anxious (LA) males from the lower 25%.

Design. The HA and LA Ss were alternately assigned to one of two reinforcement schedules in order of their appearance. Both schedules consisted of 20 training trials, 10 shock and 10 nonshock, the order randomly determined with two limiting conditions; that there be no more than two consecutive shock or nonshock trials, and that the last two trials (19 and 20) of the first schedule (S1) be nonshock trials and the last two trials of the second schedule (S2) be shock trials. The design, a 2 (anxiety level) by 2 (schedule) factorial,

generated four experimental groups: HA-S1, HA-S2, LA-S1, and LA-S2.

Apparatus. Faradic shock was delivered to the S's left wrist from a 3 V Harvard Model 308 inductorium. The GSR was recorded by a Grass Model 5 polygraph. The CS was a 15 W red light bulb located 12 ft in front of the S at eye level when the S was seated. The duration and offset of the CS, and the onset, duration, and offset of the UCS were controlled by a series of silent Hunter Interval Timers activated by a silent switch on the E's control panel. The duration of the CS was 5.0 sec, followed immediately by a shock of 2.0 sec duration. On the nonshock trials, E interrupted the shock circuit with a silent switch on his panel. The timers and inductorium were housed in a soundproof box, minimizing the possibility that the noises they produced could serve as CSs.

Procedure. The S was given shock and GSR orienting instructions. The shock level was adjusted to the maximum amount which the S could tolerate. Each S was told that the light would come on and remain on for 5 sec, sometimes followed by shock and sometimes not. He was further instructed that before each trial, he was to indicate verbally his degree of expectancy that the forthcoming trial would be a shock trial, according to an 11-point scale which was placed in his lap. It was emphasized that the schedule was completely random and predetermined, in order to reduce the possibility that the S would develop hypotheses that the shock was dependent upon his verbal response.

Expectancy scale. The shock expectancy scale consisted of 11 statements ranging from "There is no chance that I will be shocked on this trial," through "There is a 50-50 chance that I will be shocked on this trial," to "It is definite that I will be shocked on this trial." The scale yielded a wide range of expectancy scores, although few Ss used the extreme statements.

Results and Discussion

The response measure was the amplitude of the conductance change. All conductance changes were transformed according to the formula $\log_{10}[(\Delta C \times 100) + 1]$.

The rationale for using a 50% reinforcement schedule with the limiting conditions of no more than two consecutive shock or nonshock trials was that this condition would be "discovered" by S relatively rapidly and would influence his shock expectancy. To test if the schedule produced the desired variations in expectancy, Pearson correlations were run between the reported expectancies on each trial and a set of theoretical expectancies derived from each schedule.

The theoretical expectancy on the first trial was arbitrarily set at five. Thereafter, if the preceeding trial were a shock trial, the theoretical expectancy for that trial was four; if the preceeding two trials were shock trials, the expectancy was three. Similarly, if the previous trial were a nonshock trial, the theoretical expectancy of shock for that trial was six; while if both of the previous trials had been nonshock trials, the expectancy was seven. This reflected the actual composition of the schedules; if S had just gotten shocked there was less likelihood of receiving shock on the next trial, and conversely if he had not been shocked. The correlations for both schedules between the theoretical and actual expectancies were highly significant ($r=0.775$, $df=18$, $p<.01$ for S1; $r=0.821$, $df=18$, $p<.01$ for S2). Thus, even when S is not told when to expect shock, he develops a series of hypotheses about the likelihood of shock based on the previous trials which closely conforms to the actual situation.

The effects of anxiety. One of the most consistent findings in the literature is that HA Ss condition more readily and extinguish more slowly than LA Ss. In the present study there were no differences in CR amplitude during acquisition between HA and LA Ss. The HA Ss, however, reported greater mean shock expectancies on Trials 2 through 21 than the LA Ss ($F=4.086$, $df=1/52$, $p<.05$). Further, the expectancies for the HA Ss were generally higher than the theoretical expectancies, and those for the LA Ss were usually lower than the theoretical expectancies.

During extinction, there was a significant Trials by Anxiety interaction, with the LA Ss extinguishing more rapidly than the HA Ss ($F=2.354$, $df=14/728$, $p<.025$).

The effects of expectancy. The purpose of using two schedules which differed on Trials 19 and 20, both being either shock or nonshock trials, was in order to produce different shock expectancies on Trials 21 and 22 which should have been correlated with differences in the amplitude of the CRs on these trials. Although there were significant differences between the two schedules in the reported expectancy on these two trials, the differences between them for CR amplitude were not significant.

Pearson correlations were computed between the expectancy scores and the CRs using the mean score for each trial on Trials 2 through 21. During these 20 trials, the correlations between verbal expectancy and the amplitude of the CRs were significant for both schedules ($r=0.584$, $df=18$, $p<.01$ for S1; $r=0.775$, $df=18$, $p<.01$ for S2).

During the 15 extinction trials, the correlations between expectancy and the CRs were not significant for either schedule.

These results indicate that there is a linear relationship between the S's verbalized shock expectancies and the amplitude of his CRs. As such, it is supportive of the hypothesis that the CR amplitude is a measure of the amount of fear S perceives in the situation and may differ from the results one would expect with an uncertainty hypothesis. Elliott (1966) found no difference in heart rate acceleration when the S knew he was going to be shocked or knew he was not going to be shocked, but an increase when the S was uncertain whether or not he will be shocked. The present study, although operating entirely within the domain of uncertainty, did not find a curvilinear relationship between expectancy and CR amplitude in the range from a low expectancy of shock to a high one which one might predict by extrapolation from Elliott's findings, but this difference may be a function of the modalities used.

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Notes

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