# Some indices of GSR activity in a long-delay conditioning paradigm[1]

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*Skin resistance was monitored while 32 Ss watched the sweep-second-hand of a Universal Timer. They had previously been told that each time the second-hand reached the 30 sec. mark they would receive a strong electric shock. The number and magnitude of anticipatory CR's given during the eight conditioning trials were positively correlated with basal conductance and nonspecific GSR activity, and negatively correlated with the recruitment and recovery times of the UCR to shock. Nonspecific GSR activity was positively correlated with both basal conductance and magnitude of GSR to shock.*

Several investigators have reported that GSR conditioning is related to various indices of GSR acitivty. For example, Cadoret (1963) and Martin (1960) found that GSR conditioning was negatively correlated with basal skin resistance and positively correlated with nonspecific (spontaneous) GSR activity. Cadoret (1963) also found a significant positive correlation between magnitude of GSR to the UCS and conditioning. The present study reports on some similar relationships obtained in a form of long-delay conditioning paradigm. In addition to the indices mentioned above, several other response measures were obtained and related to conditioning.

## Method

Eighteen male and 14 female students from a summer session course in introductory psychology served as Ss. Age ranged from 19 to 48 (mdn = 22) for the males, and from 18 to 50 (mdn = 22) for females.

The Ss were tested individually in a quiet room. After shock and GSR electrodes had been attached, the S was asked to sit quietly for the next 10 min. during which time basal skin resistance and nonspecific GSR activity were monitored. A Lafayette GSR Recorder and zinc-zinc sulphate finger eletrodes were used for this purpose. The level of shock to be used in the experiment was then determined by gradually increasing the intensity of a 200 msec. shock (produced by a Psychological Instruments Model 1A Stimulator) until the S indicated that he was unwilling to accept anything stronger. His attention was then directed towards a Gralab Universal Timer situated on a small table directly in front of him. After he had been told to watch the large sweep-second hand carefully, the timer was started and the second-hand allowed to complete one circuit (60 sec.). The S was then informed that each time the second-hand reached the 30 sec. mark, i.e., 30 sec. after the timer started and every 60 sec. thereafter, he would receive a shock similar to that previously determined to be his maximum. Eight trials of this nature were given. This particular procedure was modified from one described by Zeaman & Smith (1965), and may be considered a special form of long-delay conditioning in which the UCS is presented at regular, predetermined intervals, and in which the S is informed of the CS-UCS relationship.

All resistance measures were converted to log conductance units (log $\mu$ mhos) prior to statistical computation. The variables analyzed included the logarithms of the following: basal conductance (BC); number of nonspecific GSR's per minute in the basal period (NSP); magnitude of GSR to the last sample shock ($UCR_0$); recruitment time of $UCR_0$, i.e., number of seconds from beginning of response to peak magnitude (RCT - $UCR_0$); recovery time of $UCR_0$, i.e. number of seconds from peak magnitude to pre-stimulus level (RCY - $UCR_0$); magnitude of GSR to shock on the first ($UCR_1$) and eighth ($UCR_8$) conditioning trials; magnitude of the anticipatory conditioned response on the first ($CR_1$) and eighth ($CR_8$) conditioning trials; the mean number of seconds by which the CR preceded the shock during the eight conditioning trials (ANT); and the total number of CR's given (TOT-CR).

## Results and Discussion[2]

During the first trial (no shock), most Ss showed a gradual, though slight decrease in conductance. Several response patterns were observed throughout the next eight (shock) trials. The two most frequent patterns were (a) no systematic change in conductance prior to the presentation of shock, followed by an UCR to the shock, and (b) a marked increase in conductance (CR) just prior to presentation of shock, followed by the response to the shock itself (cf. Hare, in press).

The matrix produced by intercorrelating the variables described above is presented in Table 1. These results indicate that conditioning, whether defined in terms of the number or magnitude of CR's elicited, is positively and significantly correlated with basal conductance and with the number of nonspecific GSR's per minute in the basal period. The findings reported by Cadoret (1963) and Martin (1960) are thus supported and extended to a long-delay conditioning procedure in which the UCS is presented at regular intervals. However, the additional finding by Cadoret (1963) that conditioning and magnitude of UCR were positively correlated was not supported.

An interesting finding was the relatively strong correlation (partial $r = .70$ when the effect of response magnitude is removed) between the recruitment and recovery times of $UCR_0$. Perhaps more interesting were the consistent and generally significant negative

Table 1. Product Moment Correlations Between GSR Indices and Conditioning Measures (N=32)

| Variables | BC | NSP | $UCR_0$ | RCT-$UCR_0$ | RCY-$UCR_0$ | $UCR_1$ | $UCR_8$ | $CR_1$ | $CR_8$ | ANT |
|---|---|---|---|---|---|---|---|---|---|---|
| NSP | .52** | | | | | | | | | |
| $UCR_0$ | .31 | .52** | | | | | | | | |
| RCT-$UCR_0$ | –.35* | –.50** | .14 | | | | | | | |
| RCY-$UCR_0$ | –.40* | –.47** | .29 | .71** | | | | | | |
| $UCR_1$ | .23 | .05 | .61** | –.10 | –.04 | | | | | |
| $UCR_8$ | .04 | .06 | .33 | –.27 | –.08 | .51** | | | | |
| $CR_1$ | .63** | .51** | .14 | –.18 | –.37* | .19 | .17 | | | |
| $CR_8$ | .53** | .50** | .30 | –.38* | –.33 | .27 | .04 | .41* | | |
| ANT | .32 | .19 | –.01 | –.15 | –.51** | –.13 | –.20 | .16 | .33 | |
| TOT-CR | .52** | .49** | –.01 | –.36* | –.58** | –.06 | –.15 | .37* | .51** | .67** |

*$p = .05$, **$p = .01$, *two-tailed test.*

correlations between both the recruitment and recovery times of $UCR_0$ and the conditioning measures (magnitude and number of CR's elicited). Although not included in Table 1, negative correlations of the same order were also obtained between the conditioning measures and both the recruitment and recovery times of the UCR's throughout the experiment. This may mean that "good" conditioning is related to rapid autonomic discharge and quick recovery.

It should be noted that the effect of the instructions used was to produce, for some Ss, a CR on the first trial. Zeaman & Smith (1965) observed the same thing in cardiac conditioning studies and suggested that the effect represented a generalized response dependent upon prior experiences with shock and verbal warning of shock (p. .384). For some Ss in the present study, the instructions were apparently not sufficient to produce a CR on the first trial. Since these Ss tended to give relatively few CR's during the remainder of the experiment, it is possible that what ever prior experiences they may have had with verbal warnings of noxious stimuli were generally ineffective in developing conditioned emotional responses. The Ss who did give a CR on the first trial were also the ones who tended to give many, relatively large, CR's and who were characterized by high basal conductance, many nonspecific GSR's, rapid UCR recruitment and recovery, and by the elicitation of CR's well before the presentation of the UCS.

Some of the relationships between the indices of GSR activity are also of interest. The significant positive correlation between basal conductance and nonspecific GSR activity is consistent with the recent suggestions that such a relationship should appear during periods of stress (Johnson, 1963; Miller & Shmavonian, 1965). Also in accord with Johnson's data on the relationship between nonspecific GSR's and GSR reactivity is the positive correlation between NSP and $UCR_0$. The lack of a significant correlation between NSP and the magnitude of the UCR's elicited during conditioning may reflect the fact that these latter responses were often superimposed upon, or came immediately after, an anticipatory response.

## References

**Cadoret, R. J.** Relationship between autonomic patterns and conditioned learning. *Percept. mot. Skills*, 1963, 16, 67-85.

**Hare, R. D.** Temporal gradient of fear arousal in psychopaths. *J. abnorm. Psychol.*, in press.

**Johnson, Laverne C.** Some attributes of spontaneous autonomic activity. *J. comp. physiol. Psychol.*, 1963, 56, 415-422.

**Martin, Irene.** Variations in skin resistance and their relationship to GSR conditioning. *J. ment. Sci.*, 1960, 106, 281-287.

**Miller, L. H., & Shmavonian, B. M.** Replicability of two GSR indices as a function of stress and cognitive activity. *J. Pers. soc. Psychol.*, 1965, 2, 753-756.

**Zeaman, D., & Smith, R. W.** Review of some recent findings in human cardiac conditioning. In W. F. Prokasy (Ed.), *Classical conditioning*. New York: Appleton-Century-Crofts, 1965. Pp. 378-418.

## Notes

1. Supported by research grant APA - 139 to R. D. Hare from the National Research Council of Canada. The correlations were computed by the University Computing Center.

2. None of the effects reported was related to sex or age of Ss.