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Eli Saltz  
*State University of Iowa*

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## Effect of Shock on Performance in a Paired-associate Learning Task \*

By ELI SALTZ

Hullian psychology conceptualizes the effects of noxious stimulation as drive producing and the effects of removal of such stimulation as a rewarding state of affairs (3). These effects have been repeatedly demonstrated in situations where they have facilitated learning (2, 4). It is obvious, however, that increased drive need not necessarily aid learning, and it may at times hinder it.

The present study is concerned with the consequences for learning when electric shock is introduced at the same time as the stimulus word and is removed when the response word is spoken in paired-associate learning. The study is particularly interested in investigating some of the phenomena recently reported by Alper (1). Alper has found that while rate of verbal learning is not faster in more motivated subjects, the retention after a twenty-four hour period is greater than for less motivated subjects. (She increased motivation by means of verbal instruction. Subjects were told the task was related to intelligence; this, she claims, constituted an "ego threat.") The effect of increased drive on both learning rate and amount of retention is considered by the research about to be reported.

### Procedure

The subjects in this experiment were 97 students, male and female, from the elementary psychology class at the State University of Iowa. Subjects were assigned to various groups according to a random list of numbers.

A Hull type memory drum was used. The stimulus word was presented for two seconds, then the shutter was raised disclosing the response word; both words were then in the window together for another two seconds. There was a four second interval between pairs of words. Twelve pairs of meaningful words were presented in six different orders with twelve seconds between each of the orders.

Shock was administered to a subject's wrist by means of an electric shock device consisting of a variac adjustable from 0 to 55 volts A.C. The shock could be made to start one-fourth seconds before the stimulus word appeared in the window. The shock could

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be terminated by the subject pulling down on a handle attached to a rope that came down over the screen separating experimenter and subject; the pulling of the handle was prevented mechanically, however, until one-half second after the shutter raised exposing the response word.

Approximately half the subjects were assigned to a shock group, half to a non-shock group.

Every subject was told to say each stimulus word as soon as it appeared, and each response word as soon — but not before — the shutter raised exposing the response word. Then each subject was to pull the handle that hung from the screen. Every subject from the shock group was told, in addition, that the shock would begin with the appearance of the stimulus word and would continue until he pulled the handle; he was instructed, however, not to pull the handle until after the shutter had raised and he had said the response word. The shock was then adjusted upward in five volt steps to a point where the subject said it was too strong; he was then told the voltage had been lowered and was presented with the same voltage again; if he still insisted that it was too strong, as some did, it was lowered five volts; no subject complained any further.

All subjects were run ten trials in the manner indicated above. Then they were tested on the eleventh trial for number of words learned by having the shutter stay down so that only the stimulus words were ever seen by the subjects during this trial. The subjects were told to try to give the word under the shutter. The drum moved at the same rate as before, the stimulus word being present in the window for four seconds, then four seconds with the window of the drum empty, then the next stimulus word. No shock was administered to the shock group during this trial and all subjects were told not to pull the handle.

Half the shock subjects and half the non-shock were next given five more learning trials under the same conditions as their original learning; these subjects were then retested on trial seventeen in a manner identical with the test on trial eleven.

Amount of retention was tested for in those subjects given no further learning after trial eleven by giving a twelve trial identical with trial eleven after a period of delay. Those subjects given five additional learning trials after trial eleven and retested on trial seventeen were then given a delay and retested again on trial eighteen. Half the shock and half the non-shock in both degrees of learning had their delay period, before being tested for retention,

three and one-half minutes long. The three and one-half minutes were spent in doing digit symbols. The other half of the subjects had a fifteen minute delay and their time was occupied doing digit symbols and writing numbers backwards and crossing out words on a page.

The manner of learning used, in which the subject did not overtly anticipate the response words but waited until he saw the correct word before he said it, was employed because it eliminates the possibility of incorrect responses being made overtly during training. This situation consequently controls for the fact that different subjects make different numbers of overt incorrect responses in the usual method of paired-associate learning.

The method has the disadvantage that special test trials must be given to measure learning; we do not have a continuous record of the number of correct anticipations from trial to trial.

It is impossible at the present time to say if this method produces faster or slower learning than the usual anticipation method. Certainly it alters the variables involved in learning.

## Results

Shocked subjects were lower than non-shock subjects in amount learned when tested at the eleventh trial (after ten learning trials). The difference was not significant, shock having a mean of 6.33 words and non-shock a mean of 6.94 words, forty-six and fifty-one subjects in the two respective groups.

The mean increase of the twenty-one shock subjects given five more learning trials was 2.19 words over the number of words on trial eleven; the mean increase of the twenty-three non-shock subjects was 2.17 words. Thus, on the seventeenth trial shock did not exhibit a differential effect on learning when compared with non-shock.

Turning to the retention data, there was no significant difference in the number of words retained after three and one-half minutes as against fifteen minutes delay within the shock group nor within the non-shock group. This was true for retention after both degrees of learning.

Next the effect on retention of shock during learning was tested. As the two lengths of delay used in this experiment had no significantly different affect on retention, the retention scores after both long and short delay were combined for the shock group and for the non-shock group to facilitate comparison.

In examining the amount retained from the eleventh to the twelfth trial, shock and non-shock subjects were matched according

to their performance on trial eleven. (It will be recalled that no significant difference in learning between shock and non-shock subjects was found on trial eleven.) The drop in retention between the eleventh and twelfth trial was calculated for both groups. The amount of retention of the shock group was .92 words less than that of the non-shock group. The variance of this difference is 2.63; with 24 degrees of freedom the difference is significant at about the .01 level of confidence.

A similar treatment of the amount of retention between trials seventeen and eighteen, combining long and short delay within each drive condition and matching shock and non-shock on trial seventeen, gives somewhat different results. Here the shocked subjects retain a mean of .55 words *more* than the non-shock; however, with 19 degrees of freedom and a variance of 1.65 between differences in drops in retention, this difference is significant only at about the .08 level of confidence.

### Discussion

In the present study, electric shock does not result in faster (nor slower) learning of paired associates. These results agree substantially with those of Alper who finds that "ego threat," also presumably a drive factor, does not increase rate of learning verbal material. Thus we see that increased drive does not necessarily facilitate learning. The assumption made by Alper to account for her data is that increased motivation results in certain interference phenomena during the course of learning, and these counter-act the facilitating aspects of increased motivation. Such a hypothesis can not be rejected on the basis of the data coming from this experiment. The job of the psychologist holding such a hypothesis becomes that of discovering the general principles that will enable us to predict under what conditions increased drive hinders and under what conditions it aids learning. While a start has been made on this task, any further consideration of this is beyond the scope of this paper.

A further hypothesis made by Alper, on the basis of her data, is that the interference due to high motivation tends to dissipate with time (1). Consequently, high drive during learning should be followed by greater retention after delay. In the present study, however, it was found that only after the larger number of learning trials did the shock subjects tend to retain better after delay than non-shock subjects; and even here the tendency was significant only at a .08 level of confidence. After fewer learning trials the shock subjects were actually significantly lower in retention than the non-shock.

It appears, then, that the effect of increased drive on retention depends on degree of learning.

#### SUMMARY

The results of the present study indicate that in paired associates learning:

1. Learning rate is neither facilitated nor hindered when electric shock accompanies each S-R so as to start at the onset of the stimulus and end after the correct response has been given.

2. Retention is poorer after learning which was accompanied by electric shock if the learning was to a low criterion.

3. Retention is not depressed and may actually be facilitated after learning which was accompanied by electric shock if the learning was to a high criterion.

Thus the functional properties of electric shock in verbal learning, as found in the present study, are very similar to the properties of increased drive as reported by Alper.

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DEPARTMENT OF PSYCHOLOGY  
STATE UNIVERSITY OF IOWA