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This investigation was concerned with two major problems: (a) the effect of punishment for error on the rate of serial verbal learning and on the amount of retroactive and proactive inhibition in the recall and relearning of the serial verbal habit, and (b) the determination of the direction and extent of muscular tension accompanying these learning and relearning conditions.

Certain investigations (1, 4) have shown that induced muscular tension facilitates the learning of simple tasks. Other studies (3, 6) have demonstrated that moderate forms of punishment will also facilitate performance and at the same time increase the muscular tension accompanying this performance (7). This positive relationship between performance and muscular tension suggests a similar relationship between motivation and muscular tension. At the time of the present investigation, no published reports were available which dealt with the effects of punishment in serial verbal learning; in view of the above mentioned relationships among performance, muscular tension, and motivation, an exploratory investigation of this type was felt to be justified. An assumption upon which this investigation proceeded was that the muscular tension can be measured by the palmar skin resistance. Although the psychogalvanic skin response has been interpreted in several ways, a recent investigation has shown a near-linear relationship between an increase in muscular tension and a decrease in the skin resistance (5).

METHOD

The experimental study of the effect of punishment for error on the learning and retention of serial verbal habits required a combination of the two most common experimental designs: the counterbalancing of experimental conditions within a single group and the comparison of experimental and control groups. Each group consisted of twenty-four subjects. Each subject in both groups served through the following four experimental conditions: (a) retroactive inhibition control, (b) retroactive inhibition, (c) proactive inhibition control, and (d) proactive inhibition. A basic rest period of twenty-five minutes was used between the time of original learning and the time of recall, with the interpo-

lated learning being introduced immediately after the original learning on the inhibition conditions. Both the original learning and the interpolated learning were learned to a degree of six trials. The criterion of final learning was two successive perfect trials.

The learned material consisted of sixteen unit lists of two syllable adjectives. These were presented to the subject at a 2.3 second rate by a modified form of the Hull memory drum. The learning was by the anticipation method. Each word in the original list had a synonym in the interpolated list, and this synonym was located at a serial position different from its complementary word in the interpolated list. This similarity factor makes for a maximum of inhibition effects, but allows for a rather clear-cut analysis of overt intrusions due to serial position identity and meaningfulness.

The punishment given was in the form of a single loud clang from a large bell placed immediately in front of the subject. The bell was sounded for incorrect responses and failures to respond and was so sounded during the last .25 second of the presentation period. The subjects were told that the bell could be heard throughout the psychology department and that anyone who so desired could follow the learning progress by the reduction in the number of clangs.

The palmar skin resistance was measured by a Darrow Behavior Research Photopolygraph. This machine provides for a continuous photographic record of the resistance changes.

Besides the four experimental days the subjects served two practice days to provide for acclimation to the experimental conditions. During the rest periods on the experimental days the subjects took the Seashore Tests for Musical Talent.

RESULTS

The results showed that punishment in the form of a bell had no facilitating effect on the speed of learning. At no point in the learning for any specified condition were the differences between the two groups significant. Significant retroactive inhibition was found, but no difference between the groups was evident. Negative transfer was present in both groups during the second trial of the interpolated learning, but contrary to other experimental findings no proactive inhibition was present at the recall point following the rest period.

Little evidence was found in the data from either group which will support the hypothesis that the frequency of overt intrusions is a valid index of inhibition.

The palmar skin resistance levels were consistently lower for the punished than for the non-punished. The resistance showed a decrease from the first to the sixth trial, i.e., during the original learning, with the decrease somewhat greater for the punished group. This was true in spite of the fact that the original resistance levels were lower for this group. At the recall point, after the rest period, the resistance levels were lower than at any other point in the learning period. A gradual increase in resistance was evident as learning approached mastery, the increase being greater for the non-punished group. The frequency of PGR's (psychogalvanic responses) was greater for the punished group during the six initial learning trials and during early relearning, with the greatest difference during the first six relearning trials of the retroactive inhibition condition. During the last two trials of all conditions the number of PGR's was about equal for the two groups.

Correlation coefficients varying from $r = .55$ to .70 were found between the frequency of correct anticipations and the frequency of PGR's occurring during the period when the correct anticipations were made. This is true for both groups.

Contrary to other published research (2), no relationship was found between either the initial or final resistance levels and the speed of learning.

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