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One of the concepts most central to Clark L. Hull's[1] systematic theory of behavior is the concept of habit strength, a logical construct which represents the strength of learning in an organism. Habit strength has the status of an intervening variable, and by that, it is meant that it is an hypothetical state of an organism, which is functionally related to antecedent, observable and manipulable events, on the one side, and to certain response manifestations, such as latency, frequency, and resistance to extinction, on the other. It is the task of the experimentalist in the field of learning theory to isolate those variable of which this hyothetical learning state is a function, and even more, to state such functions in precise mathematical terms. Often such endeavors leave in their wake minor theoretical issues which are in the need of clarification. It is with such a minor problem that the present experiment is concerned.

The role of an irrelevant drive stimulus in the acquisition of habit strength came to attention indirectly. But first let me define the term, irrelevant drive stimulus. An irrelevant drive stimulus is one which is present in an organism at the time the intensity of another drive stimulus is diminished following an appropriate response by the organism. For example, the drive stimulus associated with the need state of hunger would be an irrelevant drive stimulus if a laboratory animal such as a rat were to run off an electrified grid in order to avoid shock, but receive no food as a consequence of his response.

The implication that the irrelevant drive stimulus contributes to habit strength derives jointly from two primary principles to which Hull gives formal status in his theory. The first of these is known as the "law of primary reinforcement". This principle states in effect that whenever a response occurs in temporal contiguity with a stimulus impulse, and this conjunction is closely followed by a diminution in the intensity of a drive stimulus, there will result an increased tendency for that stimulus on subsequent occasions to evoke that reaction. Thus, when a hungry animal turns left in a maze, and finds food, the tendency for the animal to turn left on subsequent occasions, when hungry and in the same maze, will be increased, and one says that the animal has learned.

The second primary principle states in effect that there is associated with every drive a characteristic drive stimulus. It follows logically from these two postulates that whenever an organism makes a response which is contiguous, or nearly so, with an *irrelevant drive stimulus,* and this conjunction is closely followed by a reinforcing state of affairs, there will be an increased tendency for that stimulus on subsequent occasions to evoke that response.

There are two experiments which contradict this corollary. The

result of one, by Howard Kendler[2], lead him to suggest, "that only those drive stimuli which are themselves reduced become conditions to the rewarded response." A second experiment by Wilse Webb[3] gave results which led him to conclude, "that an hypothesis concerning the role of an irrelevant drive as a contributor to effective habit strength must be rejected."

The present experiment was designed to further test the above corollary. The specific experimental problem is to determine whether a group of animals which have the same irrelevant drive stimulus present during the extinction of a response as was present during the acquisition of that response will show *greater response stability*

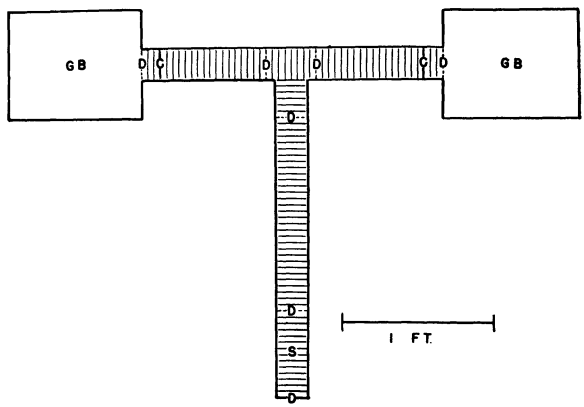

Fig. 1. Ground plan of maze. "D" represents vertical sliding doors. "C" indicates black felt curtains.

than a comparable group which has different irrelevant drive states during extinction and training. If the corollary is to receive experimental support, such must be the case.

EXPERIMENTAL METHOD

Subjects. The subjects were forty naive albino and hooded rats, of both sexes, from the colony maintained by the psychology department at the State University of Iowa.

Apparatus. The ground plan of the apparatus is shown in Fig. 1. A standard shock box was used to introduce the current to the grid floor of the T maze. A one way screen separated the experimenter from the maze.

Procedure. Prior to the experiment, the animals were randomly assigned to four groups, which are designated with letters to indicate the drive state during the training series and the extinction series. The groups were as follows: an H-t group, a T-h group, an H-h group, an a T-t group. The capital letter indicates the drive state during the training of the response, and the small letter that during the

extinction of the response. Except for these drive state differences, the experimental procedure was the same for all groups.

Training consisted of ten "escape from shock" reinforced trials a day for five successive days. The animal's choice on the initial trial designated the goal box to which the animal was run on all subsequent trials. An error was defined as body length entry into the arm of the maze opposite the goal box designated by the initial choice. On such occasions, the animals were confronted with a closed goal-box door, and they were forced to correct their run by turning and going to the opposite goal-box. Neither food nor water was given in the goal boxes.

During the extinction trials no shock was given. The anxiety aroused by the maze environment was sufficient to motivate the animals to seek escape from the grid. The animals were given five trials a day for four successive days during the extinction trials. A record was kept of the correct and incorrect responses for each animal. A correct response was one where the animal went to that side of the maze to which it had been trained to go, and an incorrect response was body length entry into the opposite arm of the T maze.

RESULTS AND DISCUSSION

It will be recalled that half of the animals underwent the extinction series with a *different* irrelevant drive stimulus than that present during the training trials. These were the animals of Groups H-t and T-h. The other half underwent both phases of the experiment under the *same* irrelevant drive stimulus conditions. These were the animals of Groups T-t and H-h. For the purpose of analysis, the latter two groups were combined, and designated the SAME group, and the first two were combined and designated the DIFFERENT group. It was the SAME group which was expected, on the basis of the corollary presented, to demonstrate greater stability of response. The mean number of correct responses during the extinction series were compared statistically.

Because the variances of the two groups were significantly different as indicated by an F test, the classical "t" test could not be utilized. The mean number of correct responses for the SAME drive group was 11.8, and for the DIFFERENT drive group, 8.2. To avoid the assumption of equal variances demanded by the classical "t" test, the scores of each group were randomly matched. A "t" test for related measures was utilized. The obtained "t" value was 2.27 which was significant above the 5% level of confidence, at 19 degrees of freedom.

The data, therefore, tend to support the hypothesis that an irrelevant drive stimulus contributes to effective habit strength. The experiment, however, is not completed. Another group of ten animals will run. In view of the disagreement of this study with the two ex-

periments mentioned in the introduction, the possibility that the differences obtained were chance differences can not be dismissed.

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