DOCUMENT RESUME

ED 102 937 IR 001 606

AUTHOR Keller, John M.
TITLE Determinants of Learned Helplessness in Problem Solving.
PUB DATE Apr 75
NOTE 51p.; Paper presented at the Association for Educational Communications and Technology Annual Conference (April 14-17, 1975)

EDRS PRICE MF-$0.76 HC-$3.32 PLUS POSTAGE
DESCRIPTORS Behavior; Educational Psychology; *Failure Factors; Instructional Improvement; *Instructional Technology; Learning Difficulties; *Learning Disabilities; Learning Motivation; Learning Processes; Learning Theories; Motivation; Problem Solving; *Psychological Studies; *Reinforcement
IDENTIFIERS *Learned Helplessness

ABSTRACT

Despite the support for the proposition that learning is enhanced by the reinforcement of correct responses, there remain learners who continue to fail when contingent reinforcement is administered, even though they may have the ability and be motivated to succeed. This condition, known as learned helplessness, presents a problem for instructional technology in that reinforcements do not strengthen a response. In this study, 54 subjects were given a training task that involved using a manipulandum to attempt to escape from an audible tone that was varied in amplitude from mild to aversive. It was found that subjects who were unable to escape during the acquisition trials showed the greatest decrement in performance during the transfer test. The study demonstrated that in laboratory settings, both instructions and reinforcement contingencies contribute to the development of learned helplessness. This phenomenon may be valuable to instructional technology because it will lead to a greater understanding of the etiology and treatment of chronic failure behavior which is independent of ability on the part of school children. (Author/DGC)

DETERMINANT` OF LEARNED HELPLESSNESS IN PROBLEM SOLVING

John M. Keller

Syracuse University

Despite the support for the proposition that learning is enhanced by the reinforcement of correct responses, there remain learners who continue to fail when contingent reinforcement is administered, even though they may have the ability and be motivated to succeed. This condition, known as learned helplessness, presents a problem for instructional technology in that reinforcements, whether administered by a human teacher or a programed format, do not strengthen a response. Hence, it is presumed that additional knowledge about the development of learned helplessness will have implications for instructional designs aimed at alleviating the condition. In previous studies of this problem the instructions given the subjects (Ss) have contained cues which may have interacted with the actual reinforcement contingencies. In the present study an attempt was made to control for both instructions and reinforcement contingencies. Each of 54 Ss was given a training task that involved using a manipulandum to attempt to escape from an audible tone that was varied in amplitude from mild to aversive. The training task was followed by a transfer test at a second manipulandum in which the task was to escape or avoid an audible tone. It was found ($p<.05$) that Ss who were unable to escape during the acquisition trials showed the greatest decrement in performance during the transfer test. Furthermore, instructions which correctly described the task and contingencies facilitated escape performance, but incorrect descriptions or no descriptions inhibited it. And, it was found that instructions interacted with the training task in such a way that only those Ss who could escape during the training task, and also were told that escape was possible, escaped in significantly less time than all other groups. In conclusion, the present study demonstrated that in laboratory studies, both instructions and reinforcement contingencies contribute to the development of learned helplessness. This phenomenon has value in instructional technology because of its potential for contributing to a greater understanding of the etiology and treatment of chronic failure behavior which is independent of ability on the part of children in school.

DETERMINANTS OF LEARNED HELPLESSNESS IN PROBLEM SOLVING[1]

John M. Keller[2]

Syracuse University

In recent years there has been a strong tendency in instructional technology to view the teacher's role as primarily that of a manager of the learning environment. In some cases this view is based, at least in part, on the principle of reinforcement. Skinner (1968), for example, has stated that "teaching is simply the arrangement of contingencies of reinforcement under which students learn [p. 64]." However, there has been a growing body of research which purports to challenge the position that learning occurs automatically as a consequence of contingent reinforcement (see Bolles, 1972; and McKeachie, 1974 for reviews). Many of these studies which are of direct relevance to instructional technology have demonstrated conditions of instructional design under which reinforcement in the form of knowledge of results failed to improve learning (e.g. Lublin, 1965). Other studies, using extrinsic rewards, have demonstrated that these rewards are differentially effective. Praise, for example, has been effective with normal achievers but not low achievers in the third grade (Blair, 1972), and with low achievers in spelling, but not language or arithmetic in elementary school (Levin, 1972).

Also relevant, although usually less directly so, are learning paradigms studied in the laboratory with infrahuman subjects (<u>S</u>s). In one such area of research which does have strong implications for instructional technology in general, and mediated instruction in particular, it has been discovered that under certain problem solving conditions an animal will actually learn that the reinforcements it receives are independent of its responses; that is, the animal learns that no matter how it responds, the reinforcements it receives are unrelated to its responses. And furthermore, this relationship, or expectancy, on the part of the animal will transfer to a new problem solving situation. When presented with a new task in which reinforcement is contingent on the animal's response, the reinforcement will fail to strengthen the response.

Specifically, Maier, Seligman, & Solomon (1968) found that if a dog were pretreated with a series of unavoidable, inescapable traumatic shocks, the dog would not learn to escape when put into a shuttlebox and shocked, even though escape was possible by jumping over a barrier across the middle of the box. Naive dogs readily learned the appropriate escape response, and also learned to avoid the shock altogether by jumping over the barrier during the presentation of a signal preceding the shock (see Solomon & Wynne, 1953, for a detailed description of how dogs are conditioned in a shuttlebox to avoid electric shock). But pretreated dogs would tend to passively accept the shock within a few trials. Occasionally a pretreated dog would jump over the barrier and escape the shock, but evidently the dog did not learn from this experience since it continued to accept the full shock on subsequent trials.

This phenomenon was called learned helplessness by the experimenters, and it was postulated that the animals were learning that there was independence between their responses and the reinforcements they received. This would account for their lack of response under the transfer test conditions, and for their failure to associate shock termination with jumping over the barrier when they did respond. Furthermore, it was found that once learned helplessness has been established, it can be difficult to extinguish. Overmier & Seligman (1967) found that if 48 hours elapsed between acquisition training in the harness, and escape/avoidance test trials in the shuttlebox, the effects of pretraining would have extinguished, and the dog would learn to escape and avoid normally. But, if a dog were placed in the shuttlebox 24 hours after acquisition training in the harness, and if the dog failed to escape, the dog would again fail to escape after rests of up to 168 hours (Seligman & Maier, 1967). Therefore, the learned helplessness effect could be maintained, perhaps indefinitely, with repeated experience of nonescape. In an effort to break up the interference effect, Seligman, Maier, & Geer (1967) were able to do so by removing the barrier from the shuttlebox and pulling the dogs back and forth across the box with leashes. With the three chronically helpless dogs they used, it took 20, 35, and 50 trials before the dogs began to respond on their own. Once they began, the barrier was replaced and the dogs continued to escape and avoid. Maier et al. (1968) reported that the recovery was complete and lasting.

The implication of these studies of extinction and reversibility would seem to be that although an organism has failure experiences which can even lead to a condition of helplessness, the effects of this experience can be reversed. However, it may be that failure experiences can have irreversible effects on the organism's behavior, at least at a particular time in an organism's development. Bainbridge (1972) found that experience with an unsolvable problem during a particular period of the rat's evelopment could permanently impair the animal's problem-solving ability. During their fiftieth to sixtieth day of development, one group was given a series of unsolvable visual discrimination tasks, while a second group had solvable tasks, and a third group stayed in the cage. After a 20-day interval, the rats in the first group showed a deficit in their ability to learn solvable problems of the same type, and their deficit generalized both to problems from a test of general intelligence, and discrimination problems in a spatial modality. Therefore, the early failure experience tended to generalize across modalities, and to new tasks.

These results would suggest that additional study of the effects of experiences with an inescapable aversive stimulus are needed. They suggest that the deleterious effects of learning that the reinforcements one receives are independent of one's responses in particular situations may be stronger than was suspected.

If the same phenomenon is found to exist with human Ss, it implies that students who could be characterized as learned helpless would benefit most from a different instructional design than that which would be most effective for students who respond to contingent reinforcement. Based on such an assumption, Dweck (in press) compared two groups of elementary children whom she identified as helpless with respect to arithmetic performance, and a control group of nonhelpless (i.e. persistent) children. She gave one group of helpless children a learning program which provided success experiences only, and the other group a program which allowed the children to fail, but taught them to take responsibility for their failure by attributing it to lack of effort rather than lack of ability. It was found that in the criterion situation following training, children in the success only group deteriorated rapidly in their performance once they experienced failure, but children in the attribution retraining group maintained or improved their performance.

Thus, it seems clear that further inquiry into the learned helplessness phenomenon in human behavior has value for instructional technology by establishing a firmer tie between basic research in human behavior and instructional practices. There have been several recent studies (Dweck & Reppucci, 1973; Hiroto, 1974; Hiroto & Seligman, in press; Krantz, Glass, & Snyder, 1974; Thornton & Jacobs, 1973) which have demonstrated that the learned helplessness effect can be produced in the development of escape or avoidance behavior with human Ss. The designs of these studies were based on the previously described paradigm developed in the study of infrahuman Ss. However, in adapting the paradigm to the study of human behavior, several changes in procedures were introduced. And, in addition to the differences between the studies with humans and those with infrahumans, there are notable differences among the studies with human Ss. In the studies with human Ss, aversive stimuli of several types and magnitudes were used, and instructions were included which, at times, described both the task and the contingencies.

In the study by Dweck & Reppucci (1973) using fifth grade children, the aversive stimulus was failure to solve a block design problem, and each S served as his own control. There were two experimenters (Es) who presented problems in a randomly ordered sequence. During the acquisition phase, one E consistently presented S with unsolvable block design problems, and the other presented solvable problems. It took Ss significantly longer ($F = 82.0$, $df = 1, 37$, $p < .01$) to solve the two problems administered by the failure E than the two administered by the success E. In fact, a number of Ss did not solve one or both of the test problems given by the failure E, even though they readily solved the other two problems during the 20 secs. allowed. Thus, in this study, when a child learned to associate unavoidable failure with one of the two Es, he continued to fail even when the problems became solvable, and he was solving identical problems presented by the success-associated E.

The Thornton & Jacobs (1971) study more nearly repeated the learned helplessness paradigm with human Ss. As the aversive stimulus, the experimenters (Es) used electric shock. The experimental training groups included one which could avoid shock and one which could not. There were also two levels of stress; one half of the Ss received a fixed level of shock, and the other half a variable level. The learned helplessness effect was obtained with the variable shock group, but not with the fixed shock group, although the trend in the latter group was in the same direction. However, there were several differences between the procedures of this study and those of the animal studies (Maier, Seligman, & Solomon, 1968). One of these, the way in which instructions were used, is of particular importance in the present context. Each experimental group in the Thornton & Jacobs (1971)study was given instructions which described the task, the contingencies, and the nature of the aversive stimulus to be used. All Ss were told that whenever one of three green lights was turned on, their task was to press the button located beneath that light. Furthermore, Ss in the avoidance groups were told that shock would result from slow or incorrect responding, and Ss in the no-avoidance groups were told that the inescapable shocks they would receive were unrelated to their task. Finally Ss were also told whether they would be receiving fixed or variable shock. Therefore, it is not at all clear whether the behavior observed in this experiment can be described as contingency-governed rather than rule-governed (Skinner, 1969). The Es stated that it did not matter. They said,

> Whereas animals transferred a self-learned helplessness state, humans transferred an instructionally set, internally verified, learned helplessness state. The point is that they did transfer "helplessness" to a second task which, in fact, offered control [p. 371].

Actually, it does make an important theoretical difference. If the behavior was under the control of the contingencies in this experiment, then it supported the position that Ss were giving up in their effort to escape or avoid an aversive stimulus; that is, they were learning that there was independence between their responses and the reinforcements they received. But, if the behavior was rule-governed, the Ss may have felt positively reinforced for not responding in some groups, because they believed this to have been the appropriate behavior. It will be recalled, for example, that the instructions to the no-avoidance Ss described exactly what task to perform during acquisition, and also stated that shock would be delivered independently of S's responses. This could very well have indicated to S that he was expected to be able to "take" the shock. Then, during the test trials, when S was simply told that there was a task to perform, there is no reason to assume that he was in any way motivated to try to discover a contingency between his responses and the shocks he received. On the contrary, he may have felt positively rewarded for successfully withstanding the shocks. Nothing in the debriefing comments of the Ss which were reported would contradict this interpretation.

In Hiroto's (1974) study, there were three acquisition groups. Two groups were given thirty trials in which a 110-db. tone was presented at 3000 Hz. through a set of headphones for 5 secs. at random intervals. The Ss in one of these groups could stop the tone by one press on a button located on a table at which they were seated. The button was inoperative for Ss in the second group; there was nothing they could do to stop the noise. However, the following instructions were given to both groups:

> Listen to these instructions carefully. I am not allowed to give you additional information other than what is given to you now. So please listen and do not ask me any questions. From time to time a loud tone will appear. When the tone comes on, there is something you can do about it [p. 189].

Obviously, these instructions contain a true description of the reinforcement contingencies for the escape group, and a false description for the no-escape group. The third group was a control group which received neither the training trials nor the instructions.

When Ss were tested during the transfer phase of the experiment, it was found that there was a significant ($F = 12.38$, $df = 2,84$, $p < .01$) difference in latency of response among the subgroups who were not able to escape during acquisition training ($\overline{E}$), those who could escape during acquisition training (E), and the control subgroups (C). Planned orthogonal comparisons indicated that $\overline{E}$ had significantly longer latencies than the average of E and C, and that the difference between E and C was not significant. This variable (i.e., type of acquisition training) also interacted significantly with trial blocks ($F = 2.29$, $df = 10,420$, $p < .05$). The latencies of all subgroups decreased as the number of trials increased and, apparently, the latencies of E and C decreased more rapidly than those of $\overline{E}$.

The same basic design which was introduced by Hiroto (1974) was used in a subsequent study by Hiroto & Seligman (in press), although there were some changes in the independent variables and the type of control group used. In this study, the generality of learned helplessness was established by using two types of aversive stimuli in the acquisition phase, and crossing each type of training with each type of aversive stimulus in the test phase. The aversive stimuli were a 90 db. tone, and insolvable discrimination problems. There were also escape (E) groups which could escape the tone or solve the problems, and a control (C) group which was told to simply listen to the tone or look at the problems. As in the two previously described studies, explicit descriptions of the contingencies were included in the instructions.

As in the Hiroto (1974) study, the $\overline{E}$ group was found to have a significantly ($p < .05$) greater mean response latency than the other groups (E and C).

Krantz, Glass, & Snyder (1974) reported two experiments designed to show the relationship between the coronary prone behavior pattern, learned helplessness, and stress. They used the previously described methodology established by Hiroto (1974) to produce learned helplessness in their Ss, and their results were the same: Ss who were unable to escape during acquisition training took longer to learn to escape, if they learned at all, during the test phase.

While a learned helplessness effect was obtained in all of these studies which was topographically similar to that obtained in the animal studies, it is not at all clear whether the controlling variables were the same due to the potentially confounding effect of instructions.

Statement of the Problem

Although an attempt was made in the three studies using an aversive tone (Hiroto, 1974; Hiroto & Seligman, in press; Krantz, Glass, & Snyder,

1974) to control for the effects of instructions by giving the same instructions to each group during acquisition training, the instructions were worded in a manner which correctly described the contingencies for the E groups, but incorrectly described them for the $\bar{E}$ groups. It would seem plausible that in the case of the escape groups, responding would have been facilitated because of the congruence between instructions and contingencies, while in the no-escape groups responding would have been inhibited because the actual contingency of no control would override the instructions. This would have resulted in behavior similar to that of the animals in the previous learned helplessness studies. However, previous research has shown that such a literal prediction of the effects of instructions on behavior under a particular reinforcement schedule may be unwarranted. Turner & Solomon (1962) reported that in the absence of instructions in studies of human traumatic avoidance learning, many Ss fail to learn the desired response. However, when instructions are included, the behavior may be more consistent with instructions than with the reinforcement schedule (Lippman & Meyer, 1969). In a study using a fixed-interval reinforcement schedule, Baron, Kaufman, & Stauber (1969) found that in the absence of instructions, Ss' reactions to the actual contingencies were imprecise, and differed both from what one would expect from the contingencies and from observed behavior of infrahuman Ss under similar contingencies. When instructions about the contingencies were given in conjunction with exposure to the actual contingencies at the start of training, behavior was obtained which was consistent with the contingencies and with behavior of infrahuman Ss. These experimenters concluded that if the goal of the experimental analysis of behavior is concerned with studying variables with major controlling influences on human behavior, then study of the effects of instructions is necessary, and is capable of being studied objectively as an observable determinant of behavior. One of the major research questions of the present study was concerned with the separate effects of instructions and reinforcement contingencies in the development of learned helplessness.

The other major question had to do with the effects of the aversive stimulus used in the development of learned helplessness with human Ss. In the animal studies, a traumatic level of shock was used, and it was presumed to be reinforcing for the animal to terminate or avoid the shock. As has been described, naive animals typically did learn to escape and avoid the shock. Learned helplessness resulted when the animal experienced repeated trials in which the presentation and termination of the shock was independent of its responses. In the studies which have produced a learned helplessness effect with human Ss, it is not clear whether escape from the aversive stimulus was reinforcing independently of the discriminative cues contained in the instructions presented by the E. It may be that helplessness resulted more from failure to learn to act in accordance with the instructions than from the aversive stimulus itself. Conversely, reinforcement may have resulted more from success in responding in accordance with the instructions than from the actual escape from the aversive stimulus. This question was suggested by the fact that the interference effect has been obtained with such a variety of stimuli, including unsolvable block design problems (Dweck & Reppucci, 1973), unsolvable discrimination problems (Hiroto & Seligman, in press), and 3000-Hz. tones ranging in amplitude from 78 db. to 110 db. (Hiroto, 1974; Hiroto & Seligman, in press; Krantz, Glass, & Snyder, 1974). Thus, the resulting behavior of those who failed, or perceived themselves as failing, may have been identical to the learned helpless behavior of the animals, but the controlling variables would not have been the same.

Therefore, the two major research questions in the present study were: (1) What are the separate effects of instructions and reinforcement contingencies in the development of learned helplessness, and (2) what is the effect of the aversiveness of the stimulus used in the escape/avoidance procedures in the development of learned helplessness with human Ss?

With respect to reinforcement contingencies, it was expected that Ss who were able to escape during the acquisition phase (the E group) would learn to escape significantly ($p < .05$) more quickly, i.e., would have shorter escape latencies, during the test phase, than Ss who could not escape during acquisition training. It was also expected that this difference would increase over trial blocks, i.e., that this variable would interact with the variable of trial block, since Ss in the E group were expected to learn the correct response in fewer trials than Ss in the $\bar{E}$ group. Furthermore, it was expected that the E group would reach the escape criterion of three successive trials of escape and/or avoidance in significantly fewer trials than the $\bar{E}$ group, and that the total number of failures to escape would be significantly less for the E group.

The instructions used in previous studies were generally of a type which indicated that there was a task to be performed, and that success in the task was contingent on S's making the proper response. Specifically, in Hiroto (1974), Hiroto & Seligman (in press), and Krantz et al. (1974) the instructions which preceded acquisition training for both the E and $\bar{E}$ groups indicated that there was a task and that the solution to the task was contingent on S's responses; i.e., that there was something S could do to stop the tone. The Thornton & Jacobs (1971) study differed in that the $\bar{E}$ subgroup was told that there was nothing they could do to prevent or stop the aversive stimulus. Thus, the relationships between the verbal descriptions of the contingencies and the actual contingencies varied between the two experiments, and were confounded in each experiment since there was no way to separately test the effects of the instructions and the actual contingencies.

In the present study a means of separately comparing the effects of instructions and reinforcement contingencies was provided by including groups which received instructions that correctly described the contingencies, and groups which received incorrect descriptions. Furthermore, in order to have a means of testing the effects of the contingencies independently of instructions, regardless of whether the instructions provided correct or incorrect descriptions, groups were included which received no instructions. In order to accomplish these comparisons, three instructional-set subgroups were included under both E and $\bar{E}$ acquisition training conditions. One subgroup was told that there was something they could do to stop the stimulus (positive instructional set), a second subgroup was told there was nothing they could do (negative instructional set), and a third group was not given any instructions which indicated what the contingencies were, or that there was a task to be performed (no instructional set). This design allowed comparisons within each of the escape and no-escape conditions, as well as comparisons across those two conditions.

As a means of testing the effects of the degree of aversiveness of the stimulus, three amplitudes of an audible tone were used. A frequency of 3000 Hz. was used in order to be consistent with previous studies using a tone as the aversive stimulus. In those studies amplitudes of 110 db., 107 db., 90 db., and 78 db. have been used, with 107 db. and 78 db. included in the same study as purportedly high stress and moderate stress aversive stimuli. The two loudest tones were generally rated by Ss in those studies as being extremely unpleasant, and the other two as moderately unpleasant. Therefore, 107 db. and 78 db. were chosen for two of the three amplitudes to be used in the present study since they apparently represent discriminably different levels of unpleasantness. A third level 45 db., which is no louder than the ambient noise in many rooms, was added in the present study to represent a presumably neutral to mildly unpleasant range.

Method

Design

Independent variables. Ss were randomly assigned in equal numbers to an escape (E) or no-escape ($\overline{E}$) group, and to one of the three instructional set groups: positive instructional set (+I), negative instructional set (-I), or no instructional set ($\overline{I}$). Ss were also randomly assigned in equal numbers to one of the three levels of amplitude of the 3000-Hz. tone. A fourth independent variable was trial block, which consisted of 6 blocks of 3 trials each.

Dependent variables. The dependent variables consisted of response latency, number of required trials to reach the escape criterion, trials to avoidance criterion, and number of trials where S failed to escape. All measures of dependent variables were taken during the 18 test trials. Response latency was measured by the time that elapsed from the onset of the red light until $\underline{S}$ responded. If $\underline{S}$ failed to respond, a latency of 10 sec. was recorded. Trials to escape criterion was defined as three successive trials of escape responding. When avoidance responses occurred before the escape criterion was reached, the escape criterion was considered to have been met if three successive trials of escape and/or avoidance responding occurred. Trials to avoidance criterion was defined as three successive trials of avoidance responding. If $\underline{S}$ failed to reach either the escape or the avoidance criterion, a score of 21 was recorded for that dependent variable. A failure to escape was equivalent to a failure to respond since $\underline{S}$ could only fail to escape in the event that he had already failed to avoid. Therefore, it was possible to determine how many failures to escape occurred, and on which trials, by recording those trials for which a response latency of 10 secs. was recorded.

Statistical model. With two dependent variables (response latency and failures to escape), the model of a multifactor experiment having repeated measures (Winer, 1971) on the trial block variable was used. With the remaining two dependent variables (trials to escape criterion and trials to avoidance criterion) the trial block variable was omitted, and a factorial model (Winer, 1971) was used with the remaining three independent variables.

Subjects

The $\underline{S}$s were 54 undergraduate students enrolled in educational psychology courses during the first summer session, 1974, at Indiana University. They were told that they were volunteering for an experiment in noise pollution which would involve listening to some loud noises, but that nothing harmful or embarrassing would happen to them. Students in these classes were not required to participate in experiments, but Ss in some classes were told that they would receive points from their instructors for participating, and all Ss were told that they would receive $2.00 at the end of the experimental session. Ss were instructed to refrain from discussing the experimental procedure with anyone until all data were collected. They were told that the full purpose and results of the experiment would be presented to their class at a later date. Therefore, no S was told the purpose of the experiment at the end of a session.

Apparatus

There were two distinctly separate manipulanda, which were used in two successive phases of the experiment. The first manipulandum was used during the acquisition, or escape training, phase of the experiment, while the second was used during the transfer, or escape/avoidance, phase. The training unit consisted of a small red response key set in the middle of a 3 X 3 3/4 X 1 1/2" metal chassis box, and a pair of Koss Pro 4AA headphones. Both items were located on a table at which S was seated.

For the transfer phase S and the headphone were moved to a different table which contained a modified "Manipulandum Type-S" human shuttlebox (Turner & Solomon, 1962). This box, 22 X 6 X 6", contained a handle, 2 X 2 X 3", that was attached to a sliding wooden block. The handle could be moved the length of the box, and it would cause the block to close a hidden microswitch at either end of the box (see Hiroto, 1971, for an illustration). On top of the box, at the midpoint near the back, was a small 28 v. lamp in a light fixture with a red lens which was used to signal the imminent onset of the aversive stimulus.

The remaining equipment was located at E's station behind a partition which completely screened E and all equipment from S. The E was able to observe S through a one-way window, and S was seated with his back toward the partition. Additional control of extraneous cues was provided by the mufflers on the headphones, and a click generator located in the experimental station.

A 3000-Hz. tone of either 45, 78, or 107 db. was delivered to the headphones by a Heathkit Model EUW-17 Sine/Square Wave Generator. The sound level was calibrated with a General Radio Sound Level Indicator, Type 1551-A, by placing the microphone into a tightly fitting hole in a piece of 1/2", 7-ply hardwood to simulate an artificial ear, and then holding the headphone tightly against it. Also, certain instructions were prerecorded on a Sony, Model TC105A, reel-to-reel tape recorder and delivered through the headphones. The tape recorder was operated manually by E at the appropriate times.

Response latency was measured with a Hunter Digital Timer and Display unit. The latency measure of each trial was manually recorded by E. Records of the durations of signal presentation, tone presentation, and intertrial interval, and of the responses made during each of those events were recorded on a 6-pen ink writing operations recorder, Model P2-C, Ralph Gerbrands Co. The cumulative number of responses made during each event were also recorded on BRS, CT-311, electromechanical counters.

Both response manipulanda were connected to solid state BRS 300 series logic circuitry which controlled the onset, duration, and offset of the red light and tone, and the operation of the equipment which recorded data related to the dependent variables. The duration of the intertrial interval was controlled by a film reader made by Lehigh Valley Electronics, which was connected to the logic circuitry. The logic which was appropriate for a given procedure (e.g., acquisition trials for $\bar{E}$ Ss) could be selected by E by throwing two single-pole, double-throw switches to the appropriate positions.

Procedure

During the training phase, all Ss received 30 trials consisting of a 5-sec. presentation of the tone to the $\bar{E}$ group followed by an inter-trial interval varying randomly in 1-sec. intervals from 10 to 20 secs. with a mean of 15 secs. The same procedure was followed with the E group with one exception. Ss in the E group could terminate the tone prior to its 5-sec. automatic termination by depressing the response key two times following its onset. Responses emitted prior to the onset of the tone would neither result in avoidance, nor reduce the number of responses required for escape.

During the transfer test phase, all Ss received 18 trials. If there was no response during a given trial, the trial consisted of the red light on the shuttlebox being turned on for a 5-sec. duration, followed immediately by a 5-sec. presentation of the tone at the appropriate decibel level. If S responded during the presentation of either stimulus by moving the handle in such a manner as to close both microswitches, the trial terminated and the randomly varying intertrial interval (range = 10-40 sec.; mean = 15 secs.; increments = 1 sec.) began. Both switches had to be closed during the presentation of one of the two stimuli, as the switching circuitry automatically reset to a zero count at the termination of the light, the tone, and intertrial interval. Responses terminating the light were recorded as avoidance responses, and responses terminating the tone were recorded as escape responses.

Following an introduction, E went to his station and provided the instructional set for the appropriate groups. For Ss in the +I group, the following tape-recorded instructions were played over the headphones:

> Listen to these instructions carefully. I am not allowed to give you any information other than what I give you now. So please listen carefully and do not ask any questions. From time to time the noise you heard will come on for awhile. When that noise comes on there is something you can do to stop it. If you find out how to do it you will be able to stop the noise. If you are not successful in stopping it, it will stop automatically. Taking the headphones off or dismantling the equipment is not the way to stop the noise.

For Ss in the -I group, the following prerecorded instructions were played over the headphones:

> Listen to these instructions carefully. I am not allowed to give you any information other than what I give you now. So please listen carefully and do not ask any questions. From time to time the noise you heard will come on for awhile. When that noise comes on, there is nothing you can do to stop it. Please do not take the headphones off.

Immediately following the instructional set period, the 30 acquisition trials began. For the E groups, a response, defined as two button presses, stopped the tone prior to its automatic termination at the end of the 5 secs. For the $\bar{E}$ group, the tone had a 5-sec. duration for each of the 30 trials.

After the completion of the 30 acquisition trials, E intervened and told S to move to the other table, which contained the shuttlebox that had been covered by a cloth since before the session began. E then returned to his station and either presented the appropriate tape-recorded instructions, or, for the $\bar{I}$ Ss, began the transfer trials. Instructions for the +I Ss were:

> You will be given some trials in which a noise will be presented to you. Whenever you hear the noise come on, there is something you can do to stop it. Taking the headphones off or dismantling the apparatus is not the way to stop the noise. Now uncover the apparatus and we'll begin.

And, instructions for the -I Ss were:

> You will be given some trials in which a noise will be presented to you. Whenever you hear the noise come on, there is nothing you can do to stop it. Please do not take off the headphones. Now uncover the apparatus and we'll begin.

Immediately following these instructions, the 18 transfer test trials began for the +I and -I groups.

Following the transfer test trials, each S was paid $2.00, reminded that the purpose of the experiment would be explained at a later time, and asked not to discuss the experiment with anyone until all data had been collected.

Results

The presentation of results will be for each of the dependent variables in turn. Unless otherwise indicated, the critical region chosen for tests of significance corresponded to the 5% level of significance.

Latency of Response

As previously indicated, latency of response refers to the time elapsed from the onset of the signal on each of the 18 transfer test trials until S responded. If S failed to respond during the 10 secs. (5 secs. of red light followed by 5 secs. of tone), a latency of 10 secs. was recorded.

As was expected (Table 1), the E group ($\bar{X}$ = 8.18) escaped in significantly less ($F_{1,36}$ = 20.40) time than the $\bar{E}$ group ($\bar{X}$ = 9.88). Since these two groups differed only in the type of acquisition training they received, this result was interpreted as demonstrating the interference effect (learned helplessness) which results from no-escape training. This interpretation was not contradicted by the significant interaction between this variable and trial block. The mean latency of the E group decreased as a function of trial blocks at a faster rate than that of the $\bar{E}$ group (see Fig. 1). Scheffe S tests indicated that the latency of the E group was significantly smaller than the $\bar{E}$ group from the 2nd through the 6th trial block.

Insert Table 1 about here

Since this variable did not interact with any variable other than trial blocks, it was concluded that the interference effect on latency of response produced by $\bar{E}$ training in the present study was independent of the effects of instructions and the decibel level of the tone.

Insert Figure 1 about here

However, there was a significant difference among the three instructional-set groups ($F_{2,36} = 4.93$). The +I group had the shortest mean latency ($\bar{X} = 8.22$) while the -I group had the longest ($\bar{X} = 9.61$) and the $\bar{I}$ group had a mean of 9.26. The significant interaction of this variable with trial block can be explained in part, at least, by the fact that the means of the +I group at trials blocks 5 & 6 (see Fig. 2) are significantly smaller than either of the other two groups as determined by pairwise comparisons using Scheffe S tests. These results indicate that a -I or $\bar{I}$ instructional set produced an interference effect on response latency which was similar to that produced by no-escape training. It is of interest to note that the combination of either of these two instructional sets and no-escape training produced an interference effect that was complete;

that is, the mean latencies for $-I \times \overline{E}$ groups and $\overline{I} \times \overline{E}$ groups were equal to 10.00 across all trial blocks, which indicates that no S in those two groups learned to escape during the test trials.

Insert Figure 2 about here

The absence of a main effect due to decibel level is consistent with previous findings, as was previously mentioned, in which interference has been produced with such a variety of stimuli. In studies with humans, at least, it is not necessary to use an unconditionally aversive event as the stimulus to be escaped from or avoided.

Trials to Escape Criterion

It will be recalled that Ss were considered to have reliably learned to escape after having escaped on three successive trials or, in the instances where avoidance was learned before escape was established, after three successive trials of escape and/or avoidance. Ss who did not meet the criterion during the 18 test trials were assigned a socre of 21. There were significant main effects for both the E vs. $\overline{E}$ variable, and the instructional set variable (Table 2). However, both of these variables were also involved in interactions which complicate their interpretation.

Insert Table 2 about here

The simple main effects analyses (Kirk, 1968; Winer, 1971) of type of acquisition training (E) at each level of instructional set (I) separately indicated that of the Ss in the +I instructional set group (see Fig. 3), those who had E acquisition training ($\bar{X}$ = 7.78) learned to escape in significantly fewer trials than those who had $\bar{E}$ training ($\bar{X}$ = 18.67). The differences between the E and $\bar{E}$ groups who had -I or $\bar{I}$ instructions were not significant. Also, there was a significant difference among the three instructional set groups who were in the E group. A Scheffe S test indicated that for the E group, (+I) < (-I) = ($\bar{I}$).

Insert Figure 3 about here

In other words, these results suggest that an interference effect, as measured by trials to escape criterion, was obtained for <u>all</u> groups <u>except</u> the one which had E acquisition training and +I instructions. This was demonstrated, on the one hand, by the lack of significant differences between the E and $\bar{E}$ groups when they had -I or $\bar{I}$ instructions, and, on the other hand, by the fact that among the levels of I at E, the -I and $\bar{I}$ groups required a significantly greater number of trials to reach escape criterion.

There was also an interaction between instructional set and decibel level. A simple main effects analysis of this interaction indicated that there were significant differences among the I groups (see Fig. 4) at the 107 decibel level ($F_{2,36}$ = 4.49). Scheffe S tests indicated that at the 107 db. level, (+I) < (-I) < ($\bar{I}$). At the 78 db. level, (+I) < (-I) = ($\bar{I}$). Thus, although the main effect for decibel level was not significant, it was the case that <u>Ss</u> in the +I group learned to escape in significantly fewer trials than the -I and $\bar{I}$ groups when the tone was at 107 db. and 78 db. Also, the -I group learned to escape in significantly less time than the $\bar{I}$ group when the tone was at 107 db.

Insert Figure 4 about here

Trials to Avoidance Criterion

The avoidance criterion, it will be recalled, was defined as three successive avoidance responses during the 18 test trials. Ss who failed to meet the criterion were assigned a score of 21. There was not a significant effect due either to decibel level or to instructional set (Table 3), but there was a significant effect due to type of acquisition training. Ss in the $\overline{E}$ group ($\overline{X}$ = 20.89) learned to avoid in significantly more trials than Ss in the E group ($\overline{X}$ = 18.15). However, a large proportion of Ss in both groups failed to achieve the avoidance criterion.

Insert Table 3 about here

It will be recalled that there was a significant main effect of instructional set for the trials to escape criterion, and it might have been expected that a similar effect would be found for trials to avoidance. However, it was the case that in the instructions given to both the +I and -I groups the possibility of escape was mentioned, but nothing was said about avoidance. Therefore, it appears that regardless of the instructions they received, or the decibel level to which they were exposed, Ss who were able to escape during acquisition training learned to avoid during the test trials more often than Ss in the $\overline{E}$ group. A similar finding was obtained by Hiroto (1974). In his study, the main effect for trials to avoidance criterion was not significant, but a planned comparison was. The mean of the E groups was significantly smaller than the average of the means of the $\bar{E}$ and control groups.

Number of Failures to Escape

A failure to escape occurred by definition when S neither avoided nor escaped from the 3000-Hz. tone during a test trial. As was the case with several of the preceding analyses, there were significant main effects for both the acquisition training and the instructional set variables; however, both of these variables were involved in several interactions (Table 4).

Insert Table 4 about here

In the interaction of acquisition training with trial block (see Fig. 5), several Ss in the E group learned to escape during the first trial block ($\bar{X}$ = 2.44), but none of those in the $\bar{E}$ group did so ($\bar{X}$ = 3.00). Even though some Ss in the $\bar{E}$ group began to learn to escape following the first trial block, the differences between the means of the two groups generally increased across trial blocks. The mean for the $\bar{E}$ group never dropped below 2.8, which indicates that no-escape acquisition training was highly effective in interfering with escape responding during the test trials.

Insert Figure 5 about here

The instructional set variable also interacted with trial block (Table 4). Scheffe S tests of pairwise contrasts of the means of the I groups at each trial block indicated that none of the differences was significant at Trial Block 1, but that at each of the remaining trial blocks, $\overline{X}_{+I} < \overline{X}_{-I} = \overline{X}_{\overline{I}}$ (see Fig. 6). These results are consistent with those obtained on the latency of response dependent variable. That is, instructional set of -I or $\overline{I}$ produced an interference effect over trial blocks with respect to the number of failures to escape as well as with respect to latency of response.

Insert Figure 6 about here

An interaction was also obtained between instructional set and type of acquisition training. A simple main effects analysis indicated that there was a significant difference within the E group due to instructional set (Fig. 7). A Scheffe S test indicated that within the E group, $\overline{X}_{+I} < \overline{X}_{-I} = \overline{X}_{\overline{I}}$. Thus, it made no difference what the instructions were if Ss were given $\overline{E}$ acquisition training, but if they were given E acquisition training, there were significantly fewer failures to escape in the +I group.

Insert Figure 7 about here

It was also demonstrated by the simple main effects analysis that in comparisons of the E group with the $\overline{E}$ group at each level of I (see Fig. 7), Ss in the E groups which had +I ($\overline{X}$ = 0.8) and $\overline{I}$ ($\overline{X}$ = 2.2) instructions had significantly fewer failures to escape than Ss in the respective $\overline{E}$ groups ($\overline{X}$ = 2.6, 3.0). Apparently, -I instructions produced an interference effect as great as that caused by $\overline{E}$ training, while +I instructions facilitated escape behavior.

In the D x I interaction for number of failures to escape, a simple main effects analysis indicated that there were significant differences among the I groups at two levels of D (see Fig. 8), and among the D groups at one level of I. However, when the means were compared using Scheffé S tests, only one contrast was significant, viz., at 107 db., +I < $\bar{I}$. Therefore, the present results indicated that in terms of failures to escape, a more aversive stimulus (107 db.) may facilitate escape responding when combined with +I instructions in contrast to providing no instructions.

Insert Figure 8 about here

Discussion

The results of the present study generally supported the expectations regarding the effect of no-escape acquisition training on an escape/avoidance transfer test. They also provided some evidence about the relationship between instructions and reinforcement contingencies, and the effect of the degree of presumed aversiveness of the stimulus in the development of learned helplessness.

The fact that Ss who had $\bar{E}$ acquisition training showed a decrement in performance on all dependent variables during the escape/avoidance transfer test provided additional confirmation that a learned helplessness effect develops in human Ss that is at least analogous to that produced in infrahuman Ss. The results of the present investigation of this phenomenon directly confirmed the findings of Hiroto (1974), Hiroto & Seligman (in press), and Krantz et al. (1974) who, it will be recalled, used essentially the same procedures, and indirectly supported the findings of Dweck & Reppucci (1973), and Thornton & Jacobs (1971) who, as previously described, used somewhat different procedures. Additional confirmation was provided by the previously described interaction of acquisition training and trial block in the case of the dependent variable of number of failures to escape. This interaction demonstrated the interference effect in that the two groups did not differ significantly on Trial Block 1, and the performance of the $\overline{E}$ group did not improve significantly on subsequent trial blocks. However, in spite of this confirmation of previous findings, it was also found that the effect of no-escape acquisition training has to be qualified since the interference effect varied also as a function of instructional set. An additional complication was that instructional set interacted with type of acquisition training in the case of two of the dependent variables.

With respect to the concern of the present study with determining the effects of the instructions on the development of learned helplessness, it can be noted from the results that an interference effect was observed with respect to response latency, trials to escape criterion, and number of failures to escape. The nature of the interference effect associated with instructional set was, it will be recalled, that the group told that they could not escape the tone in acquisition (-I) and the group for whom escape from the tone was not even mentioned ($\overline{I}$) showed relatively less improvement over blocks of trials on the transfer task than the group told that they could escape the tone (+I). This suggests that instructional set exercised discriminative control over performance on the transfer task, since the interference effect was obtained for the -I and $\overline{I}$ subgroups relative to the +I group irrespective of the actual reinforcement contingencies. When one considers that the interference effect was obtained even with the $\bar{I}$ group, it suggests that the supposed aversive stimulus is insufficient in itself to make escape/avoidance behavior likely.

Additional insight into the effects of instructional set can be gained by considering the reported interactions between this variable and the nature of acquisition training. In fact, these interactions suggest that the interference effect obtained in previous experiments with human Ss may not have been simply, or even primarily, a result of $\bar{E}$ acquisition training. In the present study, only those Ss who had E acquisition training, and who also had +I instructions, learned to escape during the transfer test in significantly fewer trials, and had significantly fewer failures to escape, than all other groups. In other words, an interference effect was obtained in the present study for all Ss regardless of type of acquisition training except those who had both +I instructions and E acquisition training. All Ss in the prior experiments who had E acquisition training, and who as a consequence showed less interference, also had instructions which would seem to be equivalent to the +I instructional set in the present experiment. Among the previous studies attempting to extend the learned helplessness paradigm to human Ss (Hiroto, 1974; Hiroto & Seligman, in press; Krantz et al., 1973; Thornton & Jacobs, 1971) the only differences in procedures with respect to the relationship between instructions given prior to acquisition training and reinforcement contingencies were in relation to the $\bar{E}$ groups. It will be recalled that in the Thornton & Jacobs (1971) study, instructions were confounded with type of acquisition training in that Ss in the $\bar{E}$ group were told that responding was independent of shock presentation or duration while in the other studies, Ss in the $\bar{E}$ groups were told that the duration of the tone was contingent on their responses even though it was not. The present study had conditions which were parallel to both of the above. The $\bar{E} \times \bar{I}$ group corresponded to the Thornton & Jacobs (1971) study, and the $\bar{E} \times I$ group corresponded to the other studies. Furthermore, the present study included an $\bar{I}$ group to determine whether the contingencies alone would produce behavior comparable to that obtained in the animal studies. And, as has just been pointed out, an interference effect was obtained for all subgroups except the one which had +I instructions and E acquisition training. Therefore, it seems clear that in the absence of explicit instructions, none of the stimuli from which S could escape in the present study were sufficient to lead S to make escape responses. Perhaps electric shock as used by Thornton and Jacobs (1971) would be sufficient, although of course it is not possible to judge in view of their confounding of ability of S to escape in acquisition with (accurate) instructions to him as to whether escape were possible.

The present study also provided additional information regarding the effect of the stimulus used in the development of learned helplessness. As was reported, there were no significant main effects for decibel level on any of the dependent variables, nor were there any significant interactions of this variable with type of acquisition training. This, as previously discussed, was expected since Krantz et al. (1973) found no significant differences in the two levels of amplitude of the tone that they used, and other researchers have obtained an interference effect using such diverse stimuli as pattern matching problems (Dweck & Reppucci, 1973), discrimination-anagram problems (Hiroto & Seligman, in press), and, in an experiment with rats, a visual discrimination problem

(Bainbridge, 1972). The present study added a 45 db. level of the 3000-Hz. tone, and, in view of the absence of significant main effects for decibel level, this lower decibel level was considered to be as reliably associated with escape/avoidance behavior as the louder, presumably more aversive levels.

Despite this summary of conditions in which the degree of aversiveness of the stimulus seems to have no effect, there was one condition observed in the present study in which the decibel level did have an effect. As was reported, there was an interaction of decibel level with instructional set in terms of trials to escape criterion, and number of failures to escape. In both cases, escape behavior was facilitated by a combination of +I instructions and the higher amplitudes of the tone, and, in the case of trials to escape criterion, escape was even facilitated by -I instructions at the highest decibel level. Since this result was unexpected, it is of interest to examine the means to determine whether further insight into the nature of this interaction is suggested. As was indicated by Figs. 5 & 10, Ss in the $\bar{I}$ group tended to learn to escape at the lowest amplitude (45 db.), but did not learn to escape at all at the highest amplitude. This is in contrast to the -I group which, with one exception, did not learn to escape at 78 db. or 45 db. It is as if the complete absence of instructions produced greater rigidity (i.e., less manual exploration of the immediate environment) under high stress conditions, while Ss who were told that there was nothing they could do were similarly rigid under the moderate and low stress conditions; and even when Ss were told they could escape, they displayed greater rigidity under the lowest stress condition. However, this interpretation is speculative and offered only as a suggestion for further inquiry.

Conclusions

We may say that the present study has demonstrated that while an interference effect similar to that produced in learned helplessness studies with infrahuman Ss may also be produced in human Ss, the controlling variables in human studies are not entirely the same. While it has been hypothesized (Hiroto, 1974; Maier et al., 1968; Thornton & Jacobs, 1971) that independence of response and reinforcement during acquisition training is a necessary condition for learned helplessness, the present study demonstrated that it is a sufficient, but not a necessary condition with human Ss. For it will be recalled that an interference effect was obtained even when reinforcement was contingent on S's response whenever S had received -I or I instructions. Therefore, it is suggested that further inquiry is needed into the parameters of the learned helplessness phenomenon, especially in the behavior of human Ss.

Further inquiry is also needed into the theoretical implications of this phenomenon since several competing theoretical positions have been presented. A cognitive explanation was presented by Maier et al. (1968), Bolles (1972) proposed an expectancy theory of learning, an opponent-process theory of motivation was recently proposed by Solomon & Corbit (1974), and the phenomenon is being used theoretically by Seligman to explain depression (Seligman, in press; Seligman, Klein, & Miller, in press). Learned helplessness also appears to be very similar to a state described by Rotter (1966) as external locus of control in which an individual tends to believe that the reinforcements he receives are not under his control. This state is explained in the context of Rotter's social learning theory (Rotter, 1954).

In addition to the need for more basic research into the parameters of learned helplessness and its theoretical status, there is a need for further research into its implications for instructional technology. This area of inquiry could be of particular value because apparently it has potential for contributing to a greater understanding of the etiology and therapy of chronic failure behavior which is independent of ability on the part of children in school (Dweck, in press). Apart from the Dweck (in press) study, and a few of the studies using the locus of control variable (e.g., Clark, 1970; Lintner & DuCette, 1974), there has been no systematic study of the interaction of this phenomenon and alternative instructional treatments.

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Footnotes

[1]This article is based on a dissertation submitted to the Graduate School of Indiana University in partial fulfillment of the requirements for the Ph.D. degree. The author would like to thank the dissertation chairman, Lawson H. Hughes, and committee members Ivor K. Davies, Richard C. Pugh, and William E. Scott, Jr. for their suggestions and advice.

[2]Requests for reprints should be addressed to the author, Area of Instructional Technology, 104 Huntington Hall, Syracuse University, Syracuse, New York 13210.

TABLE 1

Analysis of Variance for Latency of Response

Source of variation	df	MS	F
Between subjects	53		
Decibel level (D)	2	8.932	<1
Escape vs. no-escape (E)	1	232.088	20.40*
Instructional set (I)	2	56.068	4.93*
DE	2	3.943	<1
DI	4	27.914	2.45
EI	2	28.809	2.53
DEI	4	23.016	2.02
Subj. w. groups	36	11.376	
Within subjects	270		
Blocks of trials (T)	5	8.989	7.53*
DT	10	.360	<1
ET	5	5.268	4.42*
IT	10	2.544	2.13*
DET	10	.934	<1
DIT	20	.720	<1
EIT	10	.597	<1
DEIT	20	1.435	1.20
T x subj. w. groups	180	1.193	

* $p < .05$

TABLE 2

Analysis of Variance for Trials to Escape Criterion

Source	*df*	*MS*	*F*
Decibel level (D)	2	28.907	1.51
Escape vs. no-escape (E)	1	498.074	25.94*
Instructional set (I)	2	213.407	11.11*
D x E	2	.130	<1
D x I	4	51.963	2.71*
E x I	2	79.630	4.15*
D x E x I	4	44.185	2.30
Within subjects	36	19.204	

*$p < .05$

TABLE 3

Analysis of Variance for Trials to Avoidance Criterion

Source	df	MS	F
Decibel level (D)	2	19.185	1.37
Escape vs. no-escape (E)	1	101.407	7.27*
Instructional set (I)	2	10.907	1
D x E	2	18.074	1.29
D x I	4	17.741	1.27
E x I	2	6.796	1
D x E x I	4	16.630	1.19
Within Ss	36	14.019	

* $p < .05$

TABLE 4

Analysis of Variance for Number of Failures to Escape

Source of variation	df	MS	F
Between subjects	53		
Decibel level (D)	2	3.864	1.40
Escape vs. no-escape (E)	1	88.151	32.02*
Instructional set (I)	2	33.836	12.29*
DE	2	.161	<1
DI	4	10.272	3.73*
EI	2	13.096	4.76*
DEI	4	6.938	2.52
Subj. w. groups	36	2.753	
Within subjects	270		
Blocks of trials (T)	5	2.788	11.33*
DT	10	.201	<1
ET	5	1.070	4.35*
IT	10	.474	1.93*
DET	10	.424	1.72
DIT	20	.325	1.32
EIT	10	.036	<1
DEIT	20	.340	1.38
T x Subj. w. groups	180	.246	

* $p < .05$

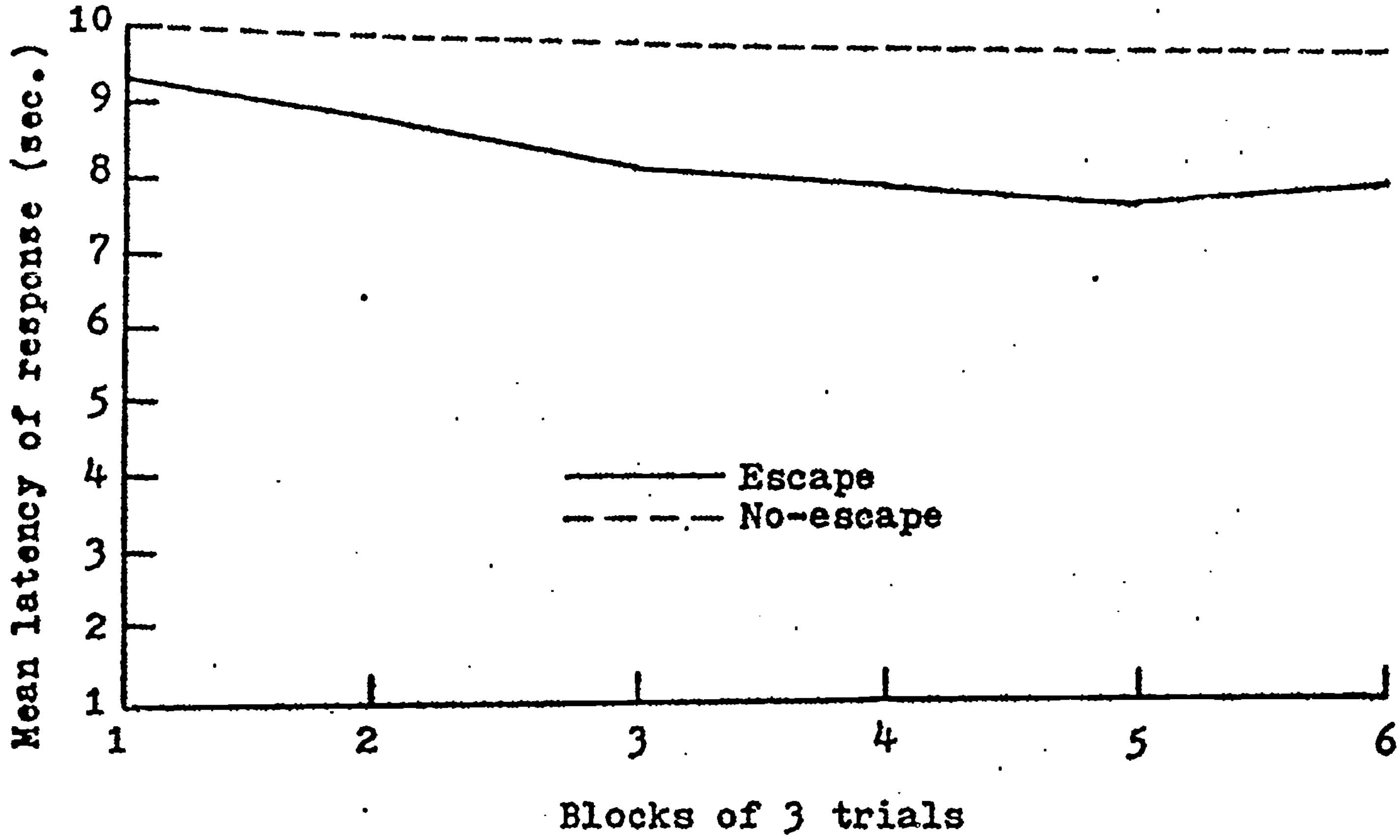

Fig. 1. Mean response latencies for the 6 transfer test trial blocks by the groups for which escape was, and was not, possible during acquisition training.

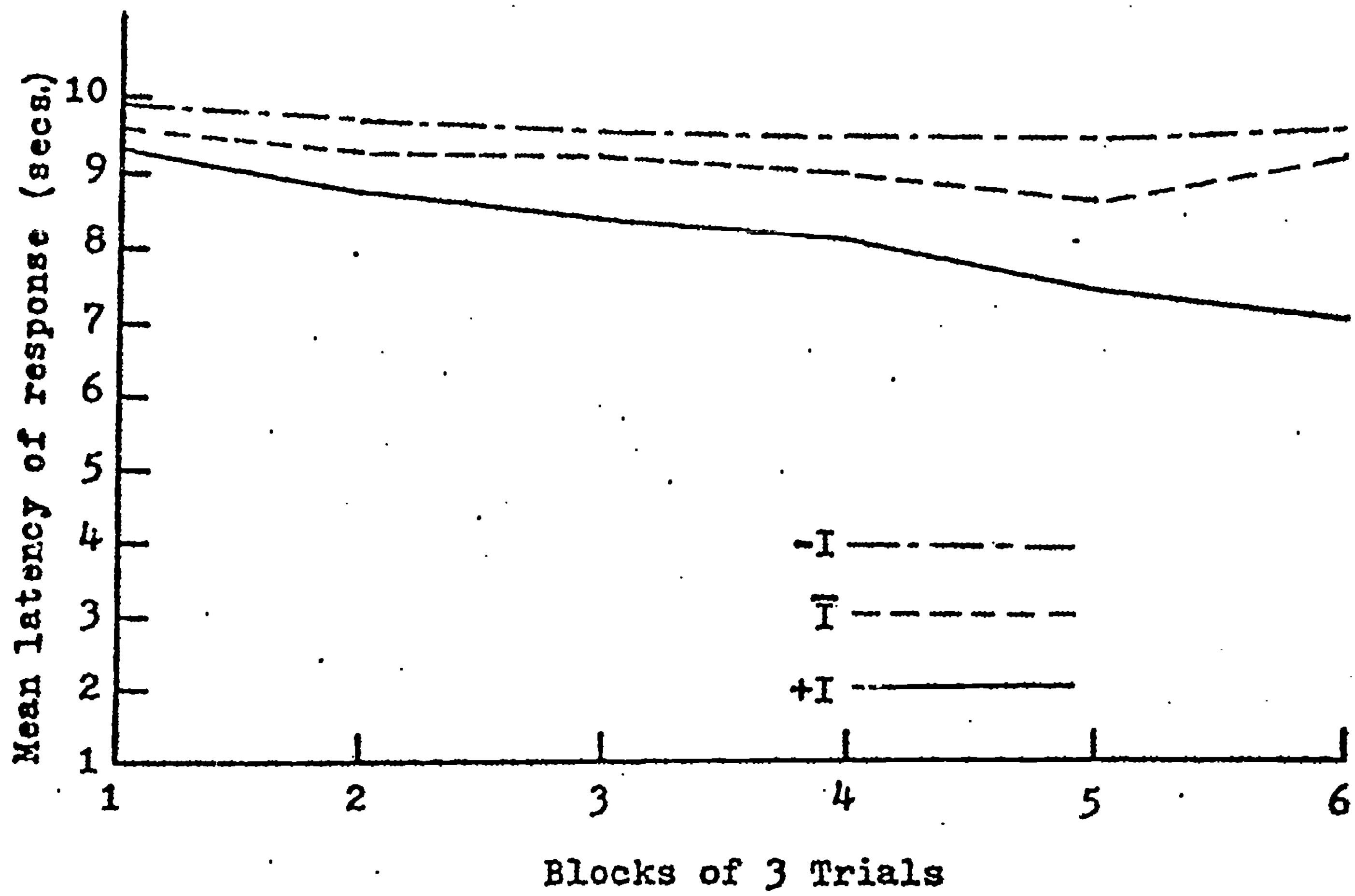

Fig. 2. Mean response latencies for the 6 transfer test trial blocks at each condition of instructional set.

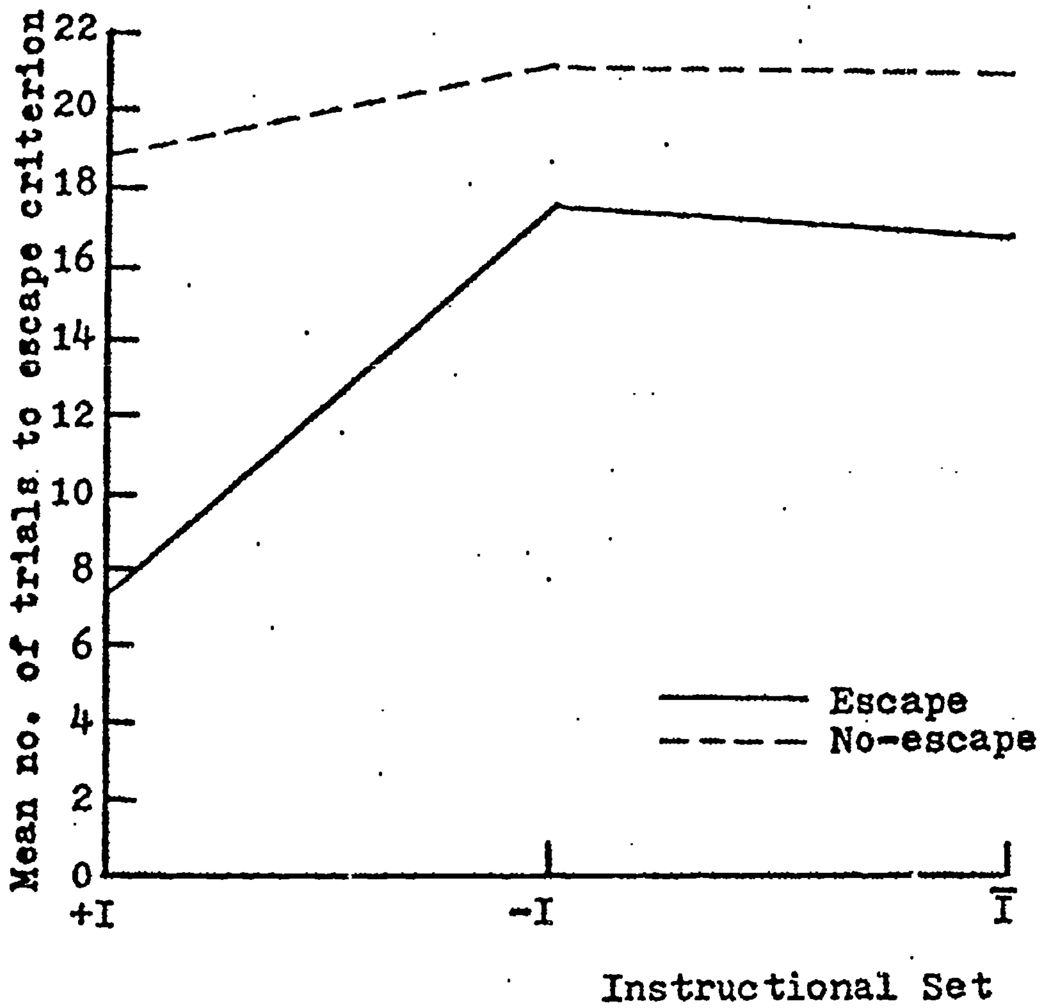

Fig. 3. Mean number of trials to escape criterion during the transfer test for each condition of instructional set by the groups for which escape was, and was not, possible during acquisition training.

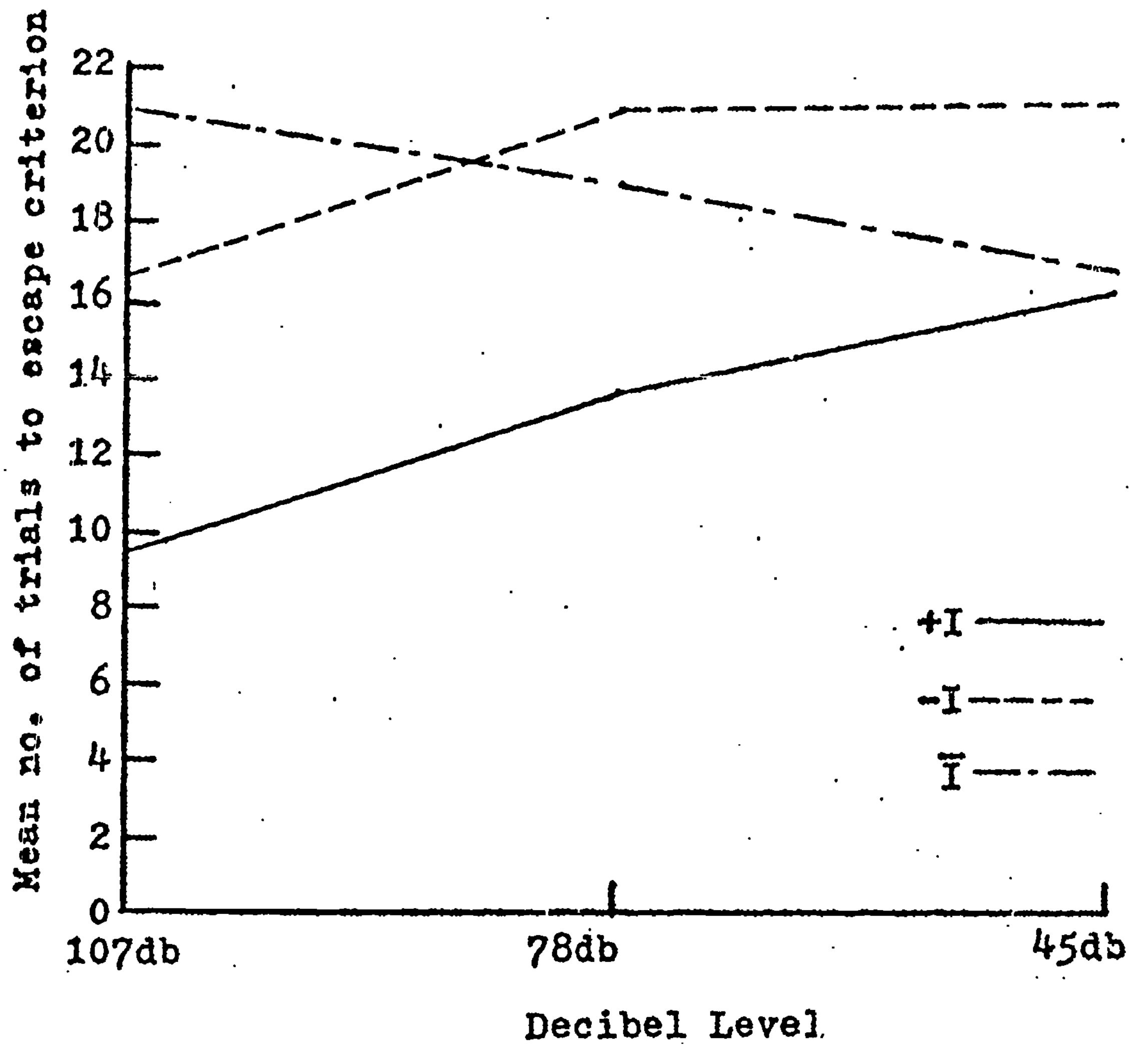

Fig. 4. Mean number of trials to escape criterion during the transfer test for each decibel level of the tone by each condition of instructional set.

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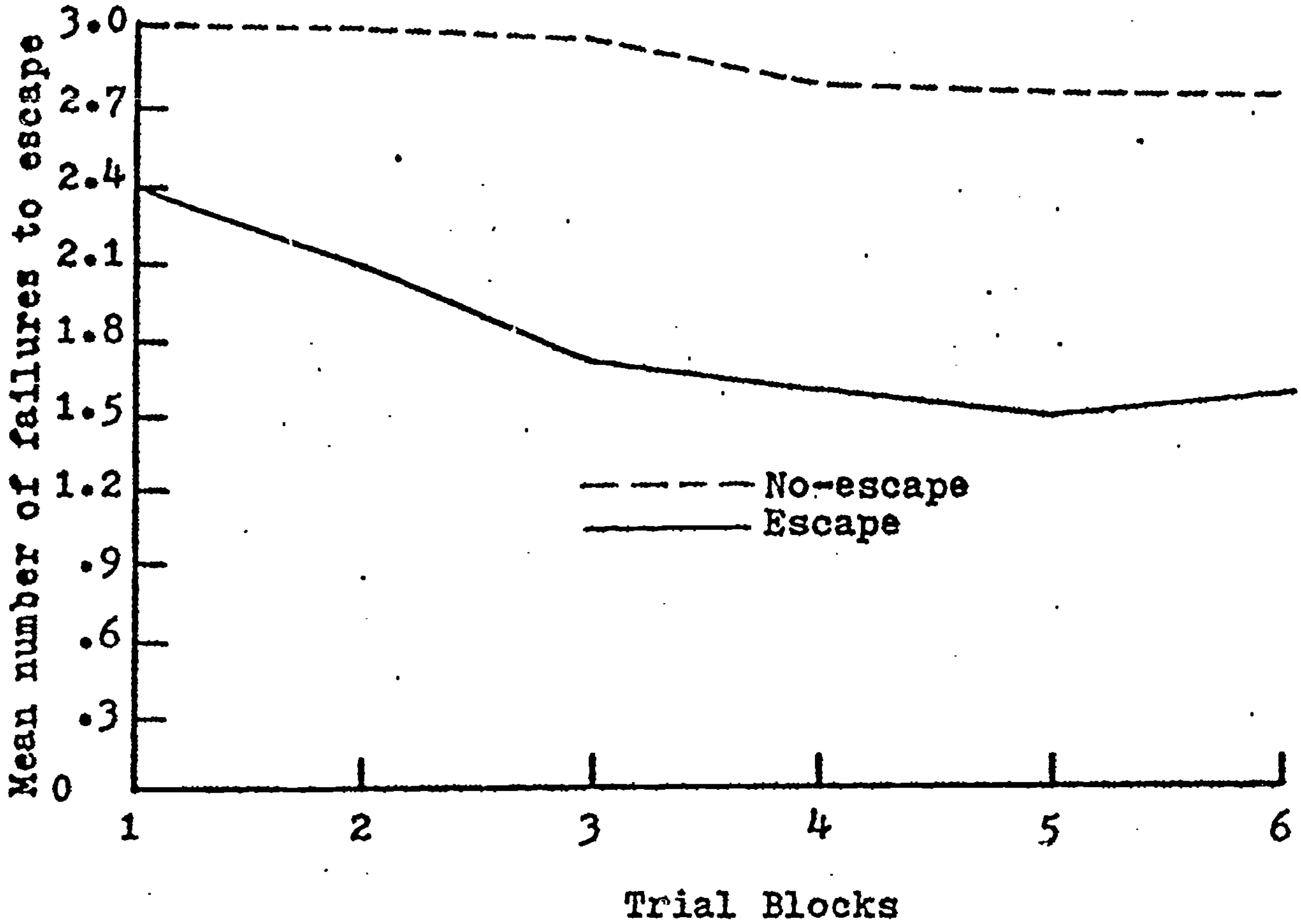

Fig. 5. Mean number of failures to escape during acquisition training for the 6 transfer test trial blocks by the groups for which escape was, and was not, possible during acquisition training.

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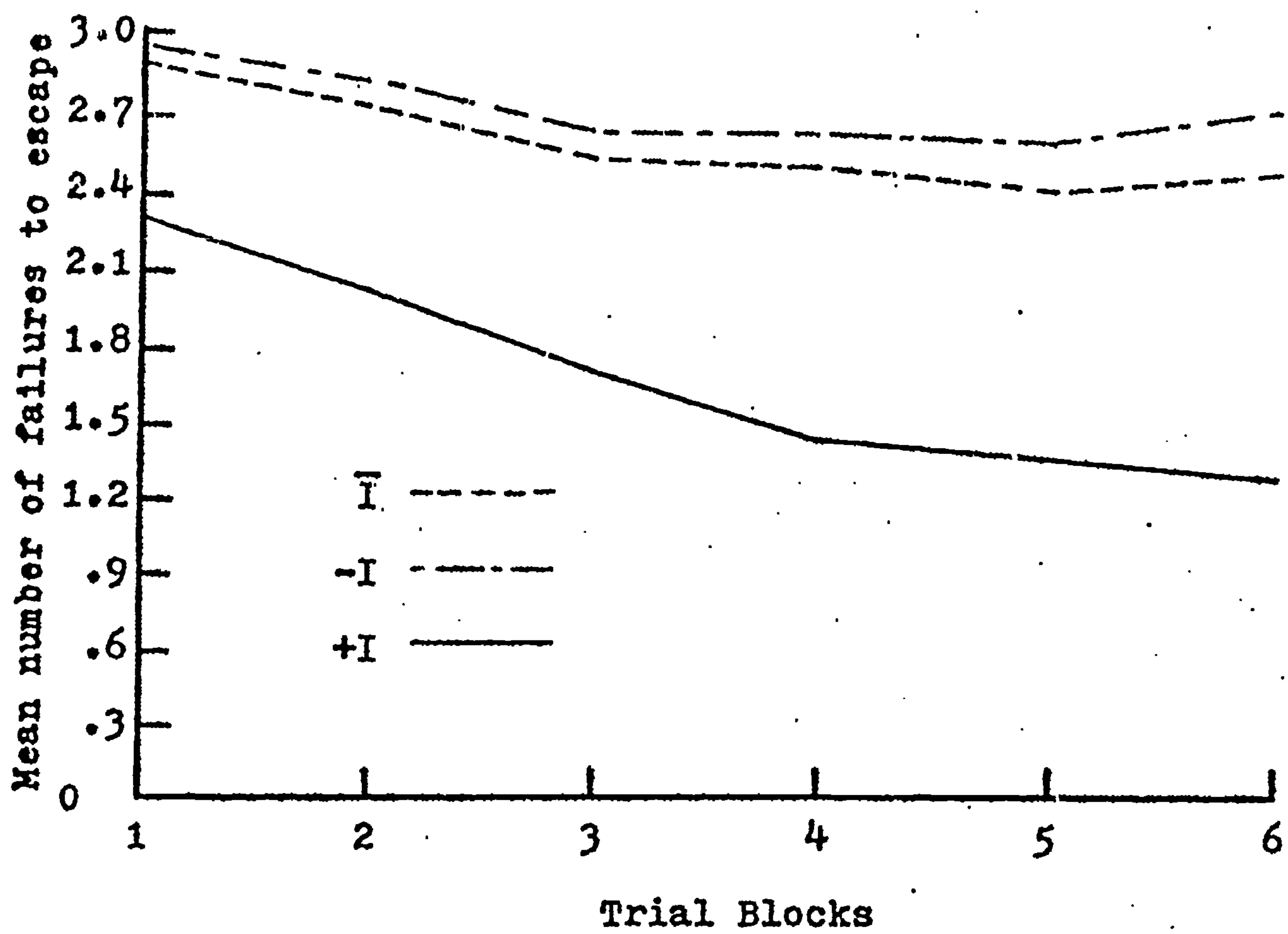

Fig. 6. Mean number of failures to escape for the 6 transfer test trial blocks by each condition of instructional set.

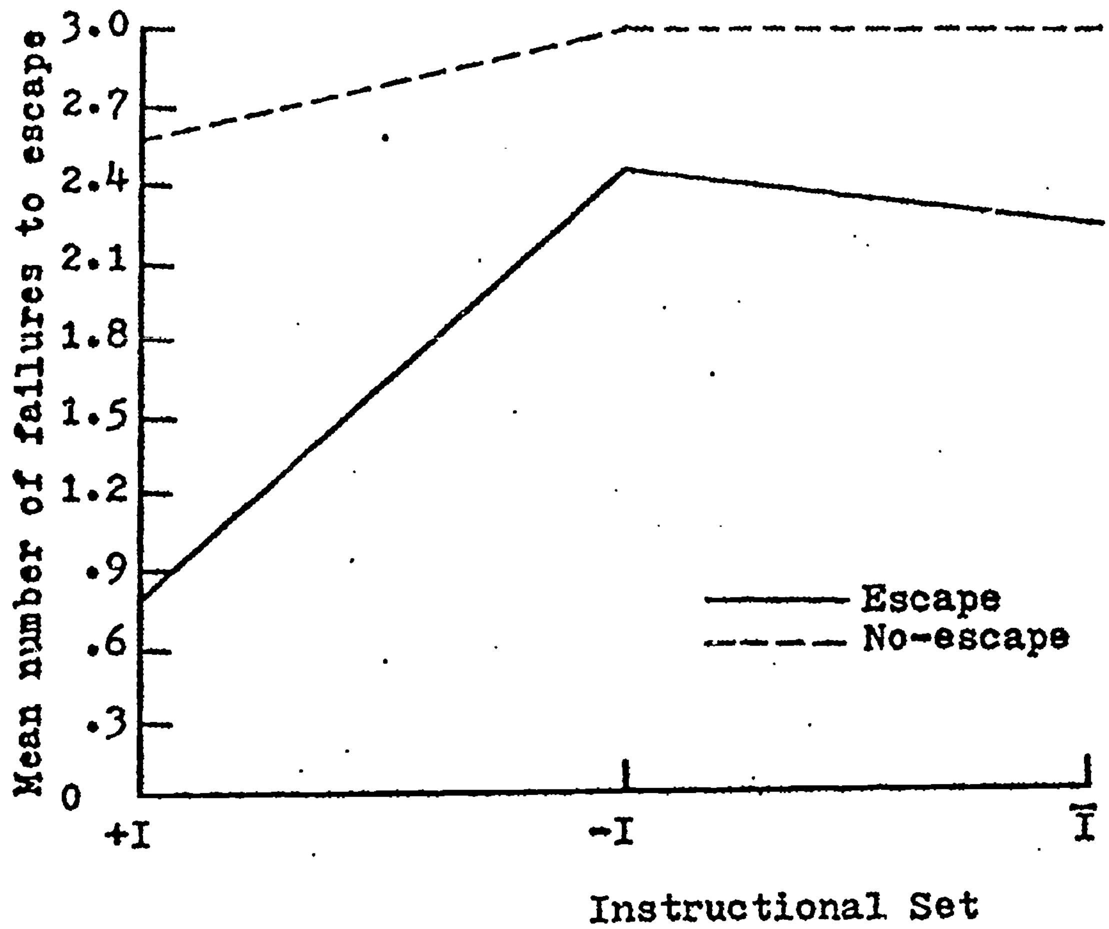

Fig. 7. Mean number of failures to escape during the transfer test for each condition of instructional set by the groups for which escape was, and was not, possible during acquisition training.

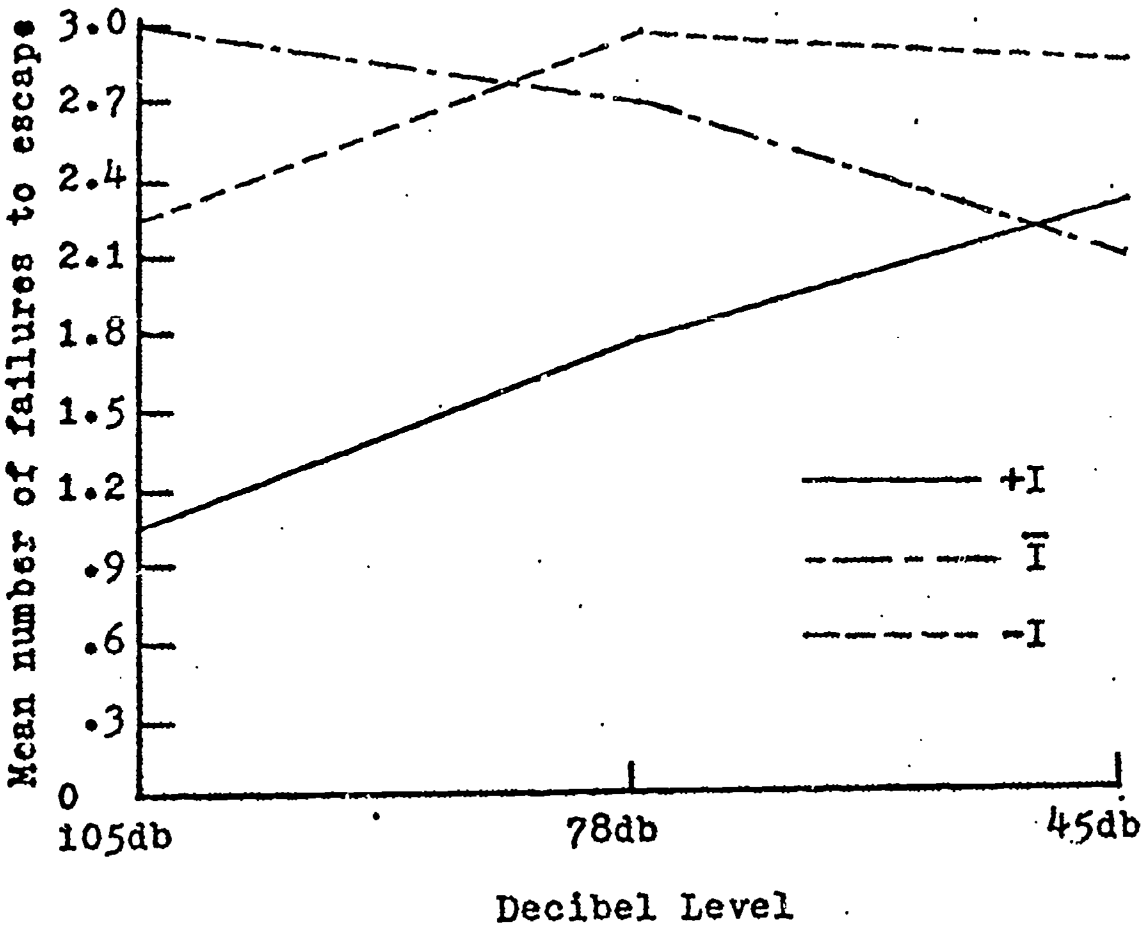

Fig. 8. Mean number of failures to escape during transfer test trials for each decibel level of the tone by each condition of instructional set.