Immunization Against Learned Helplessness in Man: Support for the S-R position

Stanton L. Jones[1] and Jack R. Nation

Texas A&M University

Running head: Immunization Against Learned Helplessness in Man

Abstract

Immunization against learned helplessness has been found in dogs and rats; this study tested for the same effect in man. College students were divided into four groups; the helplessness control group received no immunization training while the other three groups received either a 0%, 50%, or 100% schedule of success on a series of discrimination problems. Then all groups were given insoluble problems and were subsequently tested on a human shuttlebox. An immunization effect against helplessness was produced; the 50% immunization schedule produced performance significantly superior to the helplessness control and 0% groups. The 100% group failed to produce the immunization effect. These findings lend substantial support to the S-R explanation of helplessness phenomena (Levis, 1976) over the expectancy of independence explanation (Maier and Seligman, 1976). Implications of the study for the helplessness model of depression and for strategies in clinical therapy were also discussed.

Immunization Against Learned Helplessness in Man:

Support for the S-R position

Inescapable, noncontingent aversive events result in interference with subsequent instrumental learning in animals (Overmier & Seligman, 1967; Seligman & Maier, 1967; Seligman, Maier & Geer, 1968), as well as with instrumental and cognitive learning in man (Hiroto, 1974; Hiroto & Seligman, 1975; Thornton & Jacobs, 1971). These same aversive events fail to produce this debilitation in responding when the key factor of control is present. The debilitation and the process underlying it have been labeled "learned helplessness" (Seligman, Maier, & Solomon, 1971). This interpretation of the phenomenon would claim that noncontingent environmental events cause a broadly generalized internal expectancy of independence of responding in an organism (Hiroto and Seligman, 1975). This state of expectancy has three major behavioral symptoms: (a) motivational-lowered response initiation; (b) cognitive-an interference with subsequent learning of contingency relationship; and (c) emotional-passivity and despondency.

From this theoretical account of the interference with responding caused by noncontingency, it would seem that with the proper stimulus history, an organism would be impervious to the effect of short-term failure. That is, it should be possible to "immunize" an organism or prevent debilitation in responding by a behavioral injection of the proper stimulus history. This type of behavioral immunization effect has been produced in dogs (Seligman and Maier, 1967) and in rats (Seligman, Rosellini, & Kozak, 1975).

Theoretically, the same process of immunization is possible with humans with the substitution of insoluble tasks for noncontingent punishment. These insoluble tasks are formally analogous to inescapability, as in both cases the key factor is the noncontingent relationship between responding and reinforcement (Hiroto and Seligman, 1975). Also, success on soluble cognitive tasks is analogous to the successful avoidance of aversive events, as the key factor in this instance is the learning of the existence of the contingency relationship between responding and reinforcement.

The following experiment tested the effectiveness of three different percentages of success training in preventing the helplessness effects of noncontingent failure as tested on an instrumental task. The three immunization groups were created by varying the success percentages on the immunization pretreatment; the three immunization groups were the 0% success group, the 50% success group, and the 100% success group. The following predictions were made concerning the experiment:

1. The two groups which were given partial or total success on the immunization pretreatment would perform significantly better on the instrumental test task than a helplessness control group.

2. The group which was given no success on the immunization pretreatment would perform in a fashion similar to the helplessness control group.

3. Either the 50% or the 100% immunization group would distinguish itself as a superior immunizing schedule.

Method

Subjects

Subjects were 35 Texas A&M University undergraduates recruited from the subject pool of students taking the Introduction to Psychology course. On the basis of pilot research, participation in this experiment was limited to those subjects who scored in the lower one-third of all students on the chance scale of Levenson's (1974) locus of control scale (which was administered to all classes early in the semester). Two subjects were released prior to the experiment due to mechanical failure of the apparatus. One subject from the 50% immunization group was rejected because of failure to follow instructions. For the final sample, 32 individuals, consisting of 14 males and 18 females, were randomly assigned to one of the four possible groups with no constraints on sex.

Apparatus

Immunization pretreatment. A series of five-dimensional stimulus configurations patterned after those used in a previous discrimination learning study (Levine, 1971) were used as the immunization pretreatment. Each of the five dimensions had two associated values as in Hiroto and Seligman (1975): (a) letter (A or T); (b) letter color (red or black); (c) letter size (large or small); (d) border surrounding letter (circle or square); and (e) position (left or right). For the 100% success immunization group, there were values in each of the four problems which were consistently correct. For the 50% success group, however, only half of the problems had a correct value; for the 0% success group, no value was consistently correct. Each pattern was on a 4 x 6-in. (10 x 15 cm.) "wire-index" card.

Helplessness treatment. A different set of problems patterned after the Levine (1971) study were constructed and used for the helplessness treatment. Again, each of the five dimensions had two associated values: (a) shape (triangle or circle); (b) shading (solid or empty); (c) number of dots (one or two), (d) number of borders (one or two); and (e) position (left or right). For this phase, these were no values on any of the four problems which were consistently correct.

Test task. The apparatus was a modified Turner and Solomon (1962) human shuttlebox, the specifications of which are described in Hiroto (1974). Moving the peg from one side to the other escaped or avoided the tone.

The aversive stimulus was a 3,000 hertz tone emanating from as R. C. A. audio generator patched through a Merantz 40 linear amplifier. The tone was presented to subjects at 90 decibels through Lafayette headphones. The apparatus was calibrated for accurate tone output through the headphones. This tone was previously judged as "moderately aversive" (Hiroto and Seligman, 1975).

Procedure

Subjects were randomly assigned to one of the four experimental groups. The four groups were formed by varying the immunization phase success percentage. The helplessness control group received neither success nor failure on the immunization task during this first phase, but simply looked passively at the cards for 5 seconds per card, a time period approximating the normal time spent per card by the other groups. The 0% immunization group received four completely insoluble problems in the immunization phase. The 50% immunization group received two soluble problems and insoluble problems for this phase. Finally, the 100% immunization group received four soluble problems. The helplessness group differed from the three immunization groups only in that they were not required to attempt a solution for the problems. Thus, they experienced neither success nor failure during this phase. All groups received four more completely different discrimination problems in the helplessness phase. All four of these problems were insoluble, and all subjects received appropriate feedback communicating their failure. Finally, on the third phase all subjects were tested on the shuttlebox.

Instructions for the immunization pre-treatment phase. All subjects received the following instructions to introduce the immunization task:

In this experiment, you will be looking at cards like this one.

> Each card has two stimulus patterns on it. The sample patterns are composed of five different dimensions and the two values associated with each dimension. The dimensions and their values are [experimenter described each dimension and value for the immunization pretreatment]. Each stimulus pattern has one value from each of the five dimensions.

Here, the helplessness group was further instructed that they were to study each card for the time period allowed until they were told to turn the card. The instructions for the immunization groups continued:

> I have arbitrarily chosen one of the ten values as being correct. For each card, I want you to choose which side contains this value, and I will then tell you if your choice was correct or incorrect. In a few trials, you can learn what the correct value is by this feedback. The object is for you to figure out what the answer is so that you can choose correctly as often as possible.

Five sample trials of a single five-dimensional problem were first presented. This clarified the task of finding the "correct" value. The helplessness group was shown the sample problem with no clarifying instructions. All subjects were asked if there were any questions.

The experimental stimulus patterns were composed of five dimensions. Four different problems were presented in blocks of 10 trials each. Subjects in the helplessness group were to simply look at the cards. At the end of each 10-trial problem, each subject in each of the immunization groups was asked for the correct value. The criterion for solution of the problem was identification of the correct value after the 10-trial block. On insoluble problems, each subject in the 0% and 50% groups received a predetermined schedule of "correct" (c) and "incorrect" (I), regardless of what value was guessed. In this manner, reinforcement was made completely independent of responding. The schedules of reinforcement were: (a) C-I-I-C-C-I-I-C-C-I for the first problem; (b) I-C-I-C-C-I-C-I-C-I for the second; (c) I-C-I-C-I-C-C-I-C-I for the third; and (d) I-C-C-I-I-C-C-I-I-C for the last problem. After the insoluble problems, subjects were told "that's the wrong answer" when they attempted to guess the correct value for the problem.

Each trial lasted a maximum of 15 seconds. The helplessness group was instructed to turn to the next card every 5 seconds. All subjects in the immunization groups were allowed 10 seconds to make a decision before the experimenter warned them that they had 5 more seconds in which to make a decision.

After each 10-trial block, each of the immunization subjects were instructed "We are now starting a new problem. You do not know at this point if I have chosen a different value for this problem. I will continue telling you if you are correct or incorrect." The helplessness group was instructed to "please continue looking at each card and turn each card when I tell you to."

Instructions for the helplessness treatment phase. All subjects in all four groups received identical instructions. These instructions were the same as those for the immunization groups on the first phase of the experiment except that the experimentor described the dimensions and values which applied to the helplessness treatment task rather than those which belonged to the immunization task.

Four different five-demensional problems were presented in blocks of 10 trials each. All problems were insoluble. The predetermined reinforcement schedules were: (a) I-C-I-C-I-C-C-I-C-I; (b) C-I-I-C-C-I-C-C-I-I; (c) I-C-I-C-C-I-C-I-C-I; and (d) C-I-C-I-C-I-I-C-I-C. At the end of each problem, each subject was asked for the correct value, and was told "that's the wrong answer" when they attempted to guess the correct value for the problem. The time constraints and inter-problem instructions were the same as for the first phase.

Instructions for the test phase. The instrumental test trials were conducted in the same room as the prior phases. The manipulandum remained covered until the subject received the following instructions:

> You will be given some trials in which a relatively loud tone will be presented to you. Whenever you hear the tone 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. I will answer all questions at the end of this study.

The apparatus was then uncovered and moved in front of the subject. The sliding knob was always located at the midpoint of the manipulandum at the beginning of the test so that the subject could slide the peg to either side of the box with equal ease. A green warning light (CS) at the midpoint of the manipulandum was on for 5 seconds before, and was terminated with, the onset of the 5 second tone. The test phase consisted of 20 signaled 10 second trials with the ITI ranging from 10 to 45 seconds, with a mean ITI of 22.5 seconds.

The appropriate response was moving the peg to one side of the manipulandum to close the microswitch controlling the stimulus light or noise. On the next trial, moving the peg to the opposite side escaped or avoided the noise. The instructions specified only escape contingencies, but an avoidance response was possible by terminating the light with the appropriate response.

A response latency under 5 seconds terminated the warning light and avoided the tone; i.e., it terminated the trial. If the subject did not terminate the light (latency under 5 seconds) or escape the tone (latency between 5 seconds and 9.99 seconds), a latency of 10 seconds was given for that trial.

Three dependent variables were analyzed on the test task: (a) trials to criterion for escape acquisition, defined as subject making three consecutive escape responses; (b) number of failures to escape, defined as the number of trials with latencies of 10 seconds; and (c) the mean latency for the 20 trials.

Results

The means, standard deviations, and levels of significance are profiled for mean latency, mean number of failures, and mean trials to criterion in Figures 1, 2, and 3 respectively. A visual inspection of Figures 1, 2, and 3 reveals that an immunization effect against helplessness was produced by the 50% success schedule during the immunization pretreatment. The 100% group apparently failed to show any corresponding immunization effects.

Insert Figures 1, 2, and 3 about here

A Mann-Whitney U test was used to statistically examine the three measured dependent variables. The 100% success pretreatment schedule failed to produce significant differences from any of the other groups, although the results tended to fall in the predicted direction (all $ps > .05$). The 50% immunization group showed a significant improvement in responding over the helplessness group on the measure of mean number of failures to escape, $U(8,8) = 15.50$, $p < .05$. The 50% immunization group also showed a significant superiority on the mean number of failures to escape measure as compared to the 0% immunization group, $U(8,8) = 14.50$, $p < .05$. The 50% immunization group additionally showed a significant superiority in trials to reach criterion over the 0% immunization group. $U(8,8) = 16.00$, $p < .05$. The comparison of the 50% group and the helplessness group on the measure of trials to criterion approached, but did not reach, significance, $U(8,8) = 17.5$, $p > .05$. None of the groups differed significantly from each other on the measure of mean latency. All other comparisons between groups failed to approach significance.

Discussion

The results produced by the present investigation at least partially support a learning interpretation of helplessness by showing that human subjects can be immunized against the effects of uncontrollable environmental events. The first prediction for the study was that the 50% immunization group and the 100% immunization group would not show escape deficits characteristic of helplessness on an instrumental task which was preceded by insoluble concept identification problems. While 100% immunization subjects showed debilitated instrumental responding in a manner similar to the learned helplessness control subjects, the 50% immunization subjects indeed did escape and avoid efficiently on the later instrumental task. The failure to show immunization effects in the 100% group is at odds with the animal literature (e.g., Seligman et al. 1975). Nevertheless, the fact that subjects were immunized against cognitively induced learned helplessness in the 50% group suggest that prior stimulus history is important in regulating human helplessness behavior.

A second prediction for the study was that the 0% group would perform in a fashion similar to that of the helplessness group. An examination of the graphical data reveals that the two groups were indeed very similar in responding. The 0% group could be conceptualized as simply another helplessness condition, with subjects encountering twice as much noncontingent reinforcement (uncontrollability). Floor effects may have prevented seperation of the two groups, otherwise the 0% subjects might have shown more pronounced effects than control subjects.

In the present study, the third prediction centered around the relationship between the 50% immunization group and the 100% immunization group. The finding of immunization against learned helplessness in the 50% group, coupled with the report of no immunization in the 100% condition, is of considerable theoretical importance. Recently, a controversy has surfaced concerning the etiology and development of learned helplessness behavior. Maier and Seligman (1976) provide an elaborate cognitive model which accounts for learned helplessness effects by appealing to the motivational, cognitive, and emotional effects of uncontrollability. Alternatively, Levis (1976) offers an equally defensible S-R account of the disrupting influence of noncontingent, independently programmed events.

Regarding the present analysis, the cognitively based learned helplessness hypothesis of Maier and Seligman makes several straightforward predictions (see pp. 38-39). Concerning immunization effects, their theory suggests that previous experience controlling events proactively interferes with the memory that responding and reinforcement are independent. Accordingly, the theory would predict that the more exposures there are to controllable situations, the greater the proactive interference and therefore the <u>less</u> likely subjects would be to manifest learned helplessness performance. Thus, in the present study the learned helplessness hypothesis of Maier and Seligman would predict superior immunization effects for the 100% group relative to the 50% group. Clearly, our results do not support such a claim.

The S-R explanation of helplessness by Levis mentions that it may prove to be a worthwhile endeaver to extend an Amsel frustration-typed model to the human helplessness literature (see p. 64). It seems the data from the present experiment are best understood from within the framework of such an S-R position. Amsel (1967, 1972) has developed a general theory of persistence based on the principle of counterconditioning. According to this view, persistence occurs whenever an organism learns through counterconditioning to maintain responding under conditions which normally disrupt or interfere with behavior. One form of persistence is reflected in the partial reinforcement extinction effect (PREE), i.e., where partially reinforced subjects show greater resistance to extinction than control subjects trained under continuous reinforcement conditions. This greater persistance on the part of the partially reinforced subjects is attributed to the fact that stimuli arising from frustration produced by nonreinforcement become counterconditioned to the goal-approach response. So, when partially reinforced subjects encounter future frustrative stimuli (i.e., in extinction), these stimuli elicit approach responses instead of the more usual competing responses which interfere with the goal-approach response. Of course, since continuously reinforced subjects have never had frustration related stimuli counterconditioned to approach, these subjects fail to show persistance effects and rapidly stop responding.

It appears that many of the ingredients necessary for the demonstration of the PREE in the basic learning literature were also present in our investigation of immunization effects against learned helplessness, using human subjects. Recall that the procedure in the present experiment involved immunization training (Phase 1); inducement of helplessness by giving noncontingent reinforcement (Phase 2); and finally contingent escape/avoidance training (Phase 3). The interpolated block of noncontingent reinforcement during Phase 2 is formally analogous to extinction, which is defined as a series of consecutive nonreinforced trials. In Amsel's terms, frustration was counterconditioned in the 50% immunization group. When subjects experienced Phase 2 extinction, the frustration produced stimuli precipitated approach behavior in the 50% group and avoidance behavior in the 100% group. The relative tendencies to approach (respond) and avoid (not respond) were reflected in performance on the later instrumental task (Phase 3). Thus, the present data seem to fit neatly within the boundary conditions of Amsel's frustration theory and in that respect are in support of an S-R interpretation of helplessness.

On a more practical level, learned helplessness has been proposed as a theoretical model of depression. Seligman (1975) suggested that in order to confidently assert the similarity of the two psychological phenomena, one must show similarity along four lines: symptoms, etiology, cure, and prevention (see Klein and Seligman (1976) for a current review of the work on this problem). Klein and Seligman (1976) have been successful in showing that "success therapy" reverses both feelings of helplessness and clinically diagnosed depression. From the standpoint of sharpening the relationship between helplessness and depression, it would also be desirable to examine depressed subjects and nondepressed subjects and determine to what extent their respective stimulus histories approximate one of the present experimental conditions. Specifically, do depressed people have a history of either complete success, or, no success experiences at all? Do non-depressed people have a history of successful experiences interlaced with experiences of failure?

In closing, immunization against (or prevention of) learned helplessness in man has been produced. The application of the data to clinical therapy for depressives remains an open question. From the limited basis of the present study, one would question the appropriateness of exclusively using schedules of complete success in the treatment of depressive clients. In view of the present results, it is quite possible that these schedules would be unable to provide any immunization effects to counter further recurrences of the depressive state. It would seem that the use of total success therapy would produce an unrealistic expectation of success and increase the chance of a relapse into the depressive state once the client was released from his therapy program. The strategic use of failure, properly interspersed with success in a therapy program, would, on the other hand, prepare the client for dealing realistically with his environment and handling failure in a competent manner.

References

Amsel, A. Partial reinforcement effects on vigor and persistence. In K. W. Spence and J. T. Spence (Eds.), The Psychology of Learning and Motivation: Advances in Research and Theory. New York: Academic Press, 1967, Vol. 1, pp. 1-65.

Amsel, A. Behavioral habituation, counterconditioning, and persistence. In A. Black and W. K. Prokasy (Eds.), Classical Conditioning II, New York: Appleton-Century-Crofts, 1972. Pp. 409-425.

Hiroto, D. S. Locus of control and learned helplessness. Journal of Experimental Psychology, 1974, 102, 187-193.

Hiroto, D. S. and Seligman, M. E. P. Generality of learned helplessness in man. Journal of Personality and Social Psychology, 1975, 31, 311-327.

Klein, D. C. and Seligman, M. E. P. Reversal of performance deficits and perceptual deficits in learned helplessness and depression. Journal of Abnormal Psychology, 1976, 89, 11-26.

Levenson, H. Activism and powerful others: distinctions within the concept of internal-external control. Journal of Personality Assessment, 1974, 38, 377-383.

Levine, M. Hypothesis theory and nonlearning despite ideal S-R reinforcement contingencies. Psychological Review, 1971, 78, 130-140.

Levis, D. J. Learned Helplessness: A reply and an alternative S-R interpretation. Journal of Experimental Psychology: General, 1976, 105(1) 47-65.

Maier, S. F. and Seligman, M. E. P. Learned Helplessness: Theory and Evidence. Journal of Experimental Psychology: General, 1976, 105(1), 3-46.

Overmier, J. B. and Seligman, M. E. P. Effects of inescapable shock upon subsequent escape and avoidance responding. Journal of Comparative and Physiological Psychology, 1967, 63, 28-33.

Seligman, M. E. P. Helplessness: on depression development and death. San Francisco: A. H. Freeman and Co., 1975.

Seligman, M. E. P. and Maier, S. F. Failure to escape traumatic shock. Journal of Experimental Psychology, 1967, 74, 1-9.

Seligman, M. E. P., Maier, S. F. and Geer, J. Alleviation of learned helplessness in the dog. Journal of Abnormal Psychology, 1968, 73, 256-262.

Seligman, M. E. P., Maier, S. F. and Solomon, R. L. Unpredictable and uncontrolable aversive events. In F. R. Brush (Ed.), Aversive conditioning and learning. New York: Academic Press, 1971.

Seligman, M. E. P., Rosellini, R., and Kozak, M. Learned helplessness in the rat: time course, immunization, and reversibility. Journal of Comparative and Physiological Psychology, 1975, 88, 542-547.

Thornton, J. W. and Jacobs, P. D. Learned helplessness in human subjects. Journal of Experimental Psychology, 1971, 87, 367-372.

Turner, L. and Solomon, R. L. Human traumatic avoidance learning: theory and experiments on the operant-respondant distinction and failures to learn. Psychological Monographs, 1962, 76, (1, whole no. 559).

Footnotes

The research reported in this article was conducted while the first author was an undergraduate at Texas A&M University, and was done under the auspices of the University Undergraduate Fellows Program. Very special thanks are extended to the second author for his patient guidance in the pursuance of this topic.

Requests for reprints should be sent to Jack R. Nation, Department of Psychology, Texas A&M University, College Station, Texas. 77841.

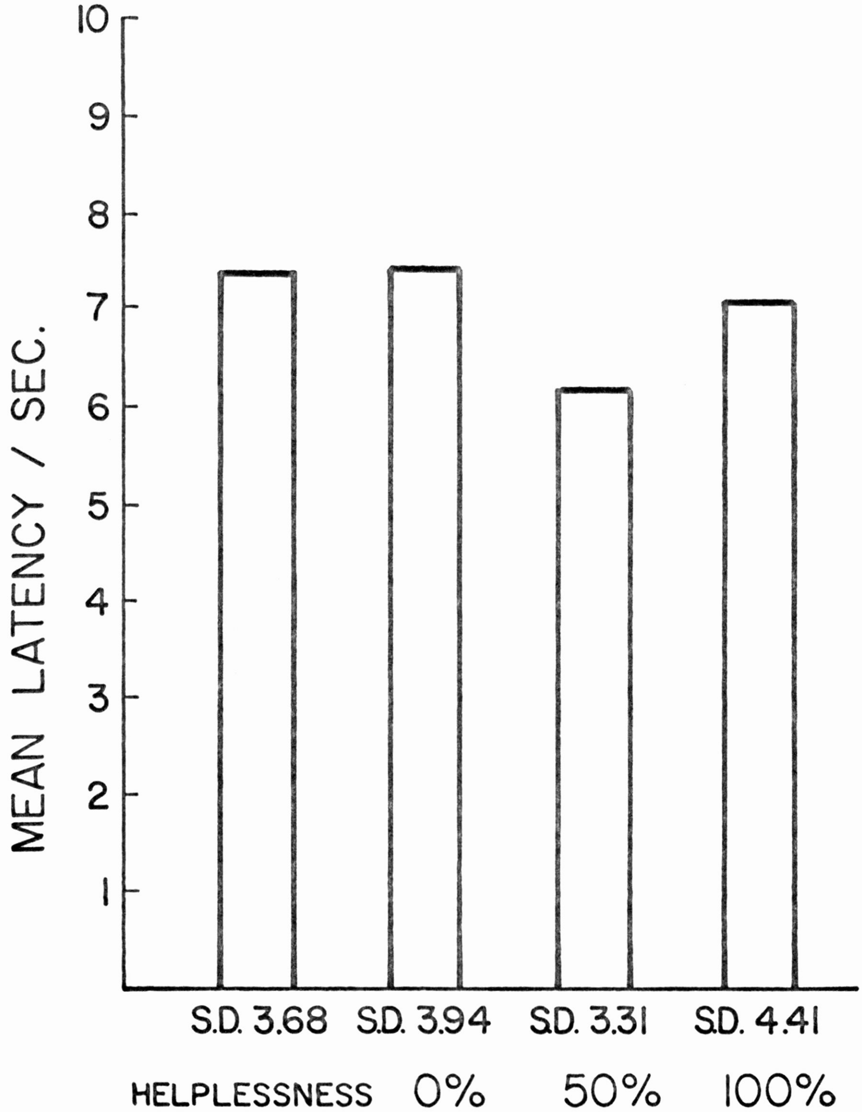
[1]Stanton L. Jones is now at Arizona State University.

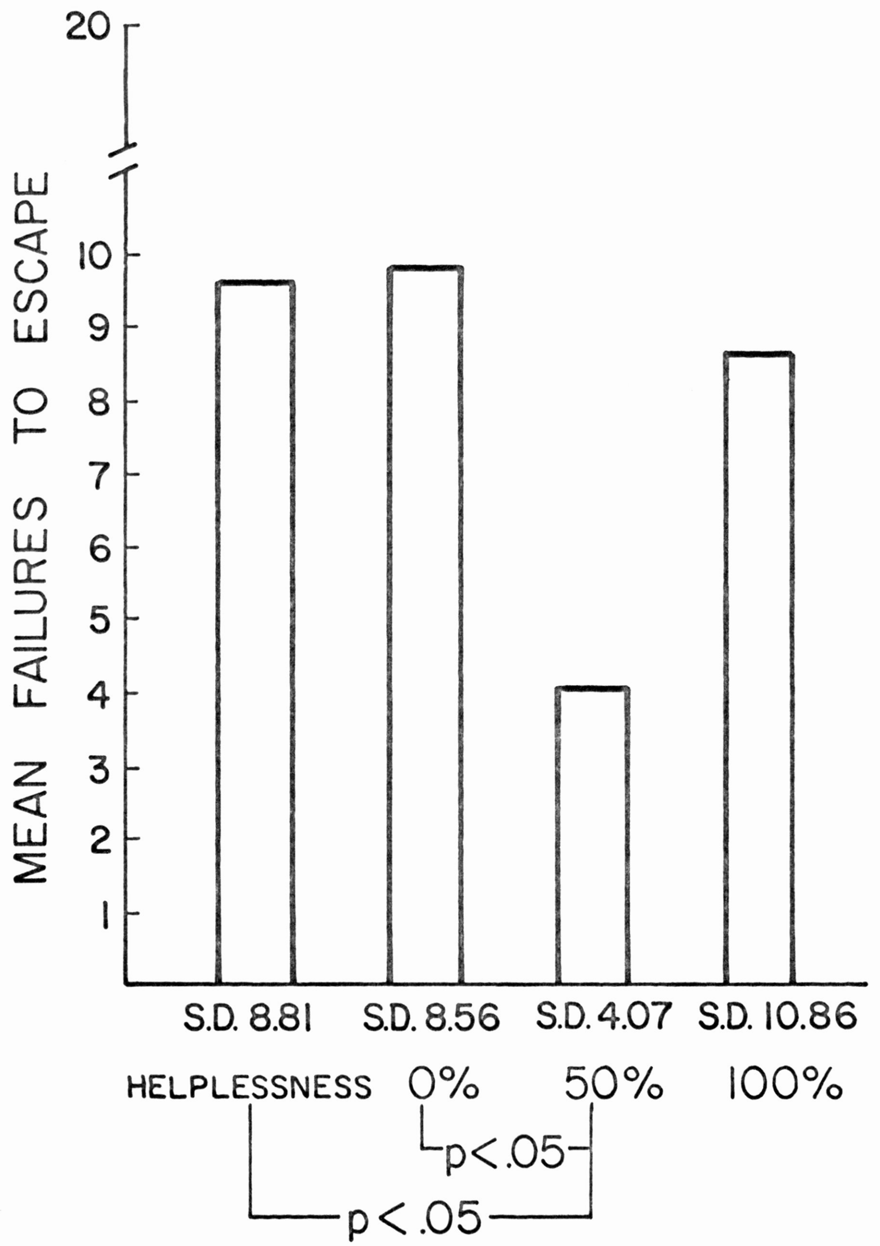
Figure Caption

Figure 1. Group means, standard deviations, and significance levels for the four groups (mean response latency).

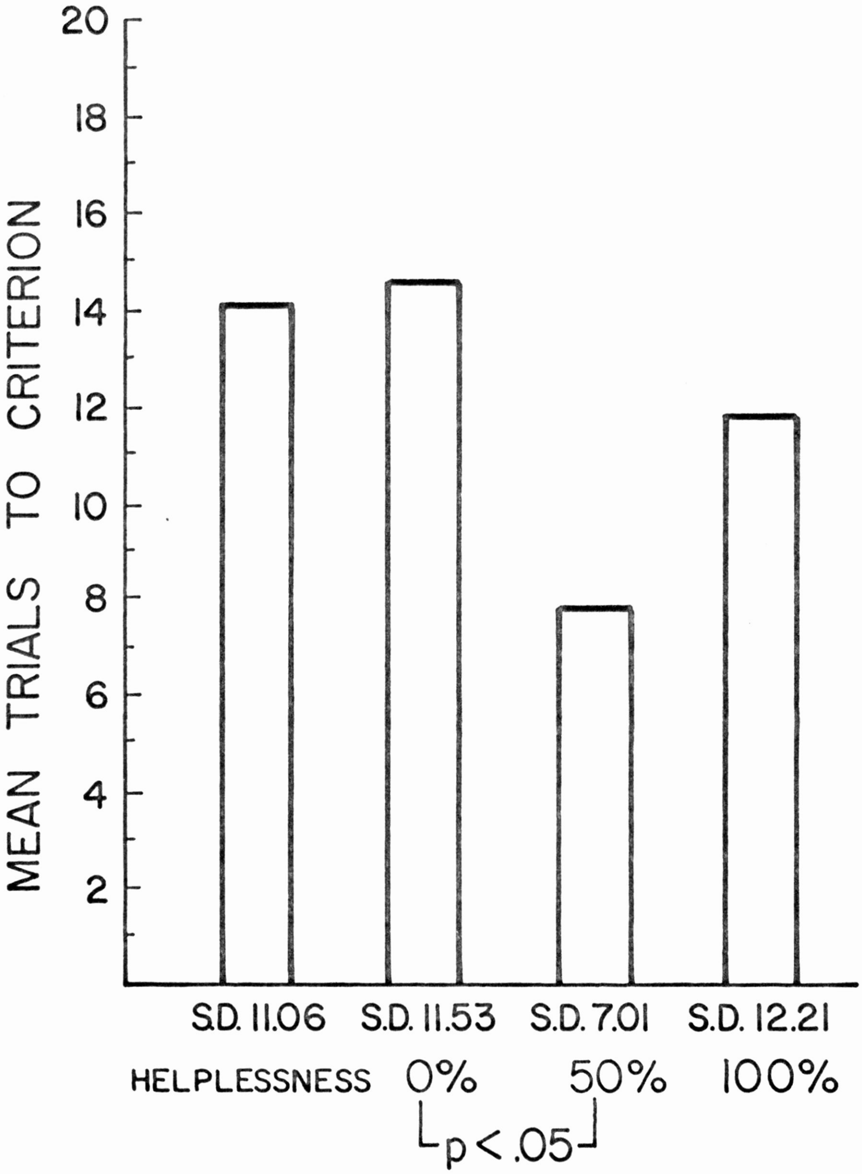
Figure 2. Group means, standard deviation, and significance levels for the four groups (mean number of failures to escape).

Figure 3. Group means, standard deviations, and significance levels for the four groups (mean trials to criterion for escape acquisition).


MEAN LATENCY / SEC.
10
9
8
7
6
5
4
3
2
1
S.D. 3.68
S.D. 3.94
S.D. 3.31
S.D. 4.41
HELPLESSNESS
0%
50%
100%



MEAN FAILURES TO ESCAPE
20
10
9
8
7
6
5
4
3
2
1
S.D. 8.81
S.D. 8.56
S.D. 4.07
S.D. 10.86
HELPLESSNESS
0%
50%
100%
p<.05
p<.05



MEAN TRIALS TO CRITERION
20
18
16
14
12
10
8
6
4
2
S.D. 11.06
S.D. 11.53
S.D. 7.01
S.D. 12.21
HELPLESSNESS
0%
50%
100%
p < .05