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Learned Helplessness Through Observation: Failure to Escape Traumatic Shock as a Result of Observing a Helpless Situation

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LEARNED HELPLESSNESS THROUGH OBSERVATION: FAILURE TO ESCAPE TRAUMATIC SHOCK AS A RESULT OF OBSERVING A HELPLESS SITUATION

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Master of Arts

by
Donald R. Jary
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LEARNED HELPLESSNESS THROUGH OBSERVATION:
FAILURE TO ESCAPE TRAUMATIC SHOCK
AS A RESULT OF OBSERVING A HELPLESS SITUATION

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LEARNED HELPLESSNESS THROUGH OBSERVATION: FAILURE TO ESCAPE TRAUMATIC SHOCK AS A RESULT OF OBSERVING A HELPLESS SITUATION

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Directed by: R.L. Miller, D.L. Roenker, C.C. Layne, and D.A. Shiek

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Twenty naive male and female hooded rats were randomly divided into four groups of five subjects each. The Observe Helpless group was allowed to observe Helpless subjects receive signaled, inescapable electric shock, after which they were tested for effective escape response acquisition. Subjects in the Observe Naive group were allowed to observe Naive subjects being given escape-avoidance training using signaled presentations of electric shock, after which the Observe Helpless group was given similar escape-avoidance training. Results indicate that there were significant differences ($p < .01$) in the acquisition of effective escape responses between the Observe Helpless group and the other two groups. Possible explanations for these differences, as well as implications for further research, are discussed.

INTRODUCTION AND LITERATURE REVIEW

Many theories of learning have emerged from psychological laboratories which attempt to explain how an organism acquires a particular behavior or set of behaviors.

Some of these theories have been set forth in an attempt to refute or revise earlier theories, while others have simply been added to an ever increasing body of knowledge. Generally, these theories are relatively pure and independent of other theories and few attempts have been made to integrate them.

In the laboratory, variables are isolated and controlled so that the researcher is able to isolate the cause of a particular event. However, control and isolation are rare in reality; and thus, in an organism's natural environment, it is likely that these variables interact with one another when an organism acquires its particular behavioral pattern.

The purpose of the present study is to investigate the possible interaction of two theories of learning: observational learning and learned helplessness.

Observational Learning

The observational procedure was designed to determine whether learning can occur through exposure to, but in the absence of, direct contact with the stimulus-response-outcome sequence. In the typical observational learning experiment the experimental subject is allowed to observe a demonstrator, usually of the same species, perform a particular task. In this situation the experimental subject, the observer, does not perform the observed task and does not receive any direct reinforcement. After a predetermined number of observation trials or period of time, the observer is tested on the observed task. If the observer learns the task quicker than control subjects that have not observed a demonstrator, it is concluded that the subject has learned through observation something about the task that facilitated acquisition.

Early studies were conducted in order to determine whether or not an animal can learn through observation. However, as a result of improper experimental design and analysis, results were inconclusive and the issue remained unresolved (Del Russo, 1975). While faulty design and improper control characterized much of the earlier research, Warden and Jackson (1935) in testing observational learning established strict criteria which eliminated or controlled several of the variables which contaminated such experiments, one of which was the possibility of trial and error learning.

Observational Learning; Primates:

Warden and Jackson's experiments required the subject, a Rhesus monkey, to observe four different tasks in which correct performance would open a door revealing food. The results of this experiment showed that observers performed significantly better than control subjects that did not observe. Thus, the success of this experiment clearly showed that learning by observation is possible.

Since that time, many other researchers have been able to demonstrate observational learning in a variety of species and in a number of learning situations. For example, in 1959 Presley and Riopelle reported that Rhesus monkeys acquired an avoidance response quicker if they had first observed demonstrator subjects perform the task in question. In this particular experiment, the subjects were placed in a double compartment cage. One compartment contained an electrified grid and beneath the grid and on each side of the barrier were two seventy-five watt, red electric light bulbs. At the onset of every trial, the red light would come on for 14 seconds. Four seconds after the light came on the grid was electrified. To avoid or escape shock, the subject was required to leap over a barrier to the safe side of the compartment. The results of this study show that the performance of the observer was superior to that of the demonstrator during all phases of training. Further, Presley and Riopelle stated that the slowest observer learned the task in as few trials as did the fastest demonstrator. This study is important not only because of its support for the phenomenon of observational learning, but also because it is the first study to demonstrate successfully observational learning of an avoidance response, whereas previous studies used "rewards" as incentives. While it can be argued that escape and avoidance of a noxious stimulus is rewarding, it is important to note that the outcome of the stimulus-response sequence did not result in the acquisition of a tangible reward such as food or water, but did result in the alleviation of pain.

Observational Learning; Cats:

In another series of experiments employing a standard observational learning paradigm John, Chesler, Bartlett, and Victor (1968) were able to show differences in cats acquiring an avoidance response, as well as differences in the acquisition of an approach response in the same species. In the first experiment the demonstrator was required to avoid foot shock by jumping a barrier upon presentation of the conditioned stimulus (CS), a buzzer. The results showed a clear difference in the number of errors committed in training by observers as compared to demonstrators.

In the second experiment which required an approach response, John, et al., were again able to show significant differences between observers and demonstrators in task acquisition. Here, the subjects were required to press a lever to obtain food. The results showed that observers committed significantly fewer errors than did demonstrators performing the same tasks. Thus, in both experiments, regardless of whether the task was approach or avoidance in nature, the observers were faster in acquiring the operant in question and committed fewer errors in doing so. In addition, in the second experiment the observers had approximately 61 percent more inter-trial responses than did the demonstrator group which, according to the authors, is a measure of stimulus discrimination. Therefore, the results of this experiment indicate that observational learning is superior to standard shaping techniques, and that these standard techniques may be utilizing relatively unnatural mechanisms, thus owing to the relative inefficiency and slowness of behavior shaping techniques.

The preceding studies in observational learning have employed cats and monkeys, both of which are relatively high on the phylogenetic scale. Thus, it could be argued that the greater degree of development of the central nervous system of these species could be a facilitative variable in task acquisition by observers.

Observational Learning; Rats:

In an attempt to establish observational learning in the rat, Corson (1967) conducted an experiment in which the subjects, 18 naive hooded rats, were maintained on a 22-hour food deprivation. Twelve of these animals were placed in the observation group, and the remaining six in the shape group. Each animal in the observation group was placed in a standard operant conditioning chamber with a similarly deprived but sophisticated lever presser that was previously trained to press the lever to a criterion of at least 75 times in a 15-minute period. Following 15 minutes of observing lever pressing and eating, each subject was tested alone for 15 minutes. This procedure was repeated three times per day until subjects were pressing at a rate of fifty or more times in fifteen minutes. The remaining six rats were trained to lever press for food using standard operant conditioning techniques, and were required to meet the same performance criteria as the observation group.

The results of this experiment showed that the observational group learned the task in fewer test sessions. However, no significant differences were seen in total time to criterion between these two groups. Corson states that advantages in this type of training would be that the number of animals that can be trained would be limited by equipment availability rather than by the number of experienced experimenters. Further, some disadvantages listed by Corson were variations in subject observation, subject anxiety, and subject adaptation.

In another study of observational learning vs. shaping, Powell (1968) attempted to replicate the Corson study. In this experiment subjects were

25 naive albino rats who were randomly separated into two groups, observational or shaped. Further, all subjects were maintained at either 70, 80, or 90 percent of their ad lib weight, although no reason was given for these weight differentials. The observer group was paired in the same chamber for 15 minutes with an experienced lever presser maintained at 80 percent of ad lib weight. The shaped group was trained to bar press for food using standard shaping techniques. The criterion for final performance was 50 or more responses during the test period, which consisted of 15 minutes training followed by 15 minutes of testing per day.

The results of this experiment showed that the shaped group reached criterion in fewer test sessions when compared to the observational group leading Powell to conclude that shaping is a more effective procedure than observation for training rats to perform an instrumental response.

However, some obvious differences are noted between the Powell and Corson studies. For example, Corson maintained his subjects solely on a food deprivation schedule, whereas Powell maintained his animals at three different levels of ad lib weight; 70 percent, 80 percent, and 90 percent, respectively. The results of the Powell replication seem to be of questionable emperical validity on the following basis. Although Powell stated that his study was a replication, he has in reality introduced new variables which were not present in the Corson study. Thus, in addition to the three levels of ad lib weight, Powell also maintained his subjects on a 23-hour food deprivation schedule whereas in the Corson study subjects were maintained on a 22-hour food deprivation schedule. Another variable Powell introduced in his "replication" was the use of albino rats, whereas Corson used hooded rats in his experiments. It is widely known and accepted that albino rats are notorious for their poor vision, and there have been numerous studies and experiments which have provided documented evidence to support this observation (Lashley, 1930; Greenhut, 1954; Davidson and Walk, 1969). It is impossible to determine whether the introduction of new variables had any effect on the outcome of the study, although Powell specifically states that it did not. However, if one examines his data it can be seen that the mean number of trials to criterion in the observer group declines as the percentage of ad lib weight of these subjects increases. Thus, while Powell claims that this study is a replication, it is quite likely that the introduction of these variables had some differential effect on the outcome of the study, which led to Powell's conclusion.

In a later study of observational learning vs. shaping, Jacoby and Dawson (1969) attempted to optimize the visual process by controlling certain factors. For example, their subjects were Long-Evans hooded rats, the lever was located directly over the food receptacle, subjects were separated by a clear plexiglas partition, outside walls of the chamber were covered with translucent paper to reduce external visual stimuli, and the chamber was maintained in an air conditioned, soundproofed room.

In the results of this study, two dependent variables were separately analyzed. These dependent variables included total number of lever presses and the mean number of trials to criterion. Analysis of the data indicated that on mean number of trials to criterion, the observe group and the shape group did not differ significantly. However, in the total number of lever presses across trials, differences existed between these two groups. That is, observers made a significantly greater number of lever presses in an equal number of trials.

Thus, while Powell (1968) indicates that shaping is a more effective and efficient method of training, it appears that the task required was not consistent with the ability of the subjects, thus confounding the results. Different results were obtained by Jacoby and Dawson when certain controls were instituted in order to optimize the visual process.

In a later study, Powell and Burns (1970), in a further attempt to show that shaping can be a more effective method of training than observational learning, designed a study that would control for visual factors in observational learning as well as for specific odors emitted by the demonstrator that might serve as cues.

There were six groups in this study: albino observe, hooded observe, hooded shape, hooded observe with screen, hooded control one, and hooded control two. The first three groups either observed or were shaped according to standard procedures in this type of experiment. The hooded observe screen group observed the demonstrator through two layers of hardware cloth between two pieces of plexiglas, thus reducing the amount of transmitted light by 52 percent. The hooded control one group was studied under the same conditions except that the partition was opaque, rendering observation impossible. Hooded control two was separated from the operational side of the chamber by an opaque screen, and in order to control for olfactory cues, no demonstrator subject was present and the lever was operated every 7.5 seconds. The results of this study show that the hooded shape group had significantly fewer test sessions to criterion than any other group. Thus, Powell and Burns state that shaping can be a more effective technique in training rats to press a lever. However, their method and subsequent results also raise some questions about their conclusions. For example, in this, as in the previous study, the group upon which they base their findings, the hooded shape group, had the fewest number of subjects, ranging from 50 percent of the largest group to 60 percent of the next smallest group.

Secondly, although it was not mentioned by Powell and Burns, the mean score of the hooded observe (screen) group is significantly lower than the mean score of the hooded observe group. It is widely known that rats are nocturnal animals, and, therefore, have better vision in reduced light. While Powell and Burns fail to state the light intensity of the observe groups, it must be reasonable to assume that it was fairly intense in view of the better performance of the hooded observe (screen) group under subdued lighting conditions.

Thus, while Powell and Burns state that one purpose of the experiment was to optimize the visual process in the experiment, it is unlikely that this goal was achieved. Further, Powell and Burns state that hooded rats observing through a screen (subdued lighting conditions) learned to press a lever just as quickly as hooded rats observing through clear plexiglas. Not only is this statement inaccurate, it is simply not true. The data clearly shows that the subjects under subdued lighting conditions had a lower mean score than did the hooded observe group (8.5 and 11.1, respectively).

While Powell and Burns purport their data and conclusions to be in support of shaping as the superior method of training, if one examines their data and methodology certain questions can be raised with respect to their design, methodology, analysis, and conclusions. Further questions arise in view of the fact that while there is an abundance of data in support of observational learning from a large number of laboratories using a variety of species and task requirements, the laboratory of Powell, et al. seems to be one of the few that is obtaining contradictory results in this area. Thus, one should use care and judgment before accepting or rejecting this concept.

In a later experiment designed to investigate some relevant variables in observational learning, Groesbeck and Duerfeldt (1971), isolated four variables which were thought to contribute to observational learning. These variables were (1) informational content, (2) modeling content, (3) vicarious reinforcement, and (4) natural tendency to follow. Subjects in this study were water deprived Long-Evans hooded rats whose task was to knock over the correct plexiglas barrier in a Y maze which would lead to ten seconds of free drinking. Subjects were separated randomly into one of six groups designed to isolate the above mentioned variables. Group one was the control group and no demonstrators were present during the observation period. The stimulus panels remained erect so that the subjects could not see beyond to the water bottle. Thus, no cues for observational learning were present. Group two observed a demonstrator knock over the barrier, walk over it and down the runway, and drink water. Thus, for this group information, modeling, and vicarious reinforcement were present. Group three viewed demonstrators being rewarded on the positive card but never saw the task being performed. Therefore, only information and vicarious reinforcement were present. Group four observed the demonstrator knock over the barrier and run down the runway. However, the water bottle was shrouded so that the demonstrator could not be observed drinking. Here, only the information and modeling variables were present. Group five observed the experimenter knock over the barrier and tap the water bottle with a pointer, thus eliminating modeling, vicarious reinforcement, and the tendency to follow. For groups two, three, four, and five the arms of the maze were reversed half of the time so that the subjects would not be consistantly rewarded for following the demonstrator. Group six observed the demonstrator knock over the barrier, run over it and down the runway and drink. However, the maze arms were not reversed and the correct choice remained in the same position. Thus, all variables being investigated were present in this condition. In this study, trials to criterion were defined as ten consecutive correct responses.

Results showed that the mean number of trials to criterion were fewest for group six, followed by groups four, two, five, three and one in that order. Thus, the data show that all of the experimental treatments facilitated task acquisition when compared to the control subjects. The authors state that modeling appeared to be the most important aspect of the observational experience, noting that the three groups allowed to observe the demonstrator's performance learned sooner than did all other groups. Information also seemed to be important as evidenced by the fact that subjects viewing the experimenter knock over the barrier and tap the water bottle spout with a pointer also acquired the task faster than did the control animals. Vicarious reinforcement was also a facilitative factor in task acquisition. Subjects in group three who were allowed to observe only the demonstrator drinking on the positive cue panel also acquired the task faster than did the control subjects. However, vicarious reinforcement with information proved to be no better than information alone. Thus, vicarious reinforcement is not seen as a potent facilitator and may actually have negative effects, which might explain the negative findings of some previous studies.

Thus, this study supports previous studies in observational learning, and indicates that modeling is probably the most important variable, along with information. Thus, when the subject is allowed to see the task being performed, and the task is kept constant, therefore providing the highest degree of correct information, task acquisition is fastest. Further, running down a runway would be more consistant with a rat's behavioral repertoire than would lever pressing, as well as providing more facilitative effects in observational learning.

In the previously noted studies of Presley and Riopelle (1959) and John, et al. (1968), observational learning of discriminative avoidance was demonstrated. It is likely that these studies would have yielded additional information if more stringent controls had been employed. Results of these studies suggest that the subjects had learned the cue function of the discriminative task through observation, according to Del Russo (1975). However, Del Russo states that it is not clear whether the subjects merely learned the correct response or whether the cue function was also learned through observation. Thus, in an attempt to isolate the effects of response learning from cue learning, Del Russo has designed an experiment in discriminative avoidance in which the observers were exposed either to the cue component, the response component, or the entire stimulus-response sequence. Thus, if control subjects exposed only to the response component performed as well as observers exposed to the stimulus-response sequence, observational learning would appear to be primarily a response learning effect. However, if observers exposed to the entire stimulus-response sequence performed better than controls, one could conclude that the observers had learned the relationship between the warning stimulus and response.

In his study, Del Russo defined the task as discriminative shuttle avoidance. A tone served as a warning stimulus and shock was delivered alternately to the right or left side of the shuttle box. An observation chamber was placed flush to the side of the shuttle box. Subjects were Long-Evans hooded rats and were placed randomly into one of five groups. The observe skilled demonstrator (OSD) group observed a demonstrator perform the discriminative avoidance task for 100 trials. The observe naive demonstrator (OND) group observed naíve demonstrators learn the discriminative avoidance task for 100 trials. The stimulus control (SC) group, while in the observation chamber, were exposed to the warning tone for 100 trials. No demonstrator was present during this time. The RC group observed a demonstrator perform 100 avoidance responses with no tone present. The naive control (NC) group spent 30 minutes in the observational chamber but were exposed to no other aspect of the test situation. Immediately after the observation period all subjects were transferred to the shuttle box for 100 trials on the discriminative-avoidance task.

The results of this study showed that the OSD and OND groups performed significantly more avoidance responses than any of the control groups. There were no significant differences between the OSD and OND groups; therefore, exposure to either stimulus alone or response alone had no significant effect upon acquisition of the discriminative avoidance task.

This data would, therefore, suggest that rats are capable of observational learning of a discriminative avoidance task, and that these subjects did in fact learn the association between stimulus and response. The failure of the response control group clearly indicates that observational learning is not a response learning effect. Further, Del Russo states that since all possible sources of vicarious reinforcement were controlled for, the observational learning by the OSD group may indicate that reinforcement, either direct or vicarious, is not necessary for observational learning.

This study lends further support to the findings of Groesbeck and Duerfeldt (1971) who concluded that the most important variables and aspects of observational learning are modeling and information, with vicarious reinforcement being of little value, and possibly harmful.

The previously cited studies, for the most part, have demonstrated and provided evidence for the construct of observational learning. These studies have shown that observational learning is possible in a wide variety of species and task requirements, and that subjects can learn both approach and avoidance responses as well as stimulus discrimination through observation. It is, therefore, not unreasonable to assume that, if observational learning is possible in sub-human species, human subjects as well are capable of learning through observation.

Observational Learning; Humans:

Vicarious reinforcement has been shown to be of limited value in animal studies as demonstrated by Groesbeck and Duerfeldt (1971) and Del Russo (1975), although learning through observation was supported. In studies conducted with human subjects, Bandura, Ross, and Ross (1963) and Bandura (1965), not only has observational learning been demonstrated, but vicarious reinforcement has been shown to be an important aspect as well. For example, Bandura, Ross, and Ross (1963) conducted an experiment designed to investigate the influence of response consequences on the imitative learning of aggression. Bandura, et al., considered vicarious reinforcement to be an important variable in observational learning in humans. Further, the authors stated that there is evidence that direct and vicarious reinforcement may function analogously in that "when a model is punished in the presence of an observer, the observer acquires conditioned emotional responses even though he himself receives no aversive stimulation . . . and that vicariously conditioned fear responses mediate avoidance responses or response inhibition" (p. 601). Conversely, observation of a positively reinforced model produces positive incentive learning and facilitates the occurrence of imitative behavior. Thus, in the study conducted by Bandura, et al. (1963), nursery school children were randomly assigned to one of four groups; aggressive model rewarded, aggressive model punished, control group shown highly expressive but non-aggressive models, and a second control group having no exposure to models.

Basically, the results of this study demonstrate that children who viewed an aggressive model acquire positive rewards showed more imitative aggressive responses and chose to emulate the aggressive model more frequently when he secured attractive rewards through aggression. The children who observed an aggressive model punished not only failed to reproduce or imitate his behavior, but also rejected him as a model for emulation. The authors further state that the children who imitated and emulated the successful aggressor evaluated his behavior as being strongly negative. It, therefore, follows that since the children adopted the aggressive behavior of the model, but evaluated it in a negative direction would automatically find themselves in a state of dissonance, which undoubtedly occurred. However, the children did not resolve the conflict by increasing the attractiveness of the aggression, but rather were highly critical of the individual who was the focus of the aggression. Conversely, in the aggressive model punished condition, no negative evaluations of the child aggressed against were noted and the aggressor was seen as a bad boy. The data also showed that children who observed models acquire rewards in a pro-social manner did not behave significantly different from those viewing the aggressive model punished, but did behave significantly different from subjects observing aggressive models rewarded. That is, children tended to adopt aggressive behavior if it was rewarded more frequently than they adopted socially acceptable behavior if it was rewarded. The authors partially explain this finding in terms of the dominance of aggressive responses in the subject's behavioral repertoires as evidenced by the fact that little boys have a strongly established repertoire of aggressive behavior, whereas little girls do not.

Thus, the implications of this study are that not only is observational learning possible in human subjects, but also that vicarious reinforcement may play a much greater role in humans than it does in lower animals. This disparity could be explained in terms of the greater cognitive powers and reasoning ability in the human species in comparison to infra-human species.

In a later follow-up study by Bandura (1965), which isolated positive incentive from the acquisition of imitative behavior, the author found that children exposed to an aggressive model rewarded showed more imitative responses than did children who observed an aggressive model punished, or an aggressive model with no consequences. Further, the children in the aggressive model punished condition exhibited significantly fewer imitative responses than did the children in the aggressive model-no consequences group. Children in all three treatment conditions were then offered attractive rewards contingent on reproducing the model's aggression. The introduction of positive incentives completedly wiped out any differences previously noted between conditions, resulting in an equivalent amount of learning in all three treatment conditions.

Thus, while vicarious reinforcement apparently played an important role in response acquisition or inhibition, it is also apparent that direct reinforcement is a more potent variable and thus can override any inhibitory effects of negative vicarious reinforcement.

It is, therefore, apparent that in carefully controlled studies observational learning can indeed be demonstrated. It is further noted that in infra-human species vicarious reinforcement plays a lesser role than it does in human subjects. It is quite apparent that when properly utilized observational learning can be a useful and effective tool in teaching organisms, both human and sub-human, to perform instrumental tasks; and that this can be done in an efficient and effective manner, probably to a greater degree than with standard behavior shaping techniques.

Learned Helplessness

Learned theory began with two major approaches and was based on the simplest of premises: operant conditioning and classical conditioning. Operant conditioning, as first hypothesized by E.L. Thorndike and later refined by B.F. Skinner, is solely concerned with voluntary responses. The operant model is characterized by the stimulus-response-outcome paradigm and basically states that the organism responds to a stimulus, the results of which, referred to as the outcome, will serve to either increase or decrease the probability of that response occurring again under similar conditions. A rewarding outcome will serve to increase the probability of that response occurring again, and an aversive outcome will reduce that probability.

Classical conditioning, as first proposed by Ivan Pavlov in 1899, concerns itself with involuntary responses. In the basic classical conditioning paradigm a novel stimulus is paired with an unconditioned stimulus, which is defined as a stimulus that will naturally and immediately result in an involuntary response, referred to as the unconditioned response. Repeated pairings of the novel stimulus and the unconditioned stimulus will result in the novel stimulus acquiring similar properties of the unconditioned stimulus. When the novel stimulus acquires these new properties, it is referred to as the conditioned stimulus. Since it has acquired these similar properties, it follows that it would result in a response similar to that of the unconditioned stimulus. This is, in fact, what occurs, and this response is referred to as the conditioned response. Thus, the organism has learned an association between the conditioned stimulus and the unconditioned stimulus. What distinguishes operant conditioning from classical conditioning is helplessness (Seligman, 1975). In classical conditioning no response is allowed to change the unconditioned stimulus or the conditioned stimulus. In operant conditioning, however, some response must result in some reward. Therefore, in operant conditioning voluntary responses control outcomes; in classical conditioning involuntary responses do not produce any change in the environment.

Learning can also occur when an organism, in the operant paradigm, makes a voluntary response and nothing happens. In this situation, if the response has been previously rewarded but is no longer rewarded, the response is less likely to occur and finally extinguishes. However, if the organism has never made that response and the response has no effect on the outcome of the situation, the organism learns that responding, or at least that particular response, is futile. Thus, the organism either makes other responses or stops responding altogether. The animal, therefore, becomes helpless and learns that responding is ineffective and futile, and that the outcome of the stimulus-response-outcome sequence is independent of any response.

Dinsmore and Campbell (1956) investigated the effects of prior inescapable shock on escape from shock training. Their study consisted of hooded rats placed randomly into one of four groups. Group NN received no prior shock and no bar was present in the operant chamber. Group BN received no prior shock but were exposed to the bar in the operant chamber. Group NS was exposed to inescapable shock of .2 ma., 60 cycle half wave, rectified DC current. No bar was present in the chamber. Group BS was was exposed to the same level of inescapable shock as was group NS, and was also exposed to the bar in the chamber. All groups received 15 minutes of magazine training before being trained to escape shock. Immediately thereafter, each animal was given 35 minutes of escape training in which the animal could escape shock by pressing then releasing a bar activated switch.

Basically, the results of this study show that both groups receiving inescapable shock prior to training made over 50 percent fewer escape responses than did the no prior shock groups over the 35-minute training session. Further, it did not make any difference whether the bar was in or out of the chamber. Responses were approximately equal across both shock groups and both non-shock groups.

Dinsmore and Campbell attempted to explain these results in terms of an acquired competing behavior. However, they also stated that the concrete form of this behavior was not clear since, on the basis of earlier work, they thought they had successfully eliminated competing behavior.

They further stated that one possible source of competing behavior in the apparatus could have been a relatively slow rate of shock pulsing in that the most typical non-escape behavior was the rapid retractions of the paws from the grid in rhythm with the shock pulses followed by slower replacements to the grid. A possible solution to this problem, as stated by Dinsmore and Campbell, would be to increase the frequency of the shock pulses reducing the animal's ability to retract the paws in rhythm with the pulse frequency.

Thus, in this study, Dinsmore and Campbell have noted greater response deficits in animals that have first been exposed to inescapable shock. It is likely in this situation that these subjects have learned that responding has no influence on the outcome and thus fail to respond later when the outcome could be influenced. Thus, reduced motivation to respond may have resulted and, therefore, prevented these animals from responding.

Overmier and Seligman (1967) also conducted an investigation of the effects of prior inescapable shock on subsequent escape and avoidance training in a series of three experiments.

Experiment I

In this experiment, 32 adult mongrel dogs of approximately equal size and weight were randomly assigned to one of four groups.

Group one, a control group, received no treatment prior to escape and avoidance training. Group two received 64 trials of inescapable shock, with an intensity of 6.0 milliamps (ma.) and five seconds duration. Group three received 640 trials of inescapable shock of 6.0 ma. with five seconds duration. Group four received 64 trials of inescapable shock of 6.0 ma. shock of .5 seconds duration. The pretreatment inter-trial intervals were ninety seconds average for group two, nine seconds average for group three, and ninety seconds average for group four. Approximately twenty-four hours later all four groups received ten trials of instrumental escape-avoidance training in a standard shuttle box. The shock was signaled by dimming the two fifty-watt lamps illuminating the shuttle compartment.

The results of this first experiment showed that group one differed significantly from all other groups on the basis of mean latency to response, number of failures to escape shock, and in the percentage of subjects never escaping shock. Further, the three groups which received inescapable shocks did not differ significantly from each other. Thus, the authors conclude, on the basis of this experiment that prior exposure to inescapable shock, even under a variety of conditions, results in interference with the acquisition of instrumental escape-avoidance responses. The fact that high shock density groups did not differ significantly from low shock density groups suggests that the interference is a general phenomenon, but that stimulus density may determine the nagnitude of the interference effect.

Experiment II

Twenty-four adult mongrel dogs, similar in size and weight, were assigned randomly to one of three groups. Group one received 64 five second trials of 6.0 ma. inescapable shock with inter-trial intervals averaging 90 seconds. Group two was paralyzed with injections of curare and then received 64 presentations of unsignaled, 6.0 ma. inescapable shock of five seconds duration. A third group was curarized but received no inescapable shock and was simply allowed to recover from paralysis.

Approximately 24 hours after curarization and shock exposure, all three groups received ten trials of instrumental escape-avoidance training as described in experiment one, with the exception that in this experiment group one received 6.5 ma. shock and was considered the high motivation group. The results showed that groups one and two did not differ significantly on mean latencies to response, number of failures to escape shock, or in the percentage of subjects which never escaped. Group three, however, differed significantly from the other two groups on all these criteria.

The authors argue that their data does not support the suggestion of Dinsmore and Campbell (1956) that the subjects have learned competing skeletal-motor responses and, thus, are prevented from escaping or avoiding shock. Since the subjects in this experiment were paralyzed it was impossible for them to learn competing responses. Further, the results were not due to the effects of curare since curarized dogs who did not experience prior inescapable shock did not show response deficits in escape-avoidance training. In addition, Overmier and Seligman state that adaptation is unlikely since shock levels greater than 6.5 ma. is frequently tetanizing and physically prevents subjects from responding.

Experiment III

This experiment was designed to investigate the interference phenomenon as a function of the delay between treatments. Adult mongrel dogs similar to those used in the previous two experiments were used as subjects. Subjects were divided into two sets of four groups each. One set received 64 presentations of unsignaled, inescapable, 6.0 ma. shock of five seconds duration with an average of 90 seconds between presentations. The second set of groups were curarized and then presented with the same stimulus parameters as group one with the exception that one half of the shocks were signaled by a tone. Further, there were an equal number of tone presentations that were not followed by shock.

All groups then received the same avoidance training as described in experiment one. However, the time between inescapable shock and escape training varied. Each group was trained either 24, 48, 72, or 144 hours after exposure to inescapable shock.

The results showed that the two sets of groups were not significantly different in their instrumental responding, nor were they different across the four time intervals. However, the results did show that the 48, 72, and 144 hour groups differed significantly from the 24 hour group. This group yielded shorter mean response latencies, fewer failures to escape shock, and a lower percentage of subjects that never escaped shock.

These results suggest that the interference phenomenon dissipates rapidly and subjects respond normally after 48 hours.

In general, the results of these experiments suggest that interference of inescapable shock on subsequent escape-avoidance training is a reliable phenomenon and that incompatible responses or adaptation on the part of the subject is not supported by these data. The authors suggest that the source of the interference is a learned helplessness which may result from receiving aversive stimuli over which the organism has no control.

Seligman and Maier (1967) conducted a series of two experiments to investigate the effects of escapable as compared to inescapable shock on subsequent escape-avoidance responding as well as to investigate the mitigating effects of prior experience with escapable shock on inescapable shock and subsequent escape-avoidance behavior.

Experiment I

Subjects in this experiment were 30 adult naive mongrel dogs randomly assigned to one of two groups, the escape group and the yoked control group. The escape group received escape training in a harness. Subjects were required to press a panel with their head in order to escape a 6.0 ma. shock. Shock was unsignaled and each subject received a total of 64 trials. For the yoked control group, panel presses had no effect upon the pre-programmed shock. The duration of shock for this group was determined by the length of shock for the corresponding trial in the escape group. Thus, the yoked control group received a series of 64 shock presentations of decreasing duration. In addition, a normal control group received only ten escape-avoidance trials in the shuttle box.

The results were measured on the basis of three criteria; mean latency to respond, percent of failure to escape on nine or more of the ten trials, and mean number of failures to escape shock. The results showed that in mean latency to respond the yoked control group differed significantly from the other two groups. The escape and normal control groups did not differ from each other. The yoked control group also differed from the other two groups in the percent of subjects failing to escape on nine or more of the ten trials, and on the mean number of failures to escape shock. No differences were seen between the escape and normal control groups on these criteria. Six subjects in the yoked control group failed to escape shock on nine or more of the ten trials. Seven days later these subjects received ten additional trials in the shuttle box. Five of them continued to fail to escape shock on every trial.

These results suggest that the degree of control allowed the subject in its initial exposure to shock determined whether or not interference occurred in later escape-avoidance training. Since the escape group had greater control over shock in comparison to the yoked control group, it would appear, and the authors suggest, that some differential learning about their control has occurred in these two groups. Interference in the escape group did not occur since subjects learned that their responding correlated with shock termination, thus creating an incentive to maintain responding. In the yoked control group an incentive to respond was absent since the subjects learned that shock termination is independent of responding. It is unlikely that the yoked control group adapted to shock in prior exposure to shock since the escape group would also have shown adaptation effects.

Experiment II

This experiment investigated whether prior experience with escapable shock in the shuttle box will mitigate the effects of inescapable shock on subsequent escape-avoidance behavior.

The subjects were 27 naive adult mongrel dogs assigned randomly to one of three groups; the pre-escape group, the no pre group, and no inescapable group. The pre-escape group received three days of treatment. On day one each subject received ten escape-avoidance trials in the shuttle box. Day two consisted of 64 five second, 6.0 ma. inescapable shocks in a harness. On day three subjects returned to the shuttle box and were given thirty more escape-avoidance trials. The no pre group had no experience in the shuttle box prior to inescapable shock in the harness. On day one this group received inescapable shock similar to that of the pre-escape group. On day two subjects were placed in the shuttle box for forty trials of escape-avoidance training. If the subject failed to respond on the first five trials, it was moved to the other side of the shuttle box. If the subject continued to fail to respond, it was put back on the original side of the shuttle box after the twenty-fifth trial. The no inescapable group was treated exactly as the pre-escape group except that it received no shock when strapped into the harness.

Data analysis indicated significant interference in the no pre group with escape-avoidance responding on day three. No such interference was shown with the other two groups, and these two groups did not differ significantly from each other.

Seligman and Maier state that three main findings emerged from experiment two. First, pre-escape subjects did not react passively to subsequent shock in the shuttle box. Secondly, the pre-escape group first having experience with escapable shock in the shuttle box showed enhanced panel pressing when receiving inescapable shock in the harness. Finally, the interference effect persisted for forty trials. Therefore, if an animal first learns that its responding results in shock termination, and then faces a situation where reinforcement is independent of responding, its persistence of responding is greater than that of a naive animal.

Overmier (1968) states that previous studies conducted by Overmier and Seligman (1967) and Seligman and Maier (1967) suggest that subjects learned during inescapable shock that shock termination was response independent and that the presence of shock mediated the generalization of non responding during shock to a new situation. Overmier states that this transituational behavior should not be observed if the investigation focused on avoidance behavior by training subjects in an avoidance technique that is not confounded by escape contingencies. Thus, the focus of Overmier's experiment was directed toward the question whether or not prior experience with inescapable shock has any effect on avoidance behavior.

Subjects consisted of thirty adult naive mongrel dogs distributed randomly among four experimental groups and one control group. The four experimental groups were exposed to sixty presentations of inescapable shock with an intensity of 6 ma. and five seconds duration. The average inter-trial interval was 80 seconds.

Instrumental avoidance training followed the exposure to inescapable shock by a time period of 24, 48, 72, or 144 hours for each experimental group, respectively. During instrumental avoidance training escape from shock was not possible. Each subject was given 21 avoidance trials each day until the subject met the criterion of ten consecutive avoidance in one day or until five days had elapsed. However, no subject received less than three days training. Each avoidance trial began with a 1900 Hz tone which remained on until trial termination. Ten seconds later shock was introduced. If the subject jumped the barrier in the shuttle box during this interval, the tone terminated and no shock was presented. Failure to avoid shock led to the presentation of an intense 9 ma., .5 second shock which was of such short duration to make escape impossible.

Results showed that one subject in each of the 24 and 48 hour groups failed to make a single avoidance response and half the subjects in these two groups failed to reach avoidance criterion in five days of training. All subjects in the 72 and 144 hour groups reached criterion within the five day training period. Further, the 24 and 48 hour groups required significantly more trials to criterion than did the control while the 72 and 144 hour groups did not differ significantly from the control group. Further examination of the data reveals that the 24 and 48 hour groups were not interfered with equally but the two groups did not differ significantly.

These data suggest that exposure to inescapable shock interfered with subsequent avoidance responding when escape was not possible. Overmier states that these results are contrary to Seligman and Maier's theory of the mechanism of interference. This theory assumes that subjects learn not to respond during inescapable shock and then demonstrate this during shock in a different context. In this study, interference was shown only in the presence of a signal for shock. Overmier concedes that shock could have occurred but was never present at the time of the avoidance response and thus could not directly mediate the interference as suggested by Seligman and Maier. However, Overmier agrees that helplessness does involve learning about response - presentation/outcome independence. These results also suggest that as in escape-avoidance responding, interference dissipates rapidly in time leaving an apparently normal subject after 72 hours, though some indices suggest that recuperation is not fully complete even after 144 hours. In addition, Overmier states that interference with avoidance behavior is more persistent than interference with escape behavior, and that interference with avoidance behavior is not dependent upon concurrent presence of shock.

Seligman and Maier (1967) reported that dogs that had first experienced escapable shock and then were exposed to inescapable shock performed as well as naive animals in escape-avoidance training. Thus, they state that these subjects were immunized against the effects of later inescapable shock. Thus, preventive measures have been shown to be effective against learned helplessness.

Seligman, Maier, and Gear (1968) attempted to investigate the retroactive elimination of learned helplessness in dogs that had continually failed to escape from traumatic shock. Subjects were four adult mongrel dogs that had chronically failed to escape shock as a result of receiving inescapable shock. These subjects had been exposed to 64 presentations of inescapable 6.0 ma. shock of 5 seconds duration. Twenty-four hours later, these subjects were given ten trials of escape-avoidance training in a standard shuttle box. All subjects failed to escape or avoid shock on all ten trials of escape-avoidance training. These subjects were then tested for chronic failure to escape. Seven days after the original training session, all subjects were again placed in the shuttle box for ten escape-avoidance trials. All subjects failed to escape shock on every trial, although one subject avoided shock once on the fifth trial. No further responding was noted on any trial by any subject. Thus, chronic failure to escape or avoid shock was established.

The attempted treatment period consisted of two phases. If phase I were successful, no further treatment was given. In phase I the same escape-avoidance contingency was in effect except that the barrier was removed and the dog had only to step over a five-inch divider to escape shock. In addition, a window was opened at the end of the shuttle box, and the experimenter called to the dog to coax it across the divider. If successful, this procedure would expose the subject to the response-reinforcement contingency. One of the four subjects responded to this treatment and began to escape and avoid.

Phase II consisted of the experimenter physically dragging the dog to the safe side of the shuttle box by a leash around its neck during shock or during the CS-UCS interval. This continued until the subject began responding without being pulled by the experimenter.

Following phase I and/or II, additional escape-avoidance trials were administered in which the barrier was replaced and gradually raised over a course of 15 trials. Ten further escape-avoidance trials were then given, the last five of which were given five to ten days after the first five trials with the barrier at full height.

The results showed that the treatment method was successful in breaking up the maladaptive failure to escape shock. On the first block of five trials immediately after the treatment phase, all subjects escaped or avoided shock 100 percent of the time, where none of these subjects, with the exception of one on one trial, ever attempted to escape or avoid prior to treatment. Further, all subjects continued to respond on four successive blocks of five trials. Thus, these results show that retroactive treatment methods can be effective in alleviating learned helplessness when subjects are physically forced to respond in such a way that the response results in reinforcement, in this case shock termination.

It appears that the perception of control over one's environment seems to be an important variable in the acquisition or suppression of an organism's response patterns, and that maladaptive behavior can be immunized against as well as modified with the proper techniques.

In an investigation of task and species generality of the helplessness phenomenon, Braud, Wepman, and Russo (1969), randomly assigned 27 albino rats to three groups of nine subjects each. Group one received two hours of shock training for six consecutive days; the shock parameters were 0.5 ma. alternating current presented according to a 30 second on - 30 second off alternating schedule. In group one, subjects could escape shock by jumping onto a vertical pole located in the center of the conditioning chamber. Subjects could avoid shock by jumping onto the pole during the off cycle and remaining in that position through the on cycle. Group two was electrically yoked to group one. Thus, when group one escaped or avoided shock, it was also either terminated or prevented for themselves and group two subjects. Group two subjects had no direct control over the shock and its contingencies. The third group was a no shock control group. These subjects were simply placed in the conditioning chambers without shock for a period of two hours daily for six days.

Following shock training, all subjects were given five water escape test trials with an inter-trial interval of one minute. In this situation, subjects were placed in a tank of water opposite an escape ramp and swimming time to the escape ramp was recorded.

Results showed that water escape performance did not differ significantly between the naive group (three) and the escape group (one). However, the data also indicate that the yoked group (two) was significantly slower in its mean escape response latencies across trials, when compared to the no shock group and the escape group. In addition, the escape group responded consistently, but not significantly, faster than the no shock control group.

Thus, the authors state that the results of this study are in close agreement with the work of Seligman, et al., and further suggest that the helplessness phenomenon can occur in a wide variety of species, stimuli, and response contingencies. However, Braud, et al., also concede that it is impossible to tell with certainty whether the inferior performance of the yoked group was a result of a learning process or due to a more basic physiological mechanism without a detailed analysis. The authors state this in view of the fact that stress produces body temperature changes which in turn could have produced a differential susceptibility to water temperature, which, they further state, is an important determinant of swimming performance in mice.

Seligman and Groves (1970) refuted earlier conclusions that learned helplessness is transient and dissipates over time (Seligman and Maier, 1967) stating learning that is present 24 hours after training is usually present 48 hours later. Seligman and Groves thus suggest that inescapable shock produces greater but transient stress which could dissipate in time and result in the previously observed effects. Thus, the authors state that it is important to produce a nontransient failure to escape since it could not result from stress dissipating over time.

In a study designed to demonstrate nontransient learned helplessness Seligman and Groves used as subjects 18 cage raised beagle dogs and 15 adult mongrel dogs of unknown history. The beagles were raised singly and had no physical contact with other dogs after weaning, and only minimal contact with humans. The dogs were divided randomly into three groups, each of which consisted of approximately half mongrels and half beagles. Group one, the four spaced group, received four sessions of inescapable shock over an eight day period, followed seven days later by escape-avoidance training in a shuttle box. Inescapable shock consisted of 60 presentations per day of 6.0 ma., unsignaled, and were five seconds in duration. Group two, the two spaced group, was treated exactly like group one except that only two sessions of inescapable shock were given on day one and again on day eight. Shuttle box training occurred on day 15. The control group received no inescapable shock and were given shuttle box training only, in which the standard CS-UCS, escape-avoidance paradigm was used.

Using the criteria of mean latency in seconds, mean failures to respond, and percent failing 10 out of 10 trials, the results of this study show that when tested seven days later, the four spaced groups were significantly slower in responding and made significantly fewer responses than controls. The two spaced group made fewer responses and was somehwat slower than controls in responding. The four spaced and two spaced groups did not differ. These data indicate that repeated exposures to inescapable shock produce nontransient failure to escape.

Further analysis revealed that beagles jumped significantly more slowly than mongrels and failed to respond on more trials. This effect was due to the two spaced group only. Mongrels and beagles did not differ significnatly in either the four spaced group or controls.

In an attempt to explain these results, the authors do so in terms of proactive interference. Seligman and Groves state that a dog of unknown past history has probably had a life time of experiences with responding that produced relief. Further, if one session of inescapable shock is introduced and the subject learns that response and outcome are independent, proactive interference from earlier experiences might affect attention. Thus, cage reared dogs in this study would have had less proactive interference and would be more susceptible to helplessness.

In addition, multiple sessions of inescapable shock should have the effect of reducing proactive interference and thus enhance learning, specifically that responding and outcome are independent.

Thus, single sessions of response independent stimulation would have a reduced effect on learning but would probably produce stress which is transient in nature and resulting in transient response deficits. On the other hand, multiple sessions enhance learning and produce prolonged response deficits.

Despite the number and variety of investigations of the helplessness phenomenon which have seemingly offered strong evidence for its existance, Maier (1970) stated that other hypotheses have not been ruled out. These other hypotheses generally assert that the subject fails to escape because it has learned incompatible motor responses. These alternative hypotheses generally fall into three general categories and are as follows.

Superstitious reinforcement. This explanation states that some specific motor response accidentally occurs in close temporal continguity with shock termination during the presentation of inescapable shocks. Shock termination reinforces this response and increases the probability that it will occur again when shock terminates. The response then transfers to the escape/avoidance training situation and is incompatible with successful responding and results in response deficits.

Superstitious punishment. Active and potentially successful responses are punished at shock onset thus reducing the probability that active responding will occur again in the presence of shock in an escape/avoidance situation.

Contingent shock mitigation. This hypothesis offers the explanation that the subject reduces the severity of shock by some specific movement or pattern of muscle tonus. The transfer of this explicitly reinforced motor response is then mediated by shock in escape/avoidance training, thus interfering with effective responding.

A direct test of these alternative hypotheses would require a design in which the subject is actually taught to escape shock by performing a response incompatible with that required to escape shock in the training sessions, so that negative transfer is actually produced. Thus, the competing response hypothesis would not predict significant differences between such a group and one that had received equal amounts of inescapable shock. Conversely, the helplessness hypothesis would predict that even though a subject had learned a competing response, it should also learn that it has control over shock. Thus, even if negative transfer should occur, the subject should eventually learn to escape and avoid shock in the new situation. Subjects receiving inescapable shocks on the other hand, should not learn to escape shock in the new situation.

In order to test these alternative hypotheses and to provide a strong test for the helplessness hypothesis, Maier (1970), randomly assigned 30 adult naive mongrel dogs to one of three groups. Group one was taught to escape shocks in a harness by not pressing panels on either side of its head for a specified period of time. Initially the subject was trained not to press the panel for a 1.5 second period. If the subject responded during this period, shock continued until the panel was released. The eventual criterion for this group was five consecutive no response trials of 3.0 seconds each. Shock intensity ranged from 3.5 ma. in the initial stages to 4.5 ma. in the final stages of training. The inter-trial interval was 60 seconds in duration.

Subjects in group two were yoked to group one. These subjects were restrained in a harness and received shock, the parameters of which were identical to that of group one in intensity, duration, and number, the only difference being that shock was inescapable.

Group three subjects were naive control subjects. They received no shock in the harness prior to escape-avoidance training.

Twenty-four hours after receiving harness training, all subjects received escape-avoidance training in a standard shuttle box to a criterion of nine out of ten avoidance responses or until 130 trials had elapsed.

The results of this study were based on two criteria; mean latency in seconds to responding, and mean percentage of trials subjects failed to jump the barrier. These results show that in mean response latency in blocks of five trials, groups one and two were virtually identical and group three was significantly different from the other two groups. By the sixth block of trials, group two had improved significantly over group one and group three was significantly faster in responding than group two. Group two continued to improve in performance and by the sixteenth block of trials, these subject's performance was equal to that of group three. Further group one subjects showed no improvement in performance over the entire 130 trials.

With respect to the second criteria, mean failures to escape or avoid shock, 27.7 percent of the group one subjects failed to escape shock while in yoked group two over 50 percent of the subjects failed to jump the barrier. In the naive control group three, only 2.2 percent of the subjects failed to cross the barrier.

These findings demonstrate that failure to perform escape responses which resulted from prior exposure to inescapable shock was not a function of response-specific negative transfer. Subjects that were taught competing escape responses performed differently than subjects that received inescapable shock. That is, subjects that had learned competing but controlling responses were able to learn new and effective responses whereas subjects that had no control over prior shock did not learn to effectively respond in the training situation. Therefore, it would be difficult to explain these results in terms of the competing response hypotheses if the interference effect were not a function of specific negative transfer.

On the other hand, these findings offer strong support for the helplessness hypothesis. This view assumes that the subject is sensitive to the relationship between the response and outcome, and not simply the paring of the two. It also assumes that the subject can generalize this relationship from specific responses to responses in general, thus allowing the subject to learn the degree of control it has over events. Thus, if the subject learns that it has little or no control over a situation, incentive to respond is reduced and subsequently interferes with learning about response-outcome relationships. Conversely, if the subject has learned that a situation is controllable, but has learned an incompatible response, that response should extinguish if it is not reinforced and a new response should be acquired. Thus, environmental control seems to be more powerful than specific response transfer.

Maier, Albin, and Testa (1973) have stated that there have been conflicting reports on the establishment of the helplessness phenomenon in rats, with a large number of studies, formal and informal, which have failed to find any effect of pretreatment with inescapable shock in rats.

Thus, Maier, et al. (1973), considered it important to determine whether or not proactive interference resulting in learned helplessness does occur in rats, and further, considered it to be important on three distinct levels. First, rats are widely used and convenient subjects, and if the effect does occur in rats, then research can proceed using this species. Secondly, it was considered important to determine whether the effect was restricted to dogs or is a more general phenomenon. Finally, establishing conditions under which the phenomenon does occur may help to illuminate conditions in which it does. Thus, the purpose of this study was to help delineate the conditions under which the effect occurs in rats. This was done in a series of six experiments.

Experiment I

This experiment was an attempt to replicate the conditions of a typical experiment that resulted in failure to escape with dogs. Subjects were 24 male Sprague-Dawley rats 90-120 days old which were randomly assigned to one of three groups. Group one subjects were held in a restraining device and exposed to 64 presentations of five second, one ma. shock. Group two was restrained, but not shocked, and group three which served as naive controls received no treatment. On day two, all rats received thirty trials of escape-avoidance training in a standard shuttle box. However, instead of being required to jump a barrier, rats were required to run through a hole in a partition to the opposite side of the box.

Results of this experiment showed that there were no differences between groups in mean latency to respond. All groups responded with short latency responses and no subject in any of the groups failed to learn to escape.

This experiment used basically the same parameters as used in the dog studies but did not yield any significant differences. However, the authors stated that this was not too surprising since there was no reason to expect that the same parameters that produced interference in the dog would also produce interference in the rat. Therefore, the problem was to attempt to discover what parameters, if any, would produce the interference effect in rats.

Experiment II

One possibility which affects production of failure to escape was the number of presentations of inescapable shock, which was the point of investigation of experiment two.

Subjects were 40 Sprague-Dawley rats, 90-120 days old, and were assigned randomly and equally to one of five groups. Each group received either 64, 96, 128, 160, or 192 presentations of inescapable shock. Shock parameters and apparatus were identical to those of experiment one. Twenty-four hours after being exposed to inescapable shock, all subjects were given 30 trials of shuttle box escape-avoidance training. The results showed that there were no significant differences between groups in mean latency to respond and that these subjects responded as quickly as did subjects in experiment one.

The dog studies had typically employed 6.0 ma. shocks, whereas in these studies intensities of 1.0 ma. were used and according to Maier, et al., there was no reason to believe that they were comparable.

Experiment III

This experiment investigated whether more intense inescapable shock would result in subsequent failure to escape. Subjects in this experiment were of the same strain and age as those described in the previous experiments. Thirty-two subjects were randomly divided into four equal groups and were exposed to 64 presentations of either 1.0 ma., 1.5 ma., 2.0 ma., or 2.5 ma. shocks of five second duration. Twenty-four hours later all subjects received 30 trials of escape-avoidance training in the previously described shuttle box.

The results of this experiment indicate that the use of more intense shocks did not result in failure to escape. All groups responded with low and approximately equal mean response latencies.

Experiment IV

This experiment investigated the effect of reduced inter-trial latency which would produce differences in acquisition of escape-avoidance responses.

Subjects were 32 Sprague-Dawley rats 90-120 days old and were randomly assigned to one of four groups. These groups received 64, five second, 1.0 ma. presentations of inescapable shock with inter-trial intervals of either 15, 30, 45, or 60 seconds. Twenty-four hours later, all groups received 30 trials of escape-avoidance training as previously described. Results indicate that reducing inter-trial interval had no effect. All groups escaped equally well with low response latencies.

An interesting aspect of the results of these studies is that at no time did a typical learning curve appear in any of the data. The subjects responded very rapidly, and responded just as quickly on the first blocks of trials as they did on the last, resulting in a flat curve. Further, collapsing mean latencies to respond across all subjects in all experiments still resulted in a flat curve; no differences were found over trials.

However, collapsing data across subjects and experiments for naive dogs yields a typical learning curve. Early trials typically had relatively long response latencies (approximately 30.0 seconds) and did not drop off until the fourth block of trials.

Maier, et al., suggested that on the basis of this data failure to escape might be difficult to produce in the rat since shuttling for a rat is a different kind of response than it is for a dog. Thus, the possibility exists that failure to escape may be produced more readily if the required response were one which would be acquired more gradually.

Experiment V

In experiment five, the immediate problem was to design a task which would be acquired more gradually. Therefore, in order to accomplish this, the task must be made conceptually more difficult but not necessarily more physically so.

Subjects in this experiment were 24 Sprague-Dawley rats 90-120 days old and randomly assigned into three equal groups; group one inescapable shock, group two restrained, and group three naive. On day one these groups received the same treatment as did equivalent groups in experiment one. Twenty-four hours later, all subjects received 30 trials of escape-avoidance training. The first five trials (FR-1) were identical to training described in experiment one. During the remaining 25 trials (FR-2) subjects were required to cross the shuttle box twice, i.e., go back and fourth in the box in order to terminate shock.

As shown previously, there were no differences between groups when only one crossing was required. However, when the FR-2 contingency was instituted, the results showed that in terms of mean response latency, significant differences existed between group one and groups two and three, and that the restrained and naive groups did not differ significantly from each other. In addition, these results also indicate that in response latency, group one was slower than the other two groups on the first block of FR-2 trials, and this difference increased across trials.

Thus, the results of this experiment showed not only an interference effect, but also that the effect was similar to that seen in dogs. This experiment also indicated that interference was possible in rats if the response contingency were made to be gradually acquired.

Experiment VI

This experiment was conducted in order to determine whether prior exposure to inescapable shocks generally interferes with a gradually acquired response or if it is peculiar to R-2 shuttling in the rat. Therefore, in order to answer this question, experiment six examined the effect of prior exposure to inescapable shock upon the acquisition of a wheel turning excape-avoidance response.

Subjects were 30 Sprague-Dawley rats, 90-120 days old, and were randomly assigned to one of three groups: the inescapable group, the restrained group, and the naive group. Pretreatment shock parameters were identical to those described in experiment one. Twenty-four hours later, all subjects received thirty trials of escape training in which the subject was required to turn a wheel in order to escape shock. No avoidance was possible in this situation.

The results of this experiment indicated that subjects previously exposed to inescapable shock did not learn to escape in the wheel turn situation in comparison to the other two groups. This was significant between groups as well as in groups by trials interaction.

These experiments indicate that rats exposed to inescapable shock can learn shuttle avoidance as fast as rats not previously shocked. Further, the number, intensity, and inter-trial interval failed to produce an interference effect. Data analysis revealed that shuttle responses for the rat was a very different response than it was for the dog. Escape responding in the rat yielded a flat learning curve, whereas the dog initially responded slowly and gradually increased response latencies.

One explanation of these results is that running to the other side of the shuttle box in response to shock is a very high probability initial response in the rat. When rats are shocked, it is possible that they run to a place that looks different without any prior instrumental learning. In conclusion, Maier, et al., have stated that just as other avoidance and punishment contingencies have different effects on different response systems, inescapable shock also seems to have different effects on different types of escape behavior.

Additional intensive experimentation by other investigators has also resulted in producing learned helplessness in the rat (Maier, and Testa, 1975; Seligman, Rosellini, and Kozak, 1975; Rosellini and Seligman, 1976). The crucial factor that has emerged from these studies is that the response used as a test for learned helplessness must be a relatively difficult one, and not something the rat does very readily. For example, if the rat is first exposed to inescapable shock and then tested on a simple escape-avoidance response such as pressing a bar once (FR-1) or running from one side of a shuttle box to the other, no response deficits are found. However, if the required response is made conceptually, but not necessarily physically more difficult, for example running back and fourth in a shuttle box (FR-2), then the rat that has been exposed to inescapable shock fails to escape. In contrast, rats that have previously been exposed to escapable shock or no shock at all have no difficulty in learning these, or more difficult, responses (Maier and Seligman, 1976).

Seligman (1975), and Maier and Seligman (1976) have stated that a major consequence of experience with uncontrollable events is motivational in nature. That is, exposure to uncontrollable events result in reduced motivation to initiate voluntary responses that control other events. A second major consequence appears to be cognitive in nature. That is, once a subject has experience with uncontrollability, it has difficulty in associating a successful response with a desired outcome; pressing a bar and shock termination for example. Thus, uncontrollability interferes with the perception of control.

Helplessness can also have emotional consequences, as first evidenced when motivational deficits dissipated in time under some circumstances (Overmier and Seligman, 1967). This same phenomenon can be seen in humans suffering from stress reactions which can occur, for example, in the aftermath of a natural disaster such as a flood or earthquake. Generally, these individuals can be seen to become stuperous and exhibit maladaptive behavior. After a period of time, however, these symptoms dissipate and the individual is able to behave more effectively. In general, these types of disorders are classified as transient situational disturbances according to the Diagnostic and Statistical Manual of Mental Disorders (1968).

Thus, the theory of learned helplessness states that the expectation of response-outcome independence (a) reduces the motivation to respond, and, therefore, controls the outcome; (b) interferes with learning that responding controls the outcome, and if the outcome is traumatic; (c) results in fear for as long as the subject is uncertain of the uncontrollability of the outcome, and then produces depression (Seligman, 1975).

Statement of the Problem

The review of the literature on observational learning indicates conclusively that organisms can and do learn by observing others in the environment. It has also shown that this is a viable, effective, and efficient method of acquiring a particular pattern of behaviors in a variety of species, and in a variety of situations.

With regard to the concept of learned helplessness, research has shown that organisms can, and do, show response dificits in a situation it perceives to be uncontrollable.

The present study was conducted to investigate whether a subject that has observed another in an uncontrollable situation would become helpless in a similar situation, even though effective responding could change the outcome. It was hypothesized that these subjects would be significantly slower in learning to bar press to escape shock than control subjects that had not observed a helpless situation. It was also predicted that these subjects would adopt behavior patterns similar to those of helpless subjects as described in the preceding literature survey.

METHOD

Subjects

The subjects were 20 Max derived hooded rats bred in the Psychology Department animal colony at Western Kentucky University. Age ranges at the time of training varied between 90 and 120 days. Subjects were housed in individual cages and had continuous access to food and water throughout the experiment.

Apparatus

A standard operant conditioning chamber which measured 35.36 centimeters (cm) long, 27.94 cm wide, and 25.4 cm high was used in all phases of training. A plexiglas panel 27.94 cm wide and 25.4 cm high divided the chamber into two equal compartments, one of which was capable of delivering electric shock through the floor grid. A 3.81 cm wide lever, present in the operational side of the chamber, was located 2.54 cm above the floor grid, 2.54 cm away from the right wall, and protruded 3.8 cm through the rear wall. When operational, this lever would allow the subject to escape or avoid painful electric shock. The nonoperational side of the chamber was identical to the operational side, with the exception that no lever was present and no shock was applied to the floor grid.

Shock was applied to the operational side of the chamber through electronic control circuitry which was designed to initiate the CS-shock sequence, time the duration of the CS, and time the duration of the shock. It was also designed to count the number of elapsed trials, the number of escape responses, and the number of avoidance responses. The AC shock source was a Skinnerian Control Center, model A613, manufactured by Lafayette Instrument Company. Shock was applied to the grid through a Grason-Stadler grid scrambler, model E7460A. During all phases of testing, the operant conditioning chamber was illuminated by a seven-watt lamp shielded by opaque white paper to reduce glare.

Procedure

Subjects were randomly assigned to one of four groups: helpless (H), observe helpless (OH), naive (N), and observe naive (ON). Subjects in the OH group were allowed to observe group H subjects receive signaled, inescapable shock for one block of 50 trials daily for a period of five days. During this period the lever in the operational side of the chamber was nonfunctional. Thus, group H subjects were not able to escape or avoid painful electric shock. Twenty-four hours after the fifth block of trials was completed, OH subjects were trained to escape or avoid signaled electric shock. The CS, a 3.0 second, 80 decible buzzer, was used to signal the onset of 6.6 ma. shock which remained on for a period of 24 seconds unless terminated by a single bar press. The subject was also able to avoid shock by a single press of the lever duirng the presentation of the three second tone. Thus, the subject could receive shock contingencies ranging from zero to 24 seconds in duration, followed by a 12 second interval. These subjects received training in single blocks of fifty trials for five consecutive days. The same general procedure was used for group N-ON pairings. Group N subjects were placed in the operational side of the chamber with the lever in a functional status and were trained to lever press to escape and avoid shock. Group ON subjects were allowed to observe the group N training process, which was completed in single blocks of fifty trials daily for a period of five days. Twenty-four hours after the final block of observation trials, group ON was also trained to escape and avoid shock in the same manner as were groups OH and N. During the training periods for all groups, when a subject had completed three blocks of trials and had made 30 escape-avoidance responses in any one block, the escape-avoidance response criterion was increased to two lever presses. The number of escape and avoidance responses in each block of trials for each criterion were recorded for all subjects in all groups. A 3 x 3 factorial analysis of variance with repeated measures on one variable was used to analyze the data.

RESULTS

The data were analyzed across the first three blocks of trials only, due to the fact that two of the subjects in the OH group failed to meet the established criterion of 30 escape-avoidance responses in any single block of trials. None of the subjects in the other two groups failed to meet this criterion. It was felt that in view of the relatively small number of subjects in these groups, formal inferential analysis would be meaningless with only three subjects in the OH group meeting the criterion for blocks four and five.

A 3 x 3 factorial analysis of variance with repeated measures on one variable was conducted to analyze the combined escape-avoidance response rates (Keppel, 1973). The results of this analysis are summarized in Table 1. As can be seen, group mean scores differed significantly from each other, F (2, 12) = 10.98, $p < .01$. An examination of Table 2 shows that control groups N and ON performed essentially in the same manner, therefore indicating that group OH differed significantly from the other two groups.

In addition, Table 1 shows that significant differences exist across trial blocks , F (2, 24) = 40.46, $p < .001$. An examination of the data in Table 2 shows that a majority of the variance between the mean scores by trial blocks is accounted for in the first trial block. These differences were not unexpected, and are representative of a classical learning curve, indicating that the subject has learned to respond more effectively with increasing numbers of trial presentations. No significant interaction was observed between groups and blocks of trials, $F\ (4, 24) = 1.19$, $p > .05$.

Figure 1 graphically represents the mean combined response rates by groups and trial blocks, and further illustrates the response deficits and generally poor performance exhibited by the OH group.

As can be seen in Figure 2, a high degree of variability existed between subjects in the OH group within the single press criterion. For example, one OH subject never learned the required task and performed at the same low level across trials. Other OH subjects either acquired the response very quickly or exhibited a more gradual rate of responding. Further, no subject in this group ever responded perfectly in 50 out of 50 trials, as did subjects in the other two groups (see Table 2).

Figure 2 also shows that, of the OH subjects that did meet the established criterion in the first three trial blocks, these three subjects were dramatically affected by the change in response requirements in trial block four. All showed response rate reductions ranging from 30 to 100 percent. In contrast, subjects in the other two groups were not affected by the change in lever press requirements at trial block four.

Figures 3 and 4 illustrate the consistency in responding between subjects in groups N and ON, respectively. As can be seen, subjects in these two groups acquired the correct response relatively quickly, and maintained a high level of responding across trial blocks. Figures 3 and 4 further show that very little variability existed between subjects across trial blocks, and that these subjects were not affected by the change in response requirements at trial block four.

TABLE 1

Analysis of Variance Summary Table

Source	DF	SS	MS	F
Groups (A)	2	5014.71	2507.35	10.98
Subjects within groups S(A)	12	2740.53	228.38	
Trial Blocks B	2	6744.57	3372.29	40.46
Groups/blocks interaction AB	4	395.83	98.96	1.19
Error S(A)B	24	2000.27	83.34	
Total	44	16895.91		

TABLE 2

Mean Combined Response Rates for Groups by Trial Blocks

Group	Trial Blocks				
	Single Press Criterion			Double Press Criterion	
	1	2	3	4	5
OH	4.4	17.40	26.60	12.00	21.66
N	14.0	46.60	50.00	50.00	49.60
ON	20.6	46.80	50.00	49.20	49.80

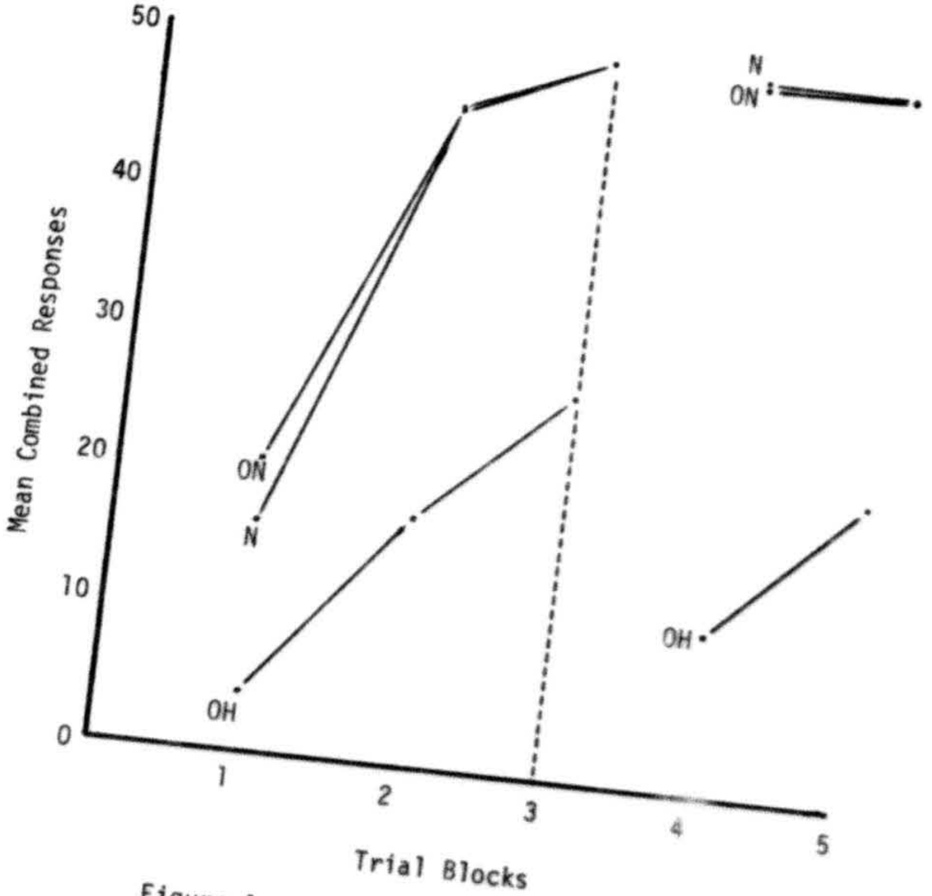

Figure 1. Mean number of responses per block by groups. Mean scores in blocks four and five for group OH reflect the scores for only three subjects since two subjects in this group failed to meet the established criterion.

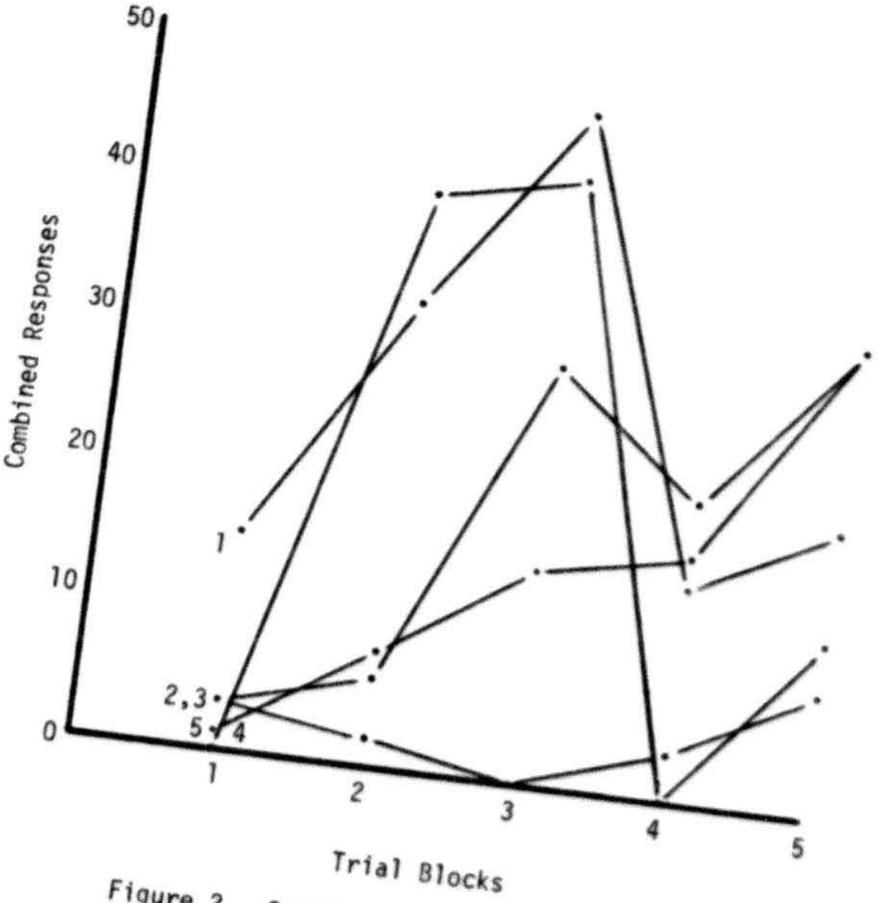

Figure 2. Combined escape-avoidance responses for OH subjects by trial blocks.

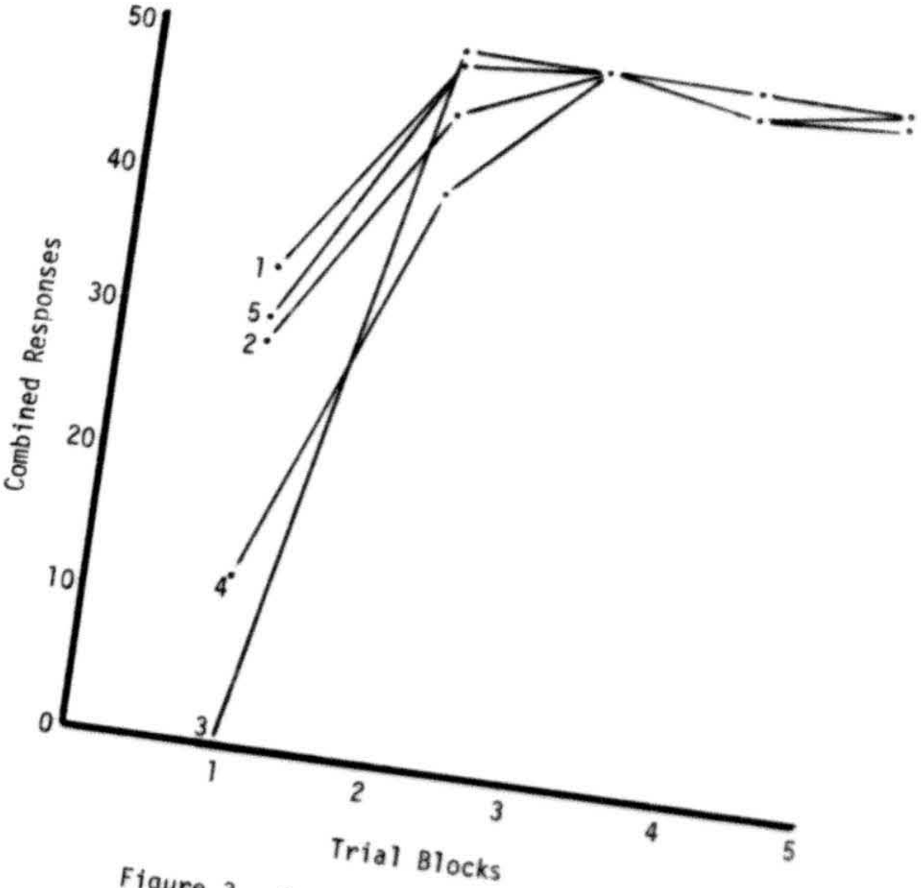

Figure 3. Combined escape-avoidance responses for ON subjects by trial blocks.

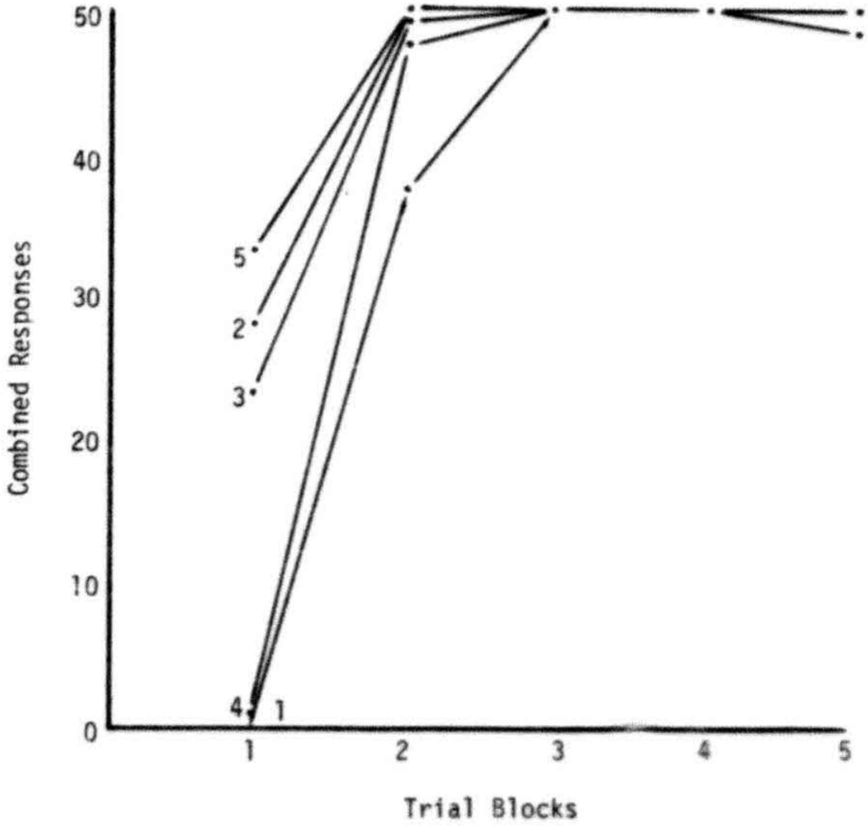

Figure 4. Combined escape-avoidance responses for N subjects by trial blocks.

DISCUSSION

The work of Corson (1967), Bandura (1965), Del Russo (1975), and others has shown that the adoption of behavioral patterns or the facilitation of task acquisition can be enhanced through the process of observational learning. Similarly, Overmier and Seligman (1967), Seligman and Maier (1967), and Seligman (1975), among others, have shown that subjects that are exposed to uncontrollable events show response deficits even when the situation becomes controllable.

The results of the present study have shown that subjects simply observing an uncontrollable event can themselves become victims of the helplessness phenomenon. That is, even though the observer subjects were never directly exposed to an uncontrollable event, except through observation, they showed response deficits and a general inability to learn when exposed to a similar but controllable situation. Further, this helplessness phenomenon seen in the observer subjects appears to be similar to that described in subjects that have been directly exposed to uncontrollability. These similarities can be compared with what Seligman (1975) referred to as three levels of direct learned helplessness; these are motivation, cognition, and emotion. Group H was not tested on their ability to later learn an effective escape response. The focus of the study was directed toward the observer's ability to effectively perform after having observed an uncontrollable event.

Motivation. Generally, a motivational disturbance would stem from a reduced incentive value of a reward. In an aversive situation, the reward is obviously escape and relief from the aversive stimulus. In an uncontrollable aversive situation, escape is not possible and therefore, the expectancy for reward is not present. If expectancy for reward is reduced or eliminated the incentive value of the reward, in this case relief from painful electric shock, is also reduced, thereby resulting in a reduction in motivation to respond. Thus, motivation (M) is an additive function of expectancy of reward (E) plus incentive value of the reward (Iv), as seen in the equation $M = E + Iv$. Therefore, if E and Iv have equal values of .5, for example, M would be equal to one, and, therefore, responding would have a high probability of occurrence. If, on the other hand, one or both of these values is reduced, motivation is lowered and responding is less likely to occur. Further, if the expectancy for reward is low but the incentive value is high, one value compensates for the other and motivation to respond increases. For example, if $E = .2$, and $Iv = .7$, in the additive model, motivation to respond would be near one, and thus the probability of responding is high. Generally stated, the incentive to respond to control any outcome results from the expectation that responding will produce that outcome. When a subject learns that outcome is response independent, reward expectancy is reduced and motivation is diminished.

In the present study the OH group, when trained to bar press to escape shock, made far fewer effective responses than did subjects in the other two groups that did not observe a response-outcome independent situation. Thus, the subjects in the OH group must have learned something about that particular situation, specifically, that responding was ineffective and independent of the outcome, which resulted in a lowered expectancy for reward, thereby reducing the motivation to respond.

Cognition. Learning is an active process, and as such previously learned concepts or responses can interfere with learning about contradictory contingencies. This can be illustrated by the following example: After driving to the university every day for the past eight months using the same route, I recently discovered a shorter, less bumpy one. However, I still find myself taking the longer route occasionally. Thus, I have experienced some difficulty in adopting the new route because it is contradictory to what I have previously learned about traveling to the university. This process is called proactive interference, and can be used to discuss the response patterns and deficits noted in the OH group in the present study.

When being trained to bar press to escape shock, after having first observed subjects who were unable to escape painful shock, subjects in the OH group made far fewer effective responses than did subjects in the other two groups. It is quite likely that this has occurred because these subjects had previously learned through observation that responding had no effect on the outcome of the situation. Thus, this previous learning interfered with the subject's later learning that responding could produce relief. This can be further illustrated through observations that I have made during many months of research in this subject. Generally, I have found that the OH subjects would respond sporadically; that is, the subjects would not continuously respond in an effective manner. They would generally make one or two effective responses followed by a series of trials in which they would either make no response or an ineffective one. This would indicate that the subjects in the OH group were unable to associate their active responses with the successful outcome of that particular event. That is, they were unable to associate their active response, a bar press, with the immediate cessation of painful shock. This pattern of sporadic responding was not observed in group N or ON subjects. In fact, in the second block of trials these groups had a mean effective response rate of 46.6 and 46.8 respectively; this in contrast to the OH subjects who, on the second block of trials, had a mean effective response rate of only 17.6. One variable that could have contributed to prior learning and the proposed proactive interference was, that in addition to the subject being able to observe reactions to pain and distress, it was also able to hear the observed subject squeal during shock presentation. Thus, it is likely that the subject was able to learn a great deal about futility of responding through both auditory and visual sensory modalities.

The results of the present study clearly show response deficits in a response that is normally learned quite readily by rats. Early studies in learned helplessness with rats were generally able to produce small, if any, differences in escape-avoidance learning between naive subjects and those having prior experience with inescapable shock (Maier and Seligman, 1976). However, later studies (Maier, Albin, and Testa, 1976; Maier and Testa, 1975; and Seligman, Rosellini, and Kozak, 1975) were able to produce significant response deficits in rats. One common factor that emerged from these studies was that the response used to test for learned helplessness must be one that is not readily acquired by the subject. Thus, in their studies, a simple response such as a single bar press was not sufficiently difficult to produce learned helplessness. A bar press response that would be considered to be sufficiently difficult would be, for example, one in which three presses would be required to escape or avoid shock. Thus, the response deficits obtained in the present study indicate that the observation of a helplessness situation has a powerful negative effect on the later acquisition of simple but potentially effective escape-avoidance responses.

In order to further test the strength and pervasiveness of the subject's response-outcome associations, and to insure purposeful responses, on the fourth trial block the effective escape response criterion was increased to two successive bar presses to escape shock, but only if the subject had made 30 out of 50 successful escape responses in any one of the first three trial blocks. Two of the subjects in the OH group never met this criterion, and of those that did, the mean effective response rate dropped to 12.0 when shifted to the new criterion. In the N and ON groups the mean effective response rates were 50.0 and 49.8 respectively in the fourth trial block. These data lend further support to the interference hypothesis. The OH group had apparently learned something, however minimal, about effective response contingencies by the end of the third block of trials. However, when the two-press contingency was introduced the response rates decreased, thus indicating that prior learning had a detrimental effect on response-outcome associations for this group. That is, the associations that were made between the response and the outcome for single bar presses were relatively weak due to prior learning about response-outcome independence. Thus, when the response-outcome contingency was increased, the subject's knowledge about response effectiveness prevented the subject from learning a more complicated and purposeful response.

It is, therefore, suggested that prior learning of response-outcome independence proactively interfered with learning about, and making associations between, single bar responses and situation outcome. Further, it is suggested that by the end of the third block of trials some subjects had acquired a minimal amount of information about response-outcome contingencies, and that this was further interfered with by changing the required response. This change did not have an effect on the control groups that had not previously observed a helpless situation.

Emotion. When a traumatic event first occurs, an emotional state similar to fear results. This continues until the subject learns that he can either control the situation, or that he has no control over it. If the subject learns controllability, fear dissipates and effective responding ensues. If, on the other hand, the subject learns that he has no control over the traumatic event, fear is generally reduced and is replaced with depression (Maier and Seligman, 1976).

In observing animals in my research, I have noted two very different types of reactions to painful electric shock. Generally, subjects that had been exposed to inescapable electric shock would at first react by squealing and rushing around the chamber in a haphazard manner. They would then jump up and hit their heads on the top cover of the chamber in an attempt to escape from this traumatic situation. Finally, when the subject had learned that these responses were ineffective, the subject would then huddle in a corner and passively accept shock, emitting an occasional squeal. Subjects that had observed this procedure adopted similar behavior patterns when exposed to escapable electric shock. This passive acceptance of shock appears to be similar to a depressive reaction in humans. When humans experience chronic situational stress, the general behavior patterns that result are marked by apathy, inattention, and general lowering of cognitive functioning (Coleman, 1976). This could explain why rats, and other animals as well, when exposed to a series of presentations of inescapable shock fail to learn effective response patterns. Apathy, inattention, and a lowering of cognitive functioning could, without doubt, adversely affect the acquisition of effective responses to stressful situations.

Another observation that I have made in the laboratory concerns itself with the behavior of animals at the end of the daily training session. Typically, subjects that have had no experience with inescapable shock (groups N and ON) would climb out of the operant conditioning chamber by themselves and would, if not caught, attempt to run away. Subjects in the OH group, on the other hand, would sit passively in the chamber and would cry out loudly when picked up to be returned to the home cage. On no occasion did these subjects ever attempt to bite the experimenter. This, it seems to me, is an indication of intense depression resulting from a perceived inability to control a particular event. It also indicates that the subject perceived itself to be "helpless" and thus made no attempt to escape when the opportunity presented itself. Thus, it is likely that this heightened emotionality and resulting depression interfered with the subject's ability to learn appropriate and effective responses.

On the basis of this, and previous research, it seems that three factors play a part in learned helplessness: motivation, cognition, and emotion. Reduced incentive value or expectancy of reward are functional factors in determining a subject's motivation to respond, with expectancy of reward possibly playing the major role. Cognition is another important factor which enables the subject to learn and assimilate information about his environment. In addition, the subject must be able to make specific associations with respect to response-outcome contingencies. Finally, the emotionality of the subject plays a major role and directly affects the subject's cognitive functioning. The subject that experiences fear and then depression is subject to apathy, inattention, and reduced cognitive functioning.

While this research has indicated learned helplessness through observation can be produced in rats, there are a number of questions that remain and can only be answered through further research. For example, such research should be concerned with the pervasiveness of learned helplessness through observation with repeated exposure, as compared to repeated direct contact with uncontrollability; situation generalization vs. specificity of helplessness through observation, species specificity and generality, stimulus specificity, and the alleviation of the helplessness phenomenon through observation. Another interesting area of research would be to investigate the helplessness phenomenon in subjects experiencing uncontrollability while observing an event with obvious response-outcome effectiveness.

Further research into the mechanisms of acquisition and alleviation of learned helplessness in animals may result in the development of more effective techniques for relieving helplessness and depression in man, as well as to devise effective preventive measures.

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