A COMPARISON OF THE GRADIENTS OF APPROACH AND AVOIDANCE WHEN BOTH TENDENCIES ARE LEARNED AND AVERSIVE

BY

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To

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CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

It is quite evident that one of the basic underlying factors in any behavior disorder is conflict. Unfortunately, however, even at this late date, many workers feel that the only method of studying the conflict dynamics which lead to maladaptive response patterns is to study the etiological factors after the symptoms are discovered. A small minority of those interested in these underlying dynamics, however, indicate that, "it is the gradual variation in response pattern during the course of a 'conflict' series that will yield the clue to the understanding of gross behavior disturbances" (Finger, 1941). In other words, these workers put the emphasis upon studying the conflict as it develops rather than studying the etiology after the symptoms of the final neurotic state are discovered.

Many different theories concerning the factors that constitute conflict have been postulated by this latter group. One such theory makes use of what is called approach and avoidance responses. It is the purpose of this chapter to integrate the relevant experimental evidence on approach-avoidance conflict and relate this evidence to the experiment reported in this thesis. The remainder of this chapter will be divided into six sections. The first will deal with the general theoretical background of approach-avoidance conflict. The

second will deal with the general theory pertaining to one specific aspect of approach-avoidance conflict. The third section will deal with the relationship of this specific aspect of approach-avoidance conflict to drug and alcohol addiction. The fourth will be concerned with relating this specific aspect of approach-avoidance conflict to psychotherapy and the concept of displacement. The fifth section will concern three investigations directly pertinent to the present study, and the sixth will be a summary and conclusion.

History and Theory of Approach-Avoidance Conflict

To understand the foundations of approach-avoidance conflict it is necessary to refer to Lewin (1935) who indicated that an organism's response was determined by the resultant strength of two large groups of forces, the positive forces tending to cause approach and the negative forces tending to cause avoidance. If these forces interact in such a manner as to render them approximately equal then a state of conflict ensues. According to Lewin there are three basic conflict states. The first is where the organism is caught between two positive valences, both approach tendencies acting in different directions. An example would be the proverbial ass that must choose between two equally high stacks of hay. The second case refers to an organism caught between a negative and positive valence, both stemming from the same source. An example would be the child who wants to ride on a horse but is at the same time, afraid. The third state concerns an organism that must choose between two avoidance responses; an example being the child who must either perform a distasteful task or be punished for not doing it. These different conflict states are referred to as type I, type II, and type III conflict, respectively.

Lewin states that an approach-approach (type I) conflict situation is more easily resolved than the other types, through the choice of one of the goals. On the other hand, an avoidance-avoidance (type III) conflict is more difficult to resolve than the others, because the subject has a tendency to vacillate between the two goals or to retreat from the field.

Referring to an approach-avoidance (type II) conflict Lewin makes the following statement: ". . .the strength of the field forces which correspond to the negative valence diminishes much more rapidly with increasing spatial distance than do the field forces corresponding to the positive valence." Lewin does not say why this occurs; it is an important concept, however, and has direct implications for the present experiment.

Though Lewin did not cite any experimental evidence in expounding his theory some empirical data which might have been used for support had already been gathered by Hull (1934). The latter investigator's most important finding could have been interpreted by assuming that a goal which evokes approach responses increases in positive valence as the organism comes nearer to the goal. Hull's findings could also have been interpreted to indicate that increased motivation increases the positive valence of the goal. In addition, what Hull termed experimental extinction and spontaneous recovery could have been interpreted in terms of approach-avoidance conflict.

Bugelski and Miller (1938) further extended Lewin's theory by generalizing Hull's (1934) primary finding. They hypothesized that avoidance reinforced by punishment should act in the same manner as approach reinforced by reward, so that a goal which evokes avoidance

responses should increase in negative valence as the organism comes closer to the goal. This hypothesis was tested and confirmed.

Hovland and Sears (1938) discuss Lewin's (1935) three types of conflict and posit a fourth: double approach-avoidance ("e.g., A man has two desirable appointments at the same hour, the neglect of either of which will produce punishment and disappointment"). These authors contend that Lewin oversimplified approach-approach and avoidance-avoidance conflict. In choosing between two approach goals the response to one will always be coupled with frustration resulting from relinquishing the other and hence will have a negative valence as well as a positive valence associated with it. What at first appears to be an approach-approach conflict is in reality a double approach-avoidance situation. However, the only experimental work carried out by Hovland and Sears could have been interpreted as easily in terms of Lewin's (1935) theories as in terms of their own hypothesis.

Lewin predicted certain modes of response to the different conflict situations that he posited. An approach-approach conflict, being relatively stable, should be more easily resolved than an approach-avoidance or an avoidance-avoidance situation. At the other end of the pole, an avoidance-avoidance conflict, being unstable, should be more difficult to resolve than an approach-avoidance or an approach-approach situation. Hovland and Sears (1938) verified these predictions.

Sears and Hovland (1941) in a second experiment further extended Lewin's theory. They hypothesized and verified, first, that one factor which should influence the mode of response in a conflict situation is the relative strengths of the two opposing forces. With a large difference between forces one would predict that there would be little

difficulty in responding whereas a conflict situation in which the two forces approach equality might often produce blocking and irresolution Their second hypothesis, which they also verified, was that blocking and irresolution, besides being dependent on the relative strengths of the competing tendencies, are also greater when the absolute strengths of the competing forces are increased, though the ratio remains the same.

It can be seen from this first section that almost all of Lewin's (1935) predictions concerning approach-approach (type I) conflict and avoidance-avoidance (type III) conflict have been verified. His prediction concerning approach-avoidance (type II) conflict, that with increasing spatial distance the avoidance tendency would fall off faster than that of the approach, will be discussed in the following section.

History and Theory Concerning the Steeper Gradient of Avoidance Compared to Approach

Now that a general theoretical background has been presented, the rest of the chapter will be concerned with one aspect of approach-avoidance conflict which is most pertinent to the investigation described in this thesis. It will be remembered that Lewin (1935) posited the notion concerning approach-avoidance conflict that with increasing spatial distance the avoidance tendency would fall off faster than the approach. This phenomenon was verified by Brown (1940)[1] who used hunger drive as the basis for approach and fear of shock as the basis for avoidance.

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[1]This verification of Lewin's hypothesis was not published until 1948 (Brown, 1948).

Brown (1940) also offered an explanation of this phenomenon. He suggested that when approach was characterized by hunger and avoidance by fear of shock, as he had done, the gradient of avoidance was steeper than that of approach because approach based on hunger was common to the organism throughout the apparatus, whereas avoidance based on fear was only common to the point of reinforcement.

In an extensive article on conflict, Miller (1944) represented the approach-avoidance conflict graphically. The figures that he presents, shown below, are based on Brown's (1940) confirmation of Lewin's hypothesis, namely that the avoidance gradient is steeper than that of approach in a spatial situation. It will be noted from Figure 1 that at a point far from the goal the approach tendency is represented as being stronger than avoidance, causing the organism to approach. As the organism draws nearer, however, the strength of avoidance increases more rapidly than that of approach until the two strengths are equal. The organism should then stop. Likewise, if the organism is too close to the goal he should retreat until the two tendencies cross at which point he will again stop. The point of intersection of the two gradients is determined by relative drive strengths. It is obvious from Figure 2 that increasing approach and/or decreasing avoidance will shift the point of intersection toward the goal while decreasing approach and/or increasing avoidance will shift the point of intersection away from the goal. This was confirmed in an experiment by Miller, Brown and Lipofsky (1944).

It is also evident from Figure 2 that when the approach gradient is raised, not only will the point of conflict be moved closer to the goal, but it will also occur higher up on the avoidance gradient, so that more fear will be elicited as the approach tendencies are increased. Miller

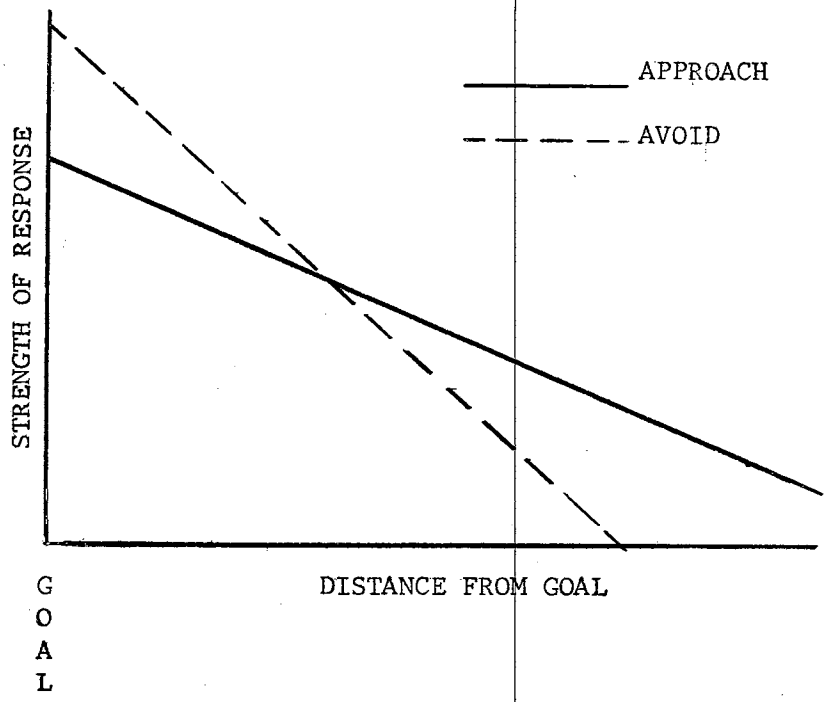

Figure 1. Avoidance Gradient Steeper than Approach Gradient

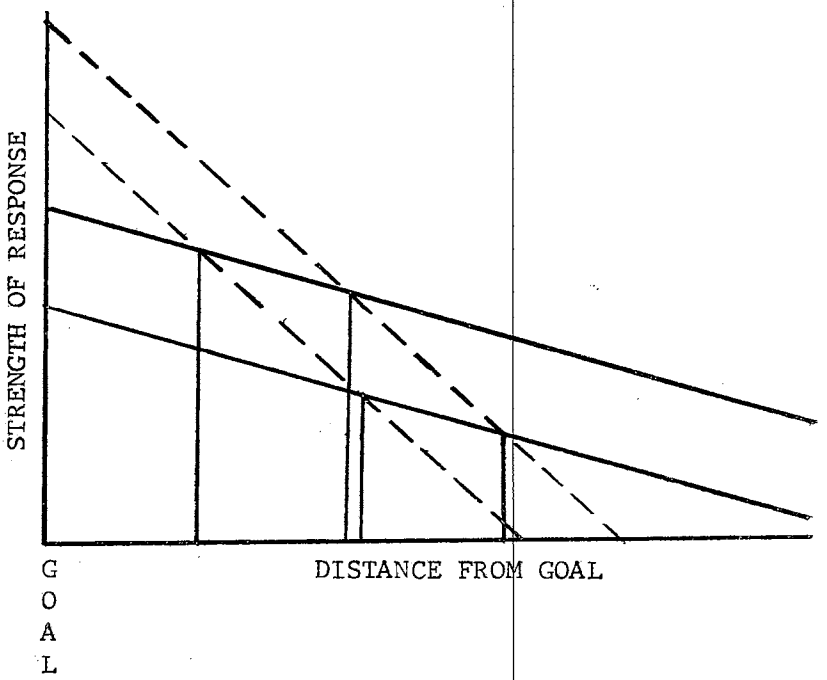

Figure 2. The Effect of Drive Strength on the Approach and Avoidance Gradients

(1944) points out that this supports one of Freud's theories, namely that evidence of fear is indicative of strong tendencies to approach. This is illustrated many times in psychotherapy. When the patient is nearing his goal (adjustment) he will suddenly revert to old maladaptive behavior which had previously been discarded during the course of therapy.

Miller (1944) also offers an explanation for the avoidance gradient's being steeper than that of approach which is quite similar to Brown's (1940) earlier explanation. It is Miller's contention that hunger is more dependent on internal organismic cues than fear whereas both fear and hunger are partly based on external environmental cues. According to the gradient of reinforcement principle, cues that are closer to the point of reinforcement will elicit stronger tendencies than those that are more spatially distant. While fear is only dependent on external stimuli and would become stronger as the organism approaches the goal, hunger is internally motivated and its strength will not vary as much with distance from the goal. This hypothesis was confirmed to some degree in an experiment by Miller and Davis (1944).

As a conclusion to this section of the chapter, it should be noted that much evidence has been obtained in support of Lewin's (1935) hypothesis concerning approach-avoidance conflict. Furthermore, two theories (Brown, 1940; Miller, 1944) have been posited in an effort to explain this assumption. The experimental verification and theorizing, however, are only concerned with one specific approach-avoidance conflict situation: approach characterized by hunger (a primary, appetitive drive) and avoidance characterized by fear (a secondary, aversive drive). It is not clear, whether Lewin's hypothesis would hold in a

different approach-avoidance situation where both tendencies were either primary or secondary, and both were appetitive or aversive.

The Steeper Gradient of Avoidance Compared to Approach in Relation to Drug and Alcohol Addiction

It is the assumption of Dollard and Miller (1950) that alcohol and certain drugs have fear reducing properties. An alternative hypothesis, antedating that of Dollard and Miller (1950), was offered by Masserman and Yum (1946). It was the latter authors' contention that conflicts are highly complex neurotic behavior patterns and that alcohol and certain drugs break down these "complex perception-reaction Gestalten" so that more simple patterns of behavior are restored. This hypothesis was verified although there were criticisms of the experimental design.

It was felt, however, by Conger (1951) that underlying the complex neurotic pattern posited by Masserman and Yum (1946), was a more basic approach-avoidance conflict and that alcohol was merely acting on the relative strengths of the approach and avoidance tendencies. Conger obtained the same results as did Masserman and Yum when he induced a relatively simple approach-avoidance conflict in rats.[2] In a second experiment Conger (1951) investigated the relationship of alcohol to conflict: does it increase the approach tendency or decrease the avoidance tendency? Despite certain criticisms of his experiment, Conger did find some justification for saying that alcohol decreased the avoidance tendency, but had little or no effect on the approach tendency. Since in his study avoidance was characterized by fear and approach by hunger, Conger postulated that either alcohol had a greater effect on learned

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[2]In a similar experiment Bailey and Miller (1952) obtained the same results when they substituted sodium amytal for alcohol.

than on primary drives, or that alcohol was specific to certain drives, i.e. fear, and not to others. The latter possibility is in accord with Dollard and Miller (1950) who say that alcohol and certain drugs have certain fear reducing properties. The drinking of alcohol is reinforcing in three ways: First, it reduces fear per se; second, fear reduction allows other previously inhibited drives satisfaction; third, it reduces tension from the conflict.

It is still not clear, however, why addiction occurs. One assumption is that alcohol and drugs act to reduce specific drives, i.e., fear. Another is that alcohol and drugs have an affect on learned drives, but have little or no affect on primary drives. A third assumption, in line with Lewin's hypothesis, is that alcohol and drugs have a greater affect on the steeper avoidance component in an approach-avoidance conflict, regardless of the drives which characterize the competing forces.

It is possible that if some light were thrown on the question of why the avoidance gradient is steeper than that of approach in a spatial situation we could then hypothesize more fruitfully about the affect of alcohol and drugs on conflict.

The Steeper Gradient of Avoidance Compared to Approach in Relation to Displacement and Psychotherapy

It is Miller's (1948) contention that psychoanalytic displacement is directly related to, if not the same as, stimulus-response generalization. The similarity between these two phenomena lies in the fact that both concepts are related to approach-avoidance conflict, and, more specifically, that the avoidance gradient is steeper than that of the approach

in both cases. It should be noted that stimulus-response generalization as referred to by Miller and his co-workers is more often spoken of as stimulus generalization. For the sake of convenience, however, this phenomena will be called stimulus-response generalization throughout this section.

Miller (1948) first trained rats to strike at each other. It was then shown that if a celluloid doll was present, whereas a fellow rat was not, a single rat would strike at the doll. "In psychoanalytic terms this might be described as displacement and in stimulus-response ones, as generalization from the rat to the doll." Miller (1948) then showed that rats would generalize from one drive to another as well as from one object to another. An example of displacement cited by Miller (1948) is the employee who is angry at his boss but cannot tell him so for fear of losing his job, so that he uses the office boy as a scapegoat instead. Displacement, then, is most often characterized by prevention of the direct response because of a conflict of one sort or another. Stimulus-response generalization, on the other hand, is usually characterized by the organism's being prevented from performing the direct response, not because of a conflict, but because of the absence of an appropriate goal. An example of the latter situation is the employee who is angry with his boss but cannot tell him so because the boss has left town for a while, resulting in abuse of the office boy. One aspect is common to both situations, however, and that is that the avoidance gradient must be steeper than that of approach in order for the employee to use the office boy as a scapegoat. This, then, is the key assumption for the similarity between displacement and stimulus-response generalization, namely that the avoidance gradient must be steeper than that of approach

in both situations.

It will be remembered that Brown (1940) verified that the avoidance gradient was steeper than that of approach in a spatial situation only. In order to link displacement with stimulus-response generalization, however, the assumption must be made that the avoidance gradient is steeper in a non-spatial situation as well. At the time of Miller's (1948) article no attempts had yet been made to verify this assumption in a non-spatial situation. Since the terms, spatial and non-spatial, are used rather loosely, it should be pointed out that the former refers to a dimension involving one particular goal object, while the latter refers to a continuum of more than one goal object having similar stimulus properties.

Experiments Pertinent to the Problem

This section will deal with three attempts to verify Lewin's (1935) hypothesis in a non-spatial situation. At this point it will help to clarify two terms used by Miller and his co-workers; these terms are primary and learned. If a conflict state is induced in an organism during experimental training, and one component of this conflict is reinforced during testing while the other is not, then the first component is called "primary" and the second component is called "learned." For example, if a conflict is induced by shocking rats at a feeding station during training, and then during testing the rats are fed but not shocked, the approach (hunger) tendency is called primary and the avoidance (fear) tendency is called learned.

Miller and Kraeling (1952) investigated the problem as to whether the avoidance gradient is steeper than the approach in a non-spatial

situation. Referring back to the example of displacement that was used in the previous section, Miller and Kraeling (1952) postulated that an employee who is angry at his chief can abuse an office boy because the aggression (approach) falls off less rapidly from the boss to the office boy than does the inhibiting response (avoidance). To test this assumption, Miller and Kraeling trained hungry rats to run down an alley to secure food following which the subjects were shocked until they refused to eat. The concept of displacement was then tested by placing the subjects in the same alley that they were trained in, a slightly different alley and completely different alley. The alleys differed in brightness and in width. It will be remembered that this is called a non-spatial situation because it involves a stimulus generalization continuum of more than one goal object. On four test trials, during which there was no reinforcement of either the approach or the avoidance tendency, the animals exhibited vacillating behavior in all three situations indicating conflict generalization. Differences between the groups run on the same and different alleys were significant at the .001 level. The direction of the differences was in accord with the hypothesis that avoidance generalized less strongly than approach in the new situations. One important criticism, however, almost completely destroys the value of the results that were obtained. The approach habit was established in many, distributed trials whereas the avoidance habit was established in few, massed trials. Also, the approach habit was established previous to the avoidance habit. This alone could account for the fact that approach generalized to a greater degree than did avoidance.

In the second study that was carried out in order to test Lewin's (1935) hypothesis in a non-spatial situation, an attempt was made to

control the factors that were uncontrolled in the previous study. Murray and Miller (1952) trained one-half of their rats to run an alley, without shock, for food reward. The food was located on a so-called "island of safety" placed at the end of the runway and elevated above the grid floor of the alley. The other half of the subjects were shocked throughout the length of the alley and were able to avoid the noxious stimulation by reaching the "island of safety" located at the end of the alley but were not rewarded with food. The first half of the subjects were designated as the approach group and the latter as the avoidance group. On the test trials all the subjects were placed in a similar but different situation, and also in the original training alley in a counter-balanced order. The strength of pull towards the island was recorded for all subjects. None of the test trials were reinforced. The results showed that the approach rats exhibited very little response decrement in the different alley, whereas the avoidance subjects showed a statistically significant response decrement from the original to the different runway. The results, then, do tend to confirm Lewin's hypothesis in a non-spatial situation. There are two major criticisms of this study. First, in an effort to control certain factors that were not controlled in the Miller and Kraeling (1952) study, none of the animals were actually placed in an approach-avoidance conflict. The second criticism involves a basic assumption made by the authors in designing the experiment. An approach-avoidance conflict is a situation in which the organism is presented with a goal that evokes both approach and avoidance tendencies. In any experiment, then, utilizing an approach-avoidance conflict situation, the goal must be the same and must evoke both approach and avoidance tendencies, even if approach is induced in only one group and avoidance in another

group as was done by Murray and Miller. In this experiment, however, strength of pull towards the island was measured for both groups. The authors were merely comparing two reactions toward the same goal. Furthermore, it is not clear whether these are approach reactions toward the island or avoidance reactions away from the alley. This situation, then, was not one of approach-avoidance, but of approach-approach or avoidance-avoidance, depending on one's reference point.

The third investigation designed to verify Lewin's hypothesis in a non-spatial situation was carried out by Miller and Murray (1952). Rats were trained to run down an alley to an "island of safety" to escape electric shock. During the test trials half of the animals were reinforced with shock (pain-primary drive group) and half were not (fear-secondary drive group). Half of each of these groups was tested in the original alley and the remaining half was tested in a different alley. Strength of pull towards the island was measured for all subjects. It was found that in comparing the original situation to the new situation, strength of pull dropped off considerably more for the fear group than for the pain group. The authors have verified, then, that of two aversive drive states, the response to the learned drive falls off more rapidly than the response to the primary drive. The major criticism of this experiment is that there was no approach-avoidance conflict present for any of the subjects. Two avoidance tendencies were measured independently, but there was no conflict. A less serious argument is that it is not clear whether approach to the island or avoidance to the alley was being measured. These are the same criticisms that were made of the previous experiment by Murray and Miller (1952). Thus, it still has not been established that the avoidance gradient is steeper than that of approach

in a non-spatial situation.

Summary and Conclusions

From all the evidence accumulated thus far on approach-avoidance conflict it is still not clear whether avoidance responses fall off more rapidly than those of approach only in a spatial situation or in a non-spatial situation as well. The criticisms made against the experiments that were carried out in an effort to establish the latter (Miller and Kraeling, 1952; Murray and Miller, 1952; Miller and Murray, 1952) indicate that the evidence is far from conclusive. If it is assumed that avoidance tendencies do fall off faster than approach tendencies in a non-spatial continuum, it is certainly not clear why this is so. Is it because learned drives fall off more rapidly than primary drives? Is it because aversive drives fall off more rapidly than appetititve drives? Or is it merely because fear responses fall off more rapidly than hunger responses? Since this assumption, that the avoidance gradient is steeper than that of the approach, is a basic and integral factor to approach-avoidance conflict and its applications, whether to psychotherapy and displacement, or to drug and alcohol addiction, any evidence which would throw some light on this concept would greatly clarify the area.

The question of why the avoidance gradient is steeper than that of approach remains unanswered. Any experiment dealing with this problem would do well to have <u>both</u> competing tendencies, the approach and the avoidance, based on aversive <u>or</u> appetitive drives, and <u>both</u> should be either learned <u>or</u> primary. Any experiment, then which tries to determine why the avoidance gradient is steeper than that of approach, should have one of the four following designs where both competing tendencies are:

aversive and learned; aversive and primary; appetitive and learned; or appetitive and primary.

CHAPTER II

STATEMENT OF THE PROBLEM

In the present study, both competing tendencies, the approach and avoidance, that were to be compared, were learned (secondary) and aversive. Two different approach-avoidance conflict situations were induced. The approach and avoidance tendencies in both situations were based on aversive stimulation. In the first conflict situation the avoidance tendency was based on past learning and was not reinforced during the test trials, while the approach tendency was reinforced during the test trials. In the second conflict situation the avoidance tendency was reinforced during the test trials, while the approach, based on past learning, was not reinforced during the test trials. This may be stated in another manner. In the first situation avoidance was based on past learning and approach was based on present learning, while in the second situation avoidance was based on present learning and approach was based on past learning. In the first situation, an organism was taught to avoid a certain goal and then had to relearn to approach that same goal. In the second situation, an organism was taught to approach a certain goal and then had to relearn to avoid that goal. The avoidance gradient of the first situation was then compared to the approach gradient of the second situation.

In the first situation, if the organism was to relearn, the strength

of the learned avoidance tendency had to decrease to a point where the organism would approach the goal. In the second situation, if relearning was to occur, the learned approach tendency had to decrease to a point where the organism would now avoid the goal. If relearning of the first task required the same number of trials as relearning the second task, it would be assumed that the steepness of both the avoidance gradient in the first situation and the approach gradient in the second situation, were equal; or, the number of trials required for an organism to learn to approach a goal previously associated with avoidance was equal to the number of trials required to learn to avoid a goal previously associated with approach.

If, on the other hand, more trials were required for relearning in the first situation than in the second situation, it would be assumed that the avoidance gradient in the first situation was less steep than the approach gradient in the second situation.

Lastly, if more trials were required for relearning the second task than for relearning the first, it would then be concluded that the avoidance gradient in the first situation was steeper than the approach gradient in the second situation.

The null hypothesis tested was as follows: When one group of rats is presented with an approach-avoidance conflict in which the approach tendency is based on present learning and the avoidance tendency is based on past learning, and another group is presented with an approach-avoidance conflict in which the approach tendency is based on past learning and the avoidance tendency is based on present learning, there will be no difference in the steepness of the avoidance gradient in the first situation and of the approach gradient in the second situation.

CHAPTER III

METHOD AND PROCEDURE

Subjects

The subjects employed in this experiment were 48 female and 32 male (N = 80) experimentally naive Sprague-Dawley albino rats. These rats were raised in the laboratory at the Oklahoma State University. The animals were approximately 240 days old at the time of the experiment.

Apparatus

The apparatus consisted of a single unit Y-maze, gridded throughout. This maze was constructed of 1/2 inch plywood and stood 5 1/8 inches high. The stem of the maze was 15 1/2 inches in length and each arm measured 15 7/8 inches. The width of the maze from wall to wall was 4 inches throughout. The grid floor of the maze consisted of 3/16 inch brass welding rod which was spaced every 5/8 inch throughout the apparatus. The roof consisted of 1/8 inch plexiglass. The plexiglass covering the stem and arms formed hinged tops which were fastened with a spring type catch when the subject was inside the apparatus.

The grids were wired with No. 14 AWG wire. The two arms and the stem were all wired separately. Connected to each arm of the maze was an Adjust-A-Volt voltage transformer manufactured by the Lafayette Instrument Company. These transformers had an output of 1.25 amperes. A Harvard

Stimulator, Model 935B, was connected to the stem of the maze. Wired between these three power sources and their respective grids, were three two-way toggle switches mounted on a small, 7 3/8 X 5 inch, fiberboard platform.

The end of the stem of the maze was closed but the ends of the arms were open. The ends of these open arms terminated on No. 10 size food can goals provided with 3/8 inch hardware cloth tops. A 3 1/2 inch square was cut from the side of each can, the bottom side of which bordered on the circular base. These cut-out squares served as openings to the goals and faced the open ends of the maze. There were three goal cans in all. One was painted on the inside with two coats of flat black paint, a second can was painted with two coats of grey paint, and the third can was painted with two coats of glossy white paint. The goals were interchangeable from arm to arm. The goal-cans were mounted on small wood bases so that their bottoms were flush with the gridded floor of the maze.

The stem of the maze was fitted with two sets of 1/4 inch fiberboard paneling which covered the sides and closed end. Seven inches from the end of the stem, 1/4 inch slots were pasted to the sides of the fiberboard inserts, for the insertion of guillotine type doors. One set of inserts and a guillotine door was painted with two coats of flat black paint, and one with white paint. The inserts were interchangeable. The first 7 inches of the stem, ending at the guillotine door, formed the start box.

Both arms of the maze were equipped with three sets of 1/4 inch fiberboard inserts, one set painted with two coats of flat black paint, one set with two coats of grey paint, and the third set with two coats

of glossy white paint. These inserts extended the length of the maze arms and were interchangeable. The goal box placed at the end of the arm always corresponded to the color of that arm. In each set of inserts two pairs of 1/4 inch slots were constructed. One pair was located 1 inch from the entrance to the arm, and the other 1 1/2 inch from the end of the arm. In each pair of slots a guillotine door could be inserted. The color of the door corresponded to the insert into which it fitted.

Directly under all of the 1/4 inch slots in the arms and stem of the maze, located beneath the grid, were 3/8 inch wooden crosspieces which extended from one plywood wall to the other. These crosspieces had a twofold purpose. First, they separated the different sections of the maze so that if a subject had all four feet on one side of a crosspiece, he was said to be within that section. Second, they formed a barrier on which the guillotine doors could descend preventing the subjects from retracing.

The animals were housed in groups of two or three in cages which were 9 X 9 X 14 inches during the experiment. A pocket stopwatch manufactured by the Meylan Stopwatch Company was used in timing operations.

Procedure

One-half of the females and one-half of the males constituted the experimental group, while the remainder of the rats formed the control group. During training, the subjects in the experimental group were divided into groups A and B and then further subdivided into subgroups A1 and A2, and B1 and B2.

With reference to subgroup A1 of the experimental group, each rat was placed in the start box within the stem of the maze at the beginning

of each training trial. The stem was white and contained a 50 volt charge on its grid floor. One arm was also white and was charged with a high intensity (30 volts); the other arm was black and charged with a low voltage (8 volts). When the rat was placed in the start box the grid floor of the maze was uncharged. Immediately after the subject was placed in the start box and the plexiglass roof over the start box was fastened, the guillotine door within the stem was lifted and the grid floor of the stem was charged. Throughout the experiment, the Harvard Stimulator attached to the stem was set on multiple shock and the frequency was set at 120 shocks per second. Immediately after the subject entered one of the two arms, the guillotine door at the entrance to that arm, previously open, was closed behind him and the grid within that arm simultaneously charged. The shock lasted for three seconds at which time the guillotine door leading to the goal box, previously closed, was opened, allowing the rat free access to the goal. Five seconds after the termination of the shock within the arm, the rat was removed from the apparatus, whether he had entered the goal or had remained in the arm. After every free choice trial, there was a forced choice trial to the opposite arm. This was accomplished by use of the guillotine doors leading to the arms. Whereas during the free choice trials both of these doors remained open previous to the rat's entering one of the arms, during the forced choice trials one of these doors remained closed. The training trials terminated for each subject in subgroup A1 when each subject chose the low shock, black arm on three successive free choice trials. In subgroup A1 there were 10 subjects, 6 females and 4 males.

It is obvious that if the same color arm was always placed in the same position, either to the right or to the left, the rats might have

a tendency to develop a position habit. In order to control this factor, 5 trial sequences were picked from a series of random sequences compiled by Gellerman (1933). The following is an example of such a sequence: rllrrllrlr. Thus, for the first free and forced choice trial, the black arm containing low shock was on the right; for the second and third free and forced choice trials black, with low shock, was on the left, etc. In subgroup A1, the 6 female subjects were divided into three pairs and the 4 male subjects were divided into two pairs. The three pairs of female subjects received sequences 1, 2, and 3 while the two pairs of male subjects received sequences 4 and 5. The low shock arm always contained 8 volts while the high shock arm always contained 30 volts. The shock in the stem, however, varied from 50-100 volts. The latter was necessary since with each successive trial, each rat required more voltage to motivate him to run.

In subgroup A2, the same procedure was followed as outlined for the subjects in subgroup A1, with the exception that the black arm contained high shock while the white arm contained low shock. The stem was colored white, the same as for subgroup A1. Subgroup A2 was composed of 6 females and 4 males, divided into pairs so that the three female pairs received sequences 1, 2, and 3, and the two male pairs received sequences 4 and 5.

Subgroups B1 and B2 were treated in the same manner as subgroups A1 and A2, respectively, with the exception that in the case of subgroups B1 and B2 the stem was black in color. The inter-trial interval during the training and test trials was approximately 5 minutes. The time interval between the training trials and the test trials for any one subject was 1 day.

During the test trials, subgroup A1 was divided into groups A1-Y and

A1-O so that a single subject from each pair was placed in A1-Y and the other subject from each pair was placed in A1-O. Consequently, there were 3 females and 2 male subjects in each of groups A1-Y and A1-O. Subgroups A2, B1, and B2 were similarly divided so that during the test trials there were 8 different groups, each composed of 3 female and 2 male subjects. All of the 5 sequences were represented in each of the 8 groups, so that the 3 female subjects received sequences 1, 2, and 3, and the 2 male subjects received sequences 4 and 5 during the test trials. Each subject received the same sequence throughout the experiment.

During the test trials, for group A1-Y, the stem was white as it was during the training trials. The arms, however, instead of being black and white as in the training trials, were black and grey. The black arm contained low shock during the training trials and high shock during the test trials; the grey arm contained low shock during the test trials. The black arm constituted an approach-avoidance conflict. The subject tended to approach the black arm on the basis of past experience and learning acquired during the training trials, but also wanted to avoid the black arm on the basis of present experience during the test trials. It is assumed that the grey arm, being a "neutral" stimulus did not involve conflict. Each subject in group A1-Y had to relearn the meaning of the black arm, which represented approach during the training trials and avoidance during the test trials. The relearning criterion for group A1-Y was choosing the low shock, grey arm on 3 successive trials. All test trials were free choice trials.

For group A1-O during the test trials, the stem was white as it was during the training trials. The subjects in this group, however, were

confronted with a white arm and a grey arm, the white arm containing low shock and the grey arm containing high shock. For group A1-O it was the white arm which constituted an approach-avoidance conflict. The subject tended to avoid the white arm on the basis of past experience, but also tended to approach on the basis of present experience. The relearning criterion for group A1-O was choosing the low shock white arm on 3 successive trials.

During the test trials, group A2-Y was treated similarly to group A1-Y. The stem was white, the arms were white and grey and contained high and low shock, respectively. The white arm, which during the training trials contained low shock, constituted an approach-avoidance conflict.

Group A2-O, during the test trials, was treated similarly to group A1-O. The stem was white, the arms were black and grey, and contained low and high shock, respectively. The black arm, which contained high shock during training, constituted an approach-avoidance conflict.

Groups B1-Y, B1-O, B2-Y, and B2-O were treated exactly the same as groups A1-Y, A1-O, A2-Y, and A2-O, respectively, except that for groups B1-Y, B1-O, B2-Y and B2-O, the stem was black.

The subjects in the control group were treated exactly the same as the subjects in the experimental group, with the exception that the training trials were omitted. The control groups were designated by the following symbols: a1-Y, a1-O, a2-Y, a2-O, b1-Y, b1-O, b2-Y and b2-O.

For any subject that did not meet the learning or relearning criterion within 10 trials, the sequential pattern for that subject was repeated. Any subject that did not meet the learning or relearning criterion within 20 trials was excluded from the experiment and another subject of the same sex replaced him.

Comments on the Procedure

It will be noted that during the training of the experimental group a forced trial was introduced after every free choice trial. If the forced choice trials were not introduced, one could argue, there would have been a stronger tendency to approach the low shock arm than there was to avoid the high shock arm at the termination of the training trials due to a greater number of approach choices. The assumption is made that, since all animals were exposed to the avoidance arm and the approach arm for an equal number of trials during training, the strength of response to both these arms was the same.

It will be noted that all the groups with designations that ended with the suffix "O" represented the approach-avoidance conflict where the avoidance tendency was based on past learning and the approach tendency had to be learned. The groups with designations that ended with the suffix "Y" represented the approach-avoidance conflict where the approach tendency was based on past learning and the avoidance tendency had to be learned. It would thus seem that the crucial test of the null hypothesis would be a comparison of the "O" groups and the "Y" groups. The following discussion will deal with why this simple comparison is not the crucial test of the null hypothesis. During the test trials the "O" groups had to learn to avoid the grey arm in all cases, and had to relearn to approach either black or white. The "Y" groups had to learn to approach the grey arm in all cases, and had to relearn to avoid either black or white. It is conceivable that grey is not a neutral stimulus. For example, the brightness reflected by the grey color might not be midway between the brightness reflected by the black and white colors.

Consequently, this might result in preference or non-preference for the grey. This preference or non-preference might interact with the high shock for the "O" groups or the low shock for the "Y" groups, resulting in differences between the gradients of preference for these groups. In turn, this difference between the gradients in the "O" and "Y" groups might account for any difference in learning between the two groups. In view of these facts a control group was employed. If there was no difference between the "O" and "Y" groups within the control group, and if there was a large difference between the "O" and "Y" groups within the experimental group, the latter difference could only be due to learning during the training trials and not to any difference between the gradients resulting from learning in the test trials. The crucial test of the null hypothesis, then, became the test of interaction between the "O" groups and "Y" groups, and the experimental and control groups.

CHAPTER IV

RESULTS

The number of trials required for each subject to reach the learning criterion of three successive choices to the low shock arm during the test trials is shown in Table I. A randomized block design with a 2 X 2 X 2 X 2 factorial arrangement of treatments was used in analyzing this data. The results of this analysis are presented in Table II.

Among all the treatment variables, two F-ratios were significant at the .05 level of confidence, and one F-ratio was significant at the .01 level of confidence. The F-ratio significant at the .01 level of confidence was for the experimental vs. the control groups. The first F-ratio significant at the .05 level of confidence was for the "O" groups vs. the "Y" groups, and the second F-ratio significant at the .05 level of confidence was the interaction between the experimental vs. the control groups, and the "O" vs. the "Y" groups.

The Bartlett Test (Edwards, 1950) indicated that homogeneity of variance existed within the sixteen treatment groups (Chi-square = 9.1468; 15 degrees of freedom; not significant at the .05 level). This affirms that the variance within each treatment group did not differ enough to yield a significant F-ratio.

TABLE I

THE NUMBER OF TEST TRIALS REQUIRED BY EACH SUBJECT TO MAKE THREE SUCCESSIVE CHOICES TO THE LOW SHOCK ARM

	Experimental								Control							
	A				B				a				b			
	A1		A2		B1		B2		a1		a2		b1		b2	
Replications	A1-Y	A1-O	A2-Y	A2-O	B1-Y	B1-O	B2-Y	B2-O	a1-Y	a1-O	a2-Y	a2-O	b1-Y	b1-O	b2-Y	b2-O
1	11	13	18	10	8	12	14	12	5	8	14	4	3	8	4	8
2	9	12	13	9	15	6	14	15	9	9	10	8	6	3	8	10
3	18	8	14	17	13	15	17	11	5	10	3	9	12	6	11	3
4	14	10	16	13	16	7	8	9	10	9	7	10	9	11	7	7
5	16	9	16	4	14	13	13	10	14	5	5	14	6	6	9	6

TABLE II

ANALYSIS OF VARIANCE OF NUMBER OF TEST TRIALS REQUIRED FOR LEARNING

Source	Sum of Squares	d.f.	Mean Square	F
Replications	142.1113	4		
Treatments	548.0875	15		
"O" vs. "Y"[1]	(52.8125)	(1)	52.8125	5.9263*
Exp. vs. Cont.[2]	(409.5125)	(1)	409.5125	45.9533**
A,a vs. B,b[3]	(13.6125)	(1)	13.6125	1.5275
"O" vs. "Y" X Exp. vs. Cont.	(43.5125)	(1)	43.5125	4.8827*
"O" vs. "Y" X A,a vs. B,b	(0.6125)	(1)	0.6125	
Exp. vs. Cont. X A,a vs. B,b	(3.6125)	(1)	3.6125	
Remainder	(24.4125)	(9)	2.7125	
Error	534.6887	60	8.9115	
Total	1224.8875	79		

*Significant at the .05 level.

**Significant at the .01 level.

[1]"O" stands for groups that avoided the grey arm; "Y" stands for groups that approached the grey arm.

[2]Exp. stands for experimental group; Cont. stands for control group.

[3]A,a stands for groups with white stems; B,b stands for groups with black stems.

CHAPTER V

DISCUSSION

Pertinent Hypothesis

The null hypothesis was as follows: When one group of rats was presented with an approach-avoidance conflict in which the avoidance gradient was due to past learning and approach was to be learned ("O" groups) and a second group of rats was presented with an approach-avoidance conflict in which the approach gradient was due to past learning and the avoidance was to be learned ("Y" groups), there would be no difference in the steepness of the avoidance gradient in the first situation and the approach gradient in the second situation. The test of this hypothesis was the interaction between the "O" vs. the "Y" groups, and the experimental vs. the control groups. Since the F-ratio for this interaction was significant at the .05 level of confidence, the null hypothesis was rejected. This significant interaction indicates that the difference between the "O" groups and the "Y" groups within the control group was significantly different from the difference between the "O" groups and the "Y" groups within the experimental group. The difference between the means for the "O" groups and the "Y" groups within the control group was 0.15, whereas the difference between the means for the "O" groups and the "Y" groups within the experimental group was 3.10. These differences were in the same direction; the means of the "Y" groups

were higher than the means for the "O" groups in both the control and experimental groups. The small difference in means within the control group indicates that there was little difference between the approach gradient due to test trial learning in the "O" groups and the avoidance gradient due to test trial learning in the "Y" groups. The larger difference in means within the experimental group, then, can be attributed to the previous training for that group, or, more specifically, to a difference in the gradients due to learning in the training trials.

Within the experimental group the "O" groups represent the approach-avoidance conflict where the avoidance tendency is based on past learning, and the "Y" groups represent the approach-avoidance conflict where the approach tendency is based on past learning. On inspecting the data, it can be seen that the "O" groups (mean = 10.75) required fewer trials to meet the learning criterion than did the "Y" groups (mean = 13.85). This indicates that the avoidance tendency due to learning during the training trials for the "O" groups, fell off more rapidly (had a steeper gradient) than the approach tendency due to learning during the training trials for the "Y" groups, enabling the former to overcome their past learning more quickly than the latter and hence to meet the learning criterion more quickly.

The F-ratio which was significant at the .01 level of confidence was for the experimental vs. the control group. Evidently, the previous training received by the experimental group had a significant influence on the subsequent test trials so that their scores were significantly different from the control subjects which had had no previous training. This significant difference has no bearing on the problem at hand.

The second F-ratio which was significant at the .05 level of

confidence was for the "O" groups vs. the "Y" groups. On inspecting the data it can be seen that this difference is due to the large difference between the "O" and "Y" groups within the experimental group. This difference, also, has no specific relevancy for the present investigation.

In a previous study it was shown that rats showed a strong preference for black over white (Kaufman, 1960). In the present experiment none of the F-ratios for the black stem vs. the white stem, and the interactions between the black stem vs. the white stem and other treatment variables, were significant. This indicates that if there was a black preference in the present study, this preference had little or no influence on the learning during the test trials.

The Relationship of this Study to Previous Work in Approach-Avoidance Conflict

The implications of this study for hypotheses concerning the steeper gradient of avoidance as compared with approach will now be considered. The first of these was posited by Miller (1944). He contends that the avoidance gradient has been found to be steeper than that of approach because the former tendency is usually characterized by a learned drive and the latter is most often characterized by a primary drive, and, he hypothesizes, responses to learned drives fall off more rapidly than do responses to primary drives. The present investigation jeopardizes this hypothesis because it was found that the avoidance gradient was steeper than that of approach when both tendencies were learned.

A second hypothesis is that the avoidance gradient is steeper than that of approach only when the former is characterized by fear and the latter by hunger. This hypothesis is also rejected because it was found

in the present experiment that the avoidance gradient was steeper than that of approach when both tendencies were based on fear.

The third hypothesis is that the avoidance gradient is steeper than that of approach when the former is characterized by an aversive drive and the latter by an appetitive drive, and that responses to aversive drives fall off more rapidly than do responses to appetitive drives. This hypothesis is also rejected because in the present investigation both tendencies were aversive.

The results of this study indicate that organisms that are first taught to avoid highly noxious stimuli and then must relearn to approach those same stimuli under less noxious conditions, relearn faster than organisms that are first taught to approach less noxious stimuli and then relearn to avoid those same stimuli under more noxious conditions. A possible theoretical explanation for these results is that avoidance falls off more rapidly than approach because the former is less "satisfying" to the organism than the latter. "Satisfaction" can be interpreted in terms of most psychological theories and it will not be attempted to relegate the steeper gradient of avoidance than of approach to any particular theory.

Future Experimentation

The approach and avoidance gradients that were compared in this study were both learned and aversive. Even though the avoidance gradient was steeper than that of approach using this design, it is possible that this will not be the case when different drive stimuli are employed. Therefore, any future experimenters working in this area would do well to utilize one of the designs mentioned earlier where both competing

tendencies are either aversive and primary, appetitive and learned, or appetitive and primary.

SUMMARY

A total of 80 rats, 48 females and 32 males, were used in a study designed to compare the relative steepness of the avoidance gradient and the approach gradient in approach-avoidance conflict situations. Both of the tendencies giving rise to the gradients were learned and aversive. In the first conflict situation an animal was taught to avoid a certain goal and then had to relearn to approach that same goal. In the second situation an animal was taught to approach a certain goal and then had to relearn to avoid that goal.

It was found that the subjects in the first situation met the relearning criterion more quickly than the subjects in the second situation. This difference was significant at the .05 level of confidence. It was concluded that the avoidance gradient in the first situation was steeper than the approach gradient in the second situation.

In light of these results, three hypotheses formulated to explain why the avoidance gradient was steeper than that of the approach do not seem to be tenable.

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