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WILLIAM H. REDD

HUNGER CUES VERSUS THE PASSAGE OF TIME IN
THE RESOLUTION OF AN APPROACH-AVOIDANCE CONFLICT

by

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A Thesis Submitted to
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Two experiments were designed to test the hypothesis that approach-avoidance conflict becomes associated with hunger cues during conflict acquisition in a straight alley runway, and that these cues lose some of their avoidance properties during that period of time spent outside the conflict situation. When the animals are returned to the alley, the avoidance component associated with hunger cues is already extinguished, and the animal makes the goal response.

Thirty-six naive male albino rats of the Sprague-Dawley strain were used in experiment I. An approach-avoidance conflict was generated in the traditional manner by first pairing the approach response with food and, after firmly establishing the approach component, pairing it with shock until the animal failed to make any forward movement. In order to insure that the gradients intersected at the same point, S_s were given extinction trials until they moved from 8 to 12 in. down the alley, and matched. They were then randomly assigned to three groups: an alley group, a home-cage satiation group, and a home-cage deprivation group. These designations refer to where the time following the conflict training was spent and, for the home-cage groups, the drive condition (satiation or deprivation) during this period. Trial-by-trial extinction (two trials per day) was administered until the alley group extinguished the avoidance response to the criterion of two successive goal responses. As soon as the alley group reached the criterion, the home-cage groups were placed on 100% deprivation for 24 hours, and subsequently were given all extinction trials in one day until the criterion was reached.

The home-cage deprivation group extinguished significantly faster than did the home-cage satiation group. Since the groups differed in the amount of food

consumed, however, it is possible that the differences found in experiment I are attributable to differences in drive strength. An investigation of this problem seems necessary for an intelligent interpretation of the data from experiment I. In order to test the possible effects of drive strength, a second experiment was conducted.

Fifty-two naive male albino rats were used in experiment II. Conflict training and matching procedures were the same as those employed in experiment I. Four groups were used: a 24-hour home-cage deprivation group, a 48-hour home-cage deprivation group, a 24-hour home-cage satiation group, and a 48-hour home-cage satiation group. After the respective home-cage periods, extinction trials were administered in the alley. There were no significant differences, in comparing the number of trials to extinction, between the 24-hour and the 48-hour groups. The home-cage deprivation groups extinguished the avoidance response significantly faster than did the satiation groups.

The hypothesis that approach-avoidance conflict becomes associated with hunger cues during conflict acquisition in a straight alley runway, and that these cues lose some of their avoidance properties during the period of time spent outside the conflict situation, was accepted. When the animal is returned to the alley, the avoidance component associated with hunger cues is already extinguished, and the animal makes the goal response. The conclusion from experiment II, that drive strength does not affect the extinction of an approach-avoidance conflict in a straight alley runway, seems to strengthen the conclusion from experiment I.

TABLE OF CONTENTS

	PAGE
APPROVAL.	ii
ACKNOWLEDGEMENTS.	iii
LIST OF TABLES	v
INTRODUCTION	1
EXPERIMENT I	14
METHOD.	14
Subjects	14
Apparatus	14
Procedure	15
RESULTS OF EXPERIMENT I	17
EXPERIMENT II.	19
METHOD.	19
Subjects	19
Apparatus	19
Procedure.	19
RESULTS OF EXPERIMENT II	22
DISCUSSION	24
SUMMARY.	27
BIBLIOGRAPHY	30
APPENDIX.	33

LIST OF TABLES

TABLE	PAGE
1. Analysis of Variance for the Number of Trials to Extinction for Deprivation Schedules	18
2. Analysis of Variance for the Number of Trials to Extinction for Drive Strength and Deprivation Schedules	23

INTRODUCTION

Conflict, considered as the situation where incompatible stimuli or forces impinge simultaneously on the organism, was first considered as a psychological issue by Lewin (1931, 1935). Lewin specified that these opposing forces must be of approximately equal strength. He developed a field theory of psychology, with the organism being in the center of his own field. The organism is influenced by valences in his field, both positive and negative. If such valences are incompatible for any reason, psychological conflict results.

Lewin identified three types of conflict. Type I conflict refers to the presence of two positive valences to which the organism cannot respond simultaneously. An example of Type I conflict is a seven-year old child who wants to go to the movie while at the same time wanting to go swimming with friends. The simultaneous presence of two equally strong valences, one positive and one negative, is referred to as Type II conflict. An example is that of a dog who wants to eat the steak that is on the table, but fears the punishment that he will receive if he approaches the table. Type III conflict is the situation where two negative valences impinge on the organism at the same time. A school child who does not want to go to school, yet does not want to spend the day in the dentist's chair, is such a situation. These incompatible valence situations have been translated into more behavioristic terms by Miller (1944). Type I is approach-approach conflict; Type II is approach-avoidance conflict; and Type III is avoidance-avoidance conflict.

In one such behavioral attempt to apply Lewin's Type II conflict to a motor task situation, Sears (1937) trained human subjects to draw lines in a specific direction to colored lights. A different response was trained to each of two different colored lights. These responses were incompatible. Following training, the two lights were presented together, thus eliciting an approach-avoidance conflict. Using a motor task similar to the one used by Sears, Hovland, and Sears (1938) experimentally developed all three types of conflict. Most research on conflict, however, seems to have focused on Type II (approach-avoidance) conflict.

Hull (1932) developed the concept of a goal gradient from his work on maze learning with albino rats, referring to the goal or excitatory gradient extending as an increasingly positive acceleration from the start end of the maze to the goal. As the goal is approached, the animal runs faster. Miller (1944, 1951, 1959) devised a model of approach-avoidance conflict and accepted the goal gradient concept as a premise of his model, referring to it as the approach gradient.

The avoidance response was first studied by Bugelski and Miller (1938). Using albino rats, they established an avoidance response by pairing electric shock with goal responses at one end of a straight alley runway and then testing the response without shock. During the test period the animals were placed at different points along the alley. The strength of avoidance was determined by the latency and speed of running. They found that, as the animals were placed farther from the goal end of the alley where the shock had been administered, both latency and speed of running decreased. This suggested that the strength of the avoidance response diminished as the animal moved away from the goal, thus establishing a gradient of avoidance. Following the identification of a gradient of approach and a gradient of avoidance,

it seemed reasonable to predict that their interaction, conflict, would behave in gradient fashion.

Miller (1935, 1937) trained rats to run for water in a straight alley runway. Electric shock, paired with the water source at one end of the runway, resulted in an approach-avoidance conflict. This conflict behavior was noted in the presence of other water sources, thus establishing a generalization gradient. Miller (1944) stated that it is not the conflict per se which generalizes, but rather the competing responses of approach and avoidance generalize to the new situation, thus creating new conflict. Maher, Weisstein, and Sylva (1964) suggested that such gradients may not be only spatial, but may also be temporal. They demonstrated temporal gradients, as indicated by the point of oscillation relative to the goal, in an experimental setting where time from the goal was the salient cue. It appears, therefore, that the approach and avoidance gradients operate along several dimensions.

In the progression toward a model of conflict, a series of studies was conducted in an attempt to ascertain the relative form of the two gradients in an approach-avoidance situation. The first experiment (Miller and Kraeling, 1952) attempted to test the assumption that the avoidance response generalizes less widely than does the approach response. An approach-avoidance conflict was established with albino rats in a straight alley runway, and S_s were tested in alleys which varied in similarity from the alley in which the conflict had been established. During the test trials, twenty-three per cent of the rats that were tested in an alley which was identical to the original alley approached the food and made the goal response. In the alley which was intermediately different from the original alley, thirty-seven per

cent of the animals tested completed the goal response, and seventy per cent of the animals tested in the most dissimilar alley made the goal response. Thirteen per cent of the control Ss made the goal response. The Miller and Kraeling data seem to support Miller's hypothesis that the avoidance gradient is steeper than the approach gradient.

Murray and Miller (1952) recognized a confound in the Miller and Kraeling study. In most experimental studies of approach-avoidance conflict the approach response is established before the avoidance response. Murray and Miller spoke of the approach response being older than the avoidance response. They trained two groups of albino rats to approach to receive food, and another group to withdraw from the goal to avoid shock. In other words, they studied two gradients established at the same time in different groups. Using force of pull as the response measure, it was found that the Ss tended to make the approach response in the more dissimilar alleys than in the alleys in which the avoidance response was made. These results further supported Miller's hypothesis that the avoidance gradient is steeper than the approach gradient.

The final study in this series was conducted by Miller and Murray (1952). Their aim was to determine why the avoidance gradient is relatively steeper than the approach gradient. Brown (1942) and Miller (1951) stated that the difference in slope is due to the difference in the source of the drive that motivates or produces this behavior. The approach response in most experimental studies of conflict is made under food deprivation, the organism being motivated by hunger. The avoidance response, on the other hand, is motivated by fear. Fear, according to Brown and Miller, is a learned drive. Being learned, it follows that in a new situation it is

weakened because of stimulus generalization. The physiological drive of hunger is not weakened in a new situation because the same physiological state exists. This means that the avoidance gradient is steeper than the approach gradient because both drive and response are weakened by stimulus generalization. Miller and Murray further stated that fear is learned from pain, and compared the response motivated by pain with the response motivated by fear. This comparison was made on the basis of responses made in a test situation which was different from the original alley situation. The fear and pain groups, defined in terms of experimental treatment received, were each separated into two groups. One fear group received a high intensity shock and the other received a low intensity shock during the training period. High and low intensity shocks were also given to the pain groups during the training and testing periods. Using strength of pull as the measure of response strength, the avoidance gradient was found to be steeper for the fear groups than for the pain groups. Furthermore, response strength was found to be a function of the intensity of shock for all groups. It was concluded that, due to stimulus generalization, the gradient for a learned response is steeper than the gradient for an unlearned response.

Before considering specific factors affecting conflict and its resolution, it seems appropriate to enumerate the ways in which conflict has been measured. Miller and Murray used pull force as a measure of the avoidance response. Evidence furnished by Martin, Loewe, Hinkle, and Fitzgerald (1963) seems to testify to the usefulness of the pull method as a means of measuring approach-avoidance conflict. They found that approach pull increased up to the point of intersection of the two gradients. When the rats were forced beyond the point of intersection, pull strength weakened as the goal was neared. These findings are consistent with Miller's conflict model.

Berryman (1962) offered an equally complicated method for measuring conflict. He devised a panel with two levers, one giving water and shock and the other serving to reduce the shock intensity. Water deprived rats were given water and shock each time they pressed a lever. Shock intensity was increased with each bar press. The animal could return the shock to its original intensity by pressing the other lever. A double approach-avoidance conflict was thus established, since both levers had positive and negative stimulus value. Berryman suggested that this was an effective method of measuring conflict because the animal indicates the level of noxious stimulation sufficient to mask the approach gradient.

Another study (Elder, 1962) suggested two possible measures of an approach-avoidance conflict. The first was recording the number of trials to recover the approach response after conflict training. This was found to correlate negatively with mean distance the S travels down the alley on successive trials, which was Elder's second suggested method. The first method appears to be preferred in most animal research on conflict.

Activation level has been utilized as a conflict measure by Epstein and Frenz (1962). They contended that the activation level of the organism, rather than overt behavior, reflects the strength of the conflict.

Bower and Miller (1960) hold that the approach and avoidance responses vary with factors that affect nonconflict behavior. Four groups of albino rats were used in their study in an attempt to examine incentive value. They gave either large or small amounts of food reinforcement and increased the level of shock intensity either rapidly or slowly. Asymptotic speed was greater for large rewards, but rate of shock

increase had no reliable effect. These results were consistent with Crespi's (1942) findings that as reinforcement magnitude increases, the response strength also increases and the response pattern becomes more stable.

Level of motivation has been found to be a relevant variable in approach-avoidance conflict resolution. By increasing drive, the response gradient is also increased. Brown (1942) noted that decreased motivation in albino rats, defined as hours of food deprivation, resulted in reduction in speed and strength of pull of approach. He also found that the steepness of the gradient is increased with reduction of drive. Miller (1939, 1948) has determined that inappropriate drives influence conflict resolution. Rats trained to run for water, when satiated with water, ran when hungry. In other words, although the animals were trained to a goal that reduced one drive, another drive could motivate that same approach behavior. Brown (1948) varied shock intensity in an attempt to manipulate the fear which motivates avoidance behavior, and attained results similar to those achieved when amount of food reinforcement was varied. As shock intensity increased, the avoidance pull increased and the gradient became less steep.

The state of the organism also affects conflict. Predisposition is attained by means of preconflict training as well as by physiological treatment such as electro-convulsive shock, alcohol, various drugs, and cortical surgery. Both Miller (1960) and Kurtz (1962) have studied the effects of electric shock, although their procedures differed. Viewing their results, it seems evident that the gradients are acutely sensitive to this type of experimental manipulation.

Studies of the effect of drugs and alcohol testify to the sensitivity of the gradients involved in approach-avoidance conflict. Poschel (1958) found that there was a reduction in the avoidance gradient as long as eight days after the administration of trypan red. Barry and Miller (1962) found that alcohol and amobarbital sodium decrease both the approach and avoidance gradients in albino rats, with the avoidance being affected more than the approach. Additionally, alcohol has been found to reduce the avoidance component of conflict established in a straight alley runway with albino rats (Conger, 1951).

There has been some question, however, as to the possibility of the confounding of variables in these experiments. Maher, Elder, and Noblin (1962) questioned the conclusion that, following frontal ablation, there is a reduction in the avoidance response. They found that, after frontal ablation, the albino rats ran in the direction they were placed. They suggested that frontal ablation results in hypermobility. Such a condition interferes with any preoperatively established motor habit. That is, there was no selective elimination of the avoidance response, but merely a decrease in discrimination. Noblin (1966) made a similar criticism of the Conger study on the effects of alcohol on an approach-avoidance conflict. He found that rats, following the consumption of alcohol, ran in the direction that they were placed, regardless of previous behavior and training. The alcohol was not selective in its effects.

Conflict has also been studied in relation to displacement behavior. Miller (1948) trained albino rats to fight or attack another rat in order to terminate shock. When a celluloid doll was introduced into the cage, the animal made no response to the doll but continued attacking the rat mate. When the rat mate was removed from the cage,

leaving only the experimental animal and the doll, the rat attacked the doll. Miller defined this behavior as displacement. The animal displaced his response when the original goal response of attacking was blocked by the removal of the rat mate. The displaced response occurred only when the original response was blocked.

Murray and Berkun (1955) trained albino rats to an approach-avoidance conflict in a straight alley runway. After the conflict was established, doors along the side of the alley were opened which permitted the animal to move to another alley, dissimilar in color and size from the original alley. The rat could move through two such dissimilar alleys. The behavior was traced, and the animals moved closer to the goal in the most dissimilar and the most distant alley. Murray and Berkun constructed a three-dimensional displacement conflict model, consistent with Miller's earlier model. In the Murray and Berkun model, spatial and stimulus similarity cues interact. Elder, Noblin, and Maher (1961) recognized a confounding of variables in the Murray and Berkun study. The third and most dissimilar alley was also the farthest one from the original alley. It was found that the animals displaced to the alley farthest from the original one, rather than to the most dissimilar one. These results generally questioned the appropriateness of the Murray and Berkun model.

Murray and Berkun also concluded that this displaced responding had a therapeutic effect on the approach-avoidance conflict. That is, after responding in the displaced alley the animals ran down the original alley. They did not compare these methods of conflict reduction with other therapeutic methods. Berkun (1957), however, investigated the therapeutic effects of displaced responding, using albino rats in a straight alley. After the approach-avoidance conflict was established, one group was placed in a

different alley and another group remained in the original alley. Both groups were permitted to make goal responses. The displaced alley Ss were returned to this original alley as soon as they made a goal response in the displaced alley. The displaced alley group moved faster down the alley than did the other group on its first trial after approach-avoidance training. Taylor and Rennie (1961), also using albino rats, found that displaced responding did in fact reduce the number of extinction test trials required to make a goal response in the original alley. In terms of total number of responses made in all alleys, however, displaced responding was ineffective.

Noblin and Maher (1962) suggested that the variable of time had been confounded in previous conflict resolution studies. They contended that since the therapeutic manipulations operate over time, the decrement in the avoidance response might be the result of the period of time spent out of the conflict-induction situation. Hall (1955) found that there was no reduction in the avoidance response after a time period of twenty-four hours spent out of the experimental setting. The Noblin and Maher study compared the effects of passage of time with various procedures employed in conflict reduction. In comparing Ss whose avoidance response was extinguished day-by-day at the rate of two trials per day with their matched mates who remained in the home-cage until conflict resolution was achieved by their alley mate, no significant differences were found in the number of trials required to extinguish the avoidance component. Removal of the animal from the conflict situation for a period of time thus appears to be as effective in the resolution of conflict as trial-by-trial avoidance reduction. The Noblin and Maher study suggested that some reduction of the avoidance gradient resulted from the mere passage of time, even when there was no experimental manipulation.

The passage of time variable is confounded in the Murray and Berkun study because the displaced responding, which they considered therapeutic, occurred over time. The animals were not only permitted to make a series of displaced responses, but also were simultaneously being given a period of time away from the conflict-induction situation. Also passage of time was not controlled in the Berkun study. These studies should be re-examined, as the conclusion does not necessarily follow from the data in light of this suggested confound. The possible therapeutic effect of passage of time outside the conflict-induction situation must be investigated in a more exhaustive fashion than in the Hall experiment.

The passage of time has rarely been considered as a crucial variable in psychological theorizing. Researchers have sought to discover factors accompanying the passage of time. Such factors might explain the behavior often attributed to the passage of time per se. Noblin and Maher have suggested that these factors may be the learning of competing responses. If the learning of competing responses during the period of time spent in the home-cage was the important variable in the resolution of conflict in the Noblin and Maher study, then it seems that both groups would learn these responses since both groups spent the greater part of each day in the home-cage. It also appears necessary to ascertain exactly what competing responses were being learned in the home-cage which would be antagonistic to the avoidance response.

The problem seems to be that of isolating some of the variables accounting for the depression of the avoidance component of an approach-avoidance conflict operating over time, including the learning of competing responses antagonistic to the avoidance response during the time spent out of the conflict-induction situation.

One possibility is that the animal learned to associate eating while hungry with the noxious electric shock, thus learning to fear eating while hungry. While in the home-cage the animals were still hungry and ate without receiving shock. This resulted in the animals learning to approach food while hungry. Some of the avoidance properties associated with eating while hungry were eliminated during the period of time in which the animals were out of the conflict-induction situation and in the home-cage. Thus, the total complex of cues was different when the Ss were returned to the alley for extinction trials during the test phase. Presumably, the animals no longer feared eating while hungry.

One approach to this problem might be that of allowing one group of Ss to spend time in the home-cage, while at the same time permitting them to eat while hungry. Another group of Ss would be prevented from eating while hungry, during the period spent in the home-cage, being allowed to eat only when satiated with food. Thus, the number of trials required to extinguish the avoidance response for the eating while hungry home-cage group would be compared to that of the eating while satiated home-cage group. By varying the drive condition during the home-cage period, the satiation group would consume more food during the home-cage period than would the deprivation group. This would result in one group being under a higher drive than the other group during the test period. In accordance with previous research (Brown, 1942, and Miller, 1944), it would be expected that animals under a greater hunger drive would approach the goal in fewer trials. An additional control study seems necessary, therefore, to ascertain the effects of drive strength on extinction of the avoidance response. These experimental comparisons would permit the testing of the hypothesis that the approach response to cues associated with eating while hungry is

learned during the period of time spent out of the conflict-induction situation, and that this response is antagonistic to the avoidance response learned during the conflict training. More specifically, this hypothesis would predict that the group which ate in the home-cage while hungry would take significantly fewer trials to extinguish the avoidance component during the test period than the group which did not eat in the home-cage while hungry, but rather ate when satiated. Two experiments were designed to test this hypothesis.

EXPERIMENT I

METHOD

Subjects

The Ss were 39 male naive albino rats of the Sprague-Dawley strain, approximately 90 days old at the beginning of the experiment. After approach-avoidance training and matching, Ss were randomly assigned to three groups: an alley group, a home-cage deprivation group, and a home-cage satiation group. These distinctions refer to where the animals were placed after approach-avoidance training and, for the home-cage group, the condition under which they remained during this period. The method of training, matching, and assignment to experimental treatment conditions is developed below.

Apparatus

The apparatus consisted of a straight alley runway 48 in. long, 5 in. wide, and 6 in. high. The alley was constructed of wood and painted flat black. The top of the alley was covered with a hardwarecloth door which could be opened by the experimenter, but which prevented the S from escaping. Aluminum foil covered the floor of the maze. At one end of the alley, a metal food cup was attached to the wall 1 in. off the floor. An Applegate shock source was wired to the food cup and to the aluminum floor covering so that, when the power switch was turned on, Ss received a .75 ma. shock upon completing the circuit between the metal cup and the aluminum floor.

Procedure

Subjects remained in the home-cage for the first seven days of the experiment, receiving 8 gm. of dry Nutrina mash per day, water ad libitum. The 8 gm. deprivation schedule was used throughout the training period. Feeding schedules employed after the training period will be specified later. On day 8, the Ss received five approach trials in the alley. An approach trial consisted of the S being placed at the start end of the alley and running to the goal end where the food cup was located. The reinforcement was a .45 mg. food pellet in the food cup. There was no time limit on these approach trials during the approach-avoidance training. Ten approach trials were given on days 9 through 14. No food was given in the home-cage on day 15. Two warm-up trials and all avoidance trials were administered on day 15. With the power switch turned on, Ss were given a .75 ma. shock when an approach response was made. Each S was permitted as many trials as necessary to reach the criterion of failing to make any forward movement from the start end of the alley for a period of two minutes. At the end of approach-avoidance training, it was assumed that the gradients intersected at or beyond the start end. To insure that the gradients for all Ss intersected at approximately the same point along the alley, extinction trials were given on day 16 until all Ss moved no more than 12 in. nor less than 8 in. down the alley toward the goal. No food was given to the Ss in the home-cage on day 16. Subjects were matched in threes according to the number of trials required to achieve the 8 to 12 in. down-the-alley criterion. Using a table of random numbers (Wallis and Roberts, 1959), Ss were assigned to experimental treatment conditions.

What has been indicated thus far is that all Ss were trained to an approach-avoidance conflict in a straight alley runway. Extinction trials were run until each S moved no less than 8 nor more than 12 in. down the alley. Subjects were matched in triplets and randomly assigned to three groups.

Thirteen Ss were assigned to each of the three groups. Beginning on day 17, each S in the alley group was placed on an 8 gm. deprivation schedule and received two extinction trials of a two minute duration per day. Extinction trials were run until the S made two successive goal responses. While the alley groups were receiving extinction trials in the alley, the two home-cage groups were placed on special feeding schedules in the home-cage. The home-cage deprivation group was put on an 8 gm. deprivation schedule, whereas the home-cage satiation group was put on ad libitum feeding. When the alley mate reached the two successive goal response criterion, its two home-cage mates were placed on 100% deprivation for 24 hours. This 24-hour period was followed by extinction in the alley. The same two successive goal response criterion was employed as was used for the alley group during the extinction trials. All extinction trials were run on one day for the Ss in the home-cage groups. The number of trials required to extinguish the avoidance component was recorded for all Ss in these groups.

If the cues provided by eating while hungry did acquire some avoidance properties during conflict training and if, during the period spent in the home-cage, hunger cues lose some of their avoidance properties, then the home-cage deprivation group should take significantly fewer trials to extinguish.

RESULTS OF EXPERIMENT I

Results indicated that the home-cage deprivation group took a mean of 3.1 trials to extinguish the avoidance component, whereas the home-cage satiation group required a mean of 9.0 trials. An analysis of variance of these data, using a matched-group design, yielded an F value of 7.33 ($p < .05$). A summary of this analysis is presented in Table 1.

At first sight these data appear to support the hypothesis that the avoidance properties associated with eating while hungry were extinguished during the period of time in which the animal was in the home-cage and eating without receiving shock. One criticism, however, is that the difference in the number of trials to extinguish the avoidance response between the home-cage deprivation and the home-cage satiation groups might be due to differences in drive strength. Presumably, the home-cage deprivation group was under higher hunger drive than was the home-cage satiation group, because of the differences in the amount of food which had been consumed by the two groups in the home-cage. It would ordinarily be expected that deprived S_s would approach the goal, because this would result in food reinforcement. Losing the avoidance in this fashion would result in drive reduction. A second experiment was designed to control the factor of relative drive strength.

The data for the alley group was not considered in the analysis as this group was employed in order to establish the length of the treatment condition which the two home-cage groups received.

Table 1

Analysis of Variance for the Number of Trials to Extinction
for Deprivation Schedules

Source	SS	df	V	F
Deprivation Schedule	228.04	1	228.04	7.33*
Between subjects	399.45	12		
Error	373.46	12	31.12	
Total	1000.96	25		

* $p < .05$

EXPERIMENT II

METHOD

The purpose of experiment II was to ascertain whether or not drive strength, defined in terms of hours of food deprivation or food satiation, affects the extinction of an avoidance response in a straight alley runway. This information seems necessary for an intelligent interpretation of the data from experiment I.

Subjects

Subjects were 52 male naive albino rats of the Sprague-Dawley strain, approximately 90 days old at the beginning of the experiment. After approach-avoidance training and matching, S_s were randomly assigned to four home-cage groups: a 24-hour satiation group, a 48-hour satiation group, a 24-hour deprivation group, and a 48-hour deprivation group. These designations refer to the drive condition of the animals during the period spent in the home-cage and the duration of the home-cage period. The method of matching and assignment to experimental treatment conditions was the same as that employed in experiment I.

Apparatus

The apparatus was a straight alley runway, the same as employed in experiment I.

Procedure

An 8 gm. deprivation schedule was employed during the pretraining period and during the approach-avoidance training. S_s were given five approach trials on the first day of training and ten trials per day for the remaining six days of approach training. Avoidance training began the day after approach training was completed,

and training consisted of Ss' receiving a .75 ma. shock upon completing the circuit between the metal food cup and the aluminum floor. All avoidance training was administered on one day until all Ss reached the criterion of failing to make any forward movement from the start end of the alley. After a 24-hour 100% deprivation period, Ss were matched according to the number of trials required to meet the 8 to 12 in. down-the-alley criterion used in experiment I. Using a table of random numbers, Ss were assigned to four experimental treatment conditions. Half of the Ss in the home-cage satiation group were placed on ad libitum feeding for 24 hours, and half were placed on ad libitum feeding for 48 hours. The home-cage deprivation Ss were placed on an 8 gm. deprivation schedule for either 24 or 48 hours. After spending time in the home-cages for these designated periods, Ss were placed on 100% deprivation for 24 hours. All extinction trials were administered on the day following this 100% deprivation period. Extinction trials were administered until the S reached the criterion of making two successive goal responses.

If no significant differences in the number of trials required to extinguish the avoidance response exist between the different drive strength groups (24 versus 48-hour groups), then the interpretation of the data from experiment I would be strengthened. This would suggest that the differences in length of time spent in the home-cage prior to extinction, presumably resulting in differences in drive strength, have no effect on the number of trials required to extinguish the avoidance response. If significant differences are found in this comparison, however, then it would seem wise to view the conclusions from experiment I with caution. Significant differences would suggest that differences obtained in experiment I reflect differences in drive strength between groups, rather than differences in learned responses.

Significant differences in the number of trials required for extinction of the avoidance response between the home-cage satiation and home-cage deprivation groups would suggest that the home-cage drive condition did in fact have an effect on the extinction. This is essentially the same comparison as was made in experiment 1, and significant differences would strengthen the conclusions from that experiment.

RESULTS OF EXPERIMENT II

Results indicated that the 24-hour home-cage satiation group extinguished the avoidance response with a mean of 6.2 trials, whereas 5.5 trials were required for the 48-hour satiation group. The 24-hour home-cage deprivation group extinguished with a mean of 2.8 trials, whereas the 48-hour home-cage deprivation took a mean of 3.3 trials. An analysis of variance, comparing the 24-hour groups with the 48-hour groups, yielded a nonsignificant F of .02. The analysis of these data for groups differing in drive condition (deprivation versus satiation) during the home-cage period yielded a significant F of 8.72 ($p < .01$). The interaction between drive strength and drive condition yielded a nonsignificant F of .39. A summary of the statistical analysis is given in Table 2.

It was concluded that drive strength had no significant effect on the resolution of this approach-avoidance conflict. The results from experiment II strengthen the conclusions drawn from experiment I.

Table 2

Analysis of Variance for the Number of Trials to Extinction
for Drive Strength and Deprivation Schedules

Source	SS	df	V	F
Drive strength (A)	.18	1	.18	.02
Deprivation schedule (B)	96.94	1	96.94	8.72**
(AXB)	4.33	1	4.33	.39
Error	533.40	48	11.11	
Total	634.85	51		

**p < .01

DISCUSSION

The data from these two experiments seem to suggest that it is not the mere passage of time spent outside the alley which accounts for the resolution of an approach-avoidance conflict, but rather the learning of competing responses during this period. The home-cage deprivation group lost the avoidance response during the time spent in the home-cage. In other words, when the Ss were returned to the alley, it appeared that cues previously maintaining the avoidance response had now lost their avoidance properties. The animals did not immediately approach the goal when they were again placed in the alley. It appeared, therefore, that some of the cues eliciting the avoidance response were associated with the alley itself. This does not mean that the competing responses were learned to all cues eliciting the avoidance response. The physical characteristics of the alley are not the only cues present in the conflict-induction situation. Cues associated with the internal state of the organism are also present. It seems that, in order to achieve approach-avoidance resolution, the avoidance response must be extinguished to cues associated with eating while hungry as well as to cues associated with the physical characteristics of the conflict-induction situation.

The two experiments presented here have broader application than merely to studies of hunger and eating. Internal states such as sexual deprivation and thirst and their corresponding behaviors of copulation and drinking are potential areas of research. These variables could be experimentally manipulated in an approach-avoidance conflict situation, and results similar to those reported here would be expected.

Methodological problems deserve consideration here. Drive conditions differed in the home-cage situation, in that half of the \underline{S}_s ate while under satiation without receiving shock, whereas the other half ate under deprivation without receiving shock. Optimally, the home-cage satiation group should have eaten only when satiated, but in order to make them satiated, it was necessary to feed them while under deprivation. This meant that during the first few hours of the home-cage period the satiation animals were actually eating while hungry. If this problem is to be eliminated, it would appear necessary that the satiation be achieved without eating. This might be done by means of a fistula, thus permitting the immediate satiation of the \underline{S}_s at the onset of the home-cage period. Hence, satiation could be achieved without eating while under deprivation. The home-cage group would be allowed to eat only after satiation had been achieved via a fistula. This procedural modification would better insure that the home-cage groups differ along the deprivation dimension during the home-cage period. The method of establishing the approach-avoidance conflict, and the response used in the two experiments above, could be employed in this suggested study. Although this methodological problem does not appear to have had any great effect, introduction of the fistula might lend even further support to the conclusions drawn from experiment I and experiment II.

A consideration of the role of the consumatory response in the resolution of an approach-avoidance conflict presents further possibilities. A third experiment might involve a comparison of the number of trials required to extinguish the avoidance response for groups deprived of consumatory behavior with that of groups permitted consumatory behavior, holding other variables constant. This would involve the

feeding of one group via a fistula during the home-cage period and permitting another group to eat in the traditional manner from a food cup. Groups thus would differ only in the means of food intake. The amount of food entering the stomach would be held constant, as would the length of time that the groups are maintained under the experimental condition. A method similar to that used in experiment I and experiment II might be employed for approach-avoidance training, using the same response measure. The data from experiment II, however, suggested that this is not a relevant variable. The home-cage satiation groups were permitted more nonshocked consumatory responses during the home-cage period than were the home-cage deprivation groups, but the home-cage satiation group required more trials to resolve the conflict. The consumatory response theory, on the other hand, would predict different results. That is, the group permitted the greater number of nonshocked consumatory responses (in this case the home-cage satiation group) would be expected to resolve the conflict in fewer trials.

Until the relevant variables in conflict reduction have been isolated, it seems prudent to view conclusions from earlier studies with caution. Time may be but one of several factors which have been confounded.

SUMMARY

Two experiments were designed to test the hypothesis that approach-avoidance conflict becomes associated with hunger cues during conflict acquisition in a straight alley runway, and that these cues lose some of their avoidance properties during that period of time spent outside the conflict situation. When the animals are returned to the alley, the avoidance component associated with hunger cues is already extinguished, and the animal makes the goal response.

Thirty-six naive male albino rats of the Sprague-Dawley strain were used in experiment 1. An approach-avoidance conflict was generated in the traditional manner by first pairing the approach response with food and, after firmly establishing the approach component, pairing it with shock until the animal failed to move from the start end of the alley. In order to insure that the approach and avoidance gradients intersected at approximately the same point for all animals, S_s were given extinction trials until they moved no more than 12 in. nor less than 8 in. down the alley, and matched. They were then randomly assigned to three groups: an alley group, a home-cage satiation group, and a home-cage deprivation group. These designations refer to where the time following the conflict training was spent; and, for the home-cage groups, the drive condition (satiation or deprivation) during this period. Trial-by-trial extinction, at the rate of two trials per day, was administered until the alley group extinguished the avoidance response to the criterion of two successive goal responses. As soon as the alley group reached the criterion,

the home-cage groups were placed on 100% deprivation for 24 hours, and subsequently were given all extinction trials in one day until the criterion was reached.

The home-cage deprivation group extinguished significantly faster than did the home-cage satiation group. Since the groups differed in the amount of food consumed, however, it is possible that the differences found in experiment I are attributable to differences in drive strength. An investigation of this problem seems necessary for an intelligent interpretation of the data from experiment I. In order to test the possible effects of drive strength, a second experiment was conducted.

Fifty-two naïve male albino rats were used in experiment II. Conflict training and matching procedures were the same as those employed in experiment I. Four groups were used: a 24-hour home-cage deprivation group, a 48-hour home-cage deprivation group, a 24-hour home-cage satiation group, and a 48-hour home-cage satiation group. After the respective home-cage periods, extinction trials were administered in the alley. There were no significant differences, comparing the number of trials to extinction, between the 24-hour and 48-hour groups. The home-cage deprivation groups extinguished the avoidance response significantly faster than did the satiation groups.

The hypothesis that approach-avoidance conflict becomes associated with hunger cues during conflict acquisition in a straight alley runway, and that these cues lose some of their avoidance properties during the period of time spent outside the conflict situation was accepted. When the animal is returned to the alley, the avoidance component associated with hunger cues is already extinguished, and the

animal makes the goal response. The conclusion from experiment II, that drive strength does not affect the extinction of an approach-avoidance conflict in a straight alley runway, seems to strengthen the conclusion from experiment I.

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APPENDIX

Individual Results for Home-cage subjects for Experiment I

Home-cage Satiation Subjects	Number of Trials to Extinction	Home-cage Deprivation Subjects	Number of Trials to Extinction
1a	11	1b	7
2a	5	2b	4
3a	17	3b	2
4a	5	4b	2
5a	2	5b	5
6a	17	6b	6
7a	4	7b	2
8a	2	8b	2
9a	6	9b	2
10a	4	10b	2
11a	13	11b	2
12a	2	12b	2
13a	29	13b	2

Individual Results for Home-cage Satiation Subjects for Experiment II

24-Hour Home-cage Satiation Subjects	Number of Trials to Extinction	48-Hour Home-cage Satiation Subjects	Number of Trials to Extinction
1c	8	1d	5
2c	4	2d	4
3c	2	3d	3
4c	21	4d	2
5c	5	5d	10
6c	2	6d	3
7c	2	7d	10
8c	6	8d	3
9c	3	9d	4
10c	8	10d	4
11c	13	11d	10
12c	4	12d	11
13c	2	13d	2

Individual Results for Home-cage Deprivation Subjects for
Experiment II

24-Hour Home-cage Deprivation Subjects	Number of Trials to Extinction	48-Hour Home-cage Deprivation Subjects	Number of Trials to Extinction
1e	4	1f	4
2e	2	2f	2
3e	2	3f	5
4e	4	4f	5
5e	2	5f	4
6e	4	6f	3
7e	3	7f	2
8e	3	8f	4
9e	2	9f	2
10e	3	10f	5
11e	2	11f	2
12e	4	12f	2
13e	2	13f	3