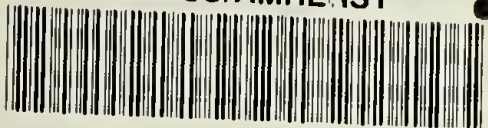




## Generalization of fixated behavior in the rat.

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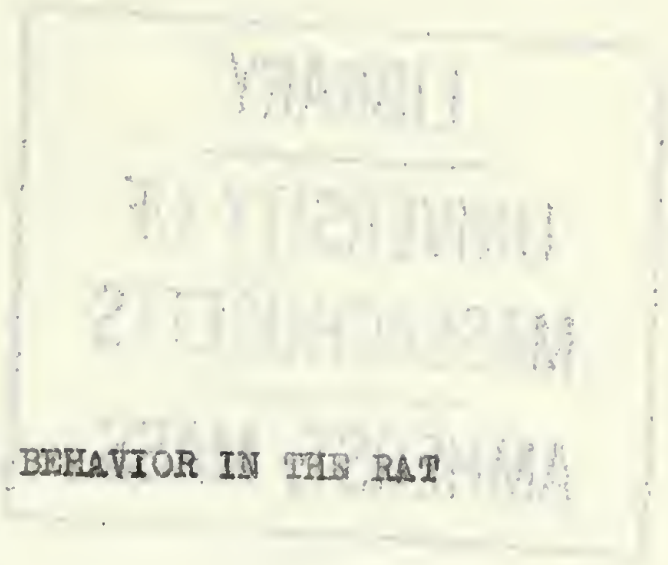
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# GENERALIZATION OF FIXATED BEHAVIOR IN THE RAT



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GENERALIZATION OF FIXATED BEHAVIOR IN THE RAT

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Paul Ellen

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THESIS SUBMITTED FOR THE DEGREE OF MASTER OF SCIENCE

UNIVERSITY OF MASSACHUSETTS

JUNE 1949

Generalization of fixated behavior in the rat. (Ellen)

Errata:

- p. 7, par. 2, line 3: change first "they", to "their strengths", also, "they can be increased in strength" to "the strength can be increased".
- p. 10, line 7: change "reaction" to "reactions"
- p. 11, par. 2: change "colleagues" to "students"
- p. 14, third from last line: change "6 out of 15" to "7 out of 28"
- p. 14, next to last line: change "16 out of 16" to "26 out of 29"
- p. 15, 3rd line: change "11 out of 14" to "20 out of 29"
- p. 15, 4th line: change "15 out of 15" to "30 out of 30"
- p. 15, line 10: change "(53.2%)" to "(52.6%)"
- p. 16, par. 2, line 1: change "colleagues" to "students"
- p. 41, last line: change "colleagues" to "students"
- p. 48, 6 lines from bottom: change "colleagues" to "students"

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## Introduction

Most research in the area of abnormal behavior in the human being is limited to either one of two possible techniques. It is possible to delve into the patient's case history to determine the possible cause of the disorder. This method, however, is not always fruitful, inasmuch as there are a great many variables that enter into the development of any form of behavior, and the research man is not able to say that this variable rather than that one caused the disorder. Another approach to the problem might be that of observing the conditions under which the patient is cured. This ad hoc technique is often quite unsatisfactory for accurate determination of the cause of the disorder.

However, if one wishes to use animals for experimentation, then a new and fruitful approach to the problem of abnormal behavior may be achieved. For, with the use of animals, the experimenter can set up certain conditions and expose animals with similar backgrounds to these conditions. Also, the experimenter can vary the hereditary makeup of his subjects, as well as the past experiences of his subjects and thus be able to observe the concomitant changes in behavior. Thus, a whole range of experimental variables may be isolated and their effects on behavior systematically measured.

This is not meant to imply that there is a simple one to one correspondence between animal and human behavior. True, human beings undergo different sorts of environmental pressures than do rats; yet, rats like human beings can learn, show emotional behavior, fear, and so on. If abnormal behavior is due to conflicts and frustrations, then we can set up these conditions for animals and perhaps gain some insight toward understanding these processes in humans. If we make this



assumption, then we add a new source of research, and thus provide ourselves with the opportunity for getting additional data on the problem.

The present problem will investigate another aspect of abnormal behavior in rats, namely the compulsive walking fixation that is observed in rats that have a previous history of jumping fixations. Essentially the technique will be to frustrate animals with an insoluble problem, and observe the resultant changes in behavior under the specified experimental conditions.



Review of Literature

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Previous studies have shown (10, 11) that rats, when placed in an insoluble discrimination problem on a Lashley Jumping Apparatus, tend to form persistent position responses. Ordinarily, in a soluble discrimination problem, the animals soon learn to associate a given stimulus configuration with reward and another with punishment, thereby readily solving the problem. However, in an insoluble problem situation, the stimulus configuration is changed in a random fashion -- neither a card nor a position being consistently rewarded, and the animal, after several failures, soon refuses to respond in the situation. However, if the animal is induced to respond by the use of an air-blast or an electric shock, it gradually settles down to a stereotyped mode of response that may not be altered later when a soluble problem involving differential reward and punishment is given. Usually these stereotyped responses are in terms of position, but occasionally, persistent preferences for one of the cards rather than for a position are found. In the case of a position response, it must not be assumed that the animals cannot make a discrimination between the two stimulus cards. Maier, Glaser, and Klee (10) found that although the animals failed to solve the discrimination problem in terms of responses made, they actually were making discriminations. These authors observed that there were differences in the amount of resistance to the air-blast that was used to induce the animals to jump when either one or the other stimulus cards was placed on the preferred side. When, for example, the negative card was placed on the preferred side, then there was a comparatively greater resistance to jumping than when the positive or correct card was placed on the preferred side. In the latter condition, the animals jumped readily and quickly.

As further evidence for this suppressed learning, these authors also analyzed the abortive behavior of the animals. Abortive jumps, consisting of jumps to the ledge, striking the card with the side of the body, leaps to the right or left of the cards, or jumps which are light and not strong enough to knock over the unlatched card, often replace the normal response which consists of a fairly vigorous leap to the center of the card. The results of their analysis of abortive behavior showed that there was a significantly greater percentage of abortive responses to the negative card than to the positive card in all animals. Therefore, "Inability to distinguish between the positive and negative cards does not account for the failure to learn the discrimination habit.... Failure to express the discrimination seemed to be due to the dominance of the position habit. Thus the discrimination even when present was unable to break through the position habit." (10, p. 538).

Before going into a discussion concerning the theoretical interpretation of fixation, it would be well to examine the various experimental conditions that have led to the formation of fixations in animals and to examine some of the important characteristics of fixations. There has been evidence to indicate that when punishment occurs during the progress of an act, behavior becomes more stereotyped. Hamilton and Krechevsky (5) found that when rats were learning to go to the opposite alley in a single unit T-maze, shock at the choice point in the maze caused them to select a response and not deviate from it regardless of its consequences. Everall (1) used the delay period at the choice-point in a single unit T-maze as punishment, and found similar results. Although there was food reward in both arms of the

maze, the experimental group showed a greater consistency in their choice of directions than did the control group of animals. On the other hand, Krechevsky and Honzik (8) found that overlearning is one of the factors in transforming a "docile" response into a fixated stereotyped response. However, one must point out that lack of variability in behavior is not absolute proof of fixation. For example, if an animal responds in an unchanging fashion to a given situation, it lacks variability, but, if it continues to respond in its repetitive fashion when the situation is changed and another mode of response is required, then we can say that the animal is fixated. It appears that Hamilton and Krechevsky (5) and Everall (1) have simply demonstrated lack of variability in behavior, because in none of their work have they altered the situation to see if the animals would resist the change necessary to meet the demands of the new situation. Krechevsky and Honzik (8) on the other hand, did demonstrate fixations because they showed that with overlearning the rat resisted a change in behavior when the situation was altered in such a way as to call forth a change.

Kleemeier (7), using a quadruple-choice apparatus, demonstrated the fixating effect of electric shock. In his experiment, after determining the natural preferences of 20 rats, he trained each animal for 50 trials to choose one alley, and immediately thereafter, he gave the animals 50 more trials with a different alley being correct. Thus, two successive position habits in the animals are developed. Shock was then administered to each animal for 10 trials at the choice-point in the apparatus. It was found that nine rats continued the habit in progress, and nine others chose a different alley upon shock. The animals which

chose a different alley with shock were further tested to observe the effects of blocking a response to shock. The conditions were the same except that the alley to which they had digressed in the first shock situation was blocked. It was found that seven out of the nine animals ran immediately to the alley that was correct on the first set of shock trials. These animals, together with the nine animals which had continued the habit in progress after the first series of shock trials, were then tested for fixations. It was thought that if these animals were not fixated, they should be able to shift their responses in a shock-free situation, since their present responses might simply be adaptive to the shock-situation. However, if these animals were fixated, they would be unable to meet the demands of a new situation, and would continue in their stereotyped fashion. To test this hypothesis, each animal was run in the apparatus a minimum of 20 trials with no shock at any time, and with a different alley being correct. It was found that all rats on any single day made a majority of their runs to the alley chosen under the shock conditions. Thus, it is seen that after removal of the shock, the animals made no change in preference to meet the demands of the new situation. Kleemeier therefore concludes, "...electric shock is a factor of great importance in producing abnormal behavior fixations in the rat." (7, p. 34).

One of the most important characteristics of fixations is their tendency to be permanent in nature, and to persist despite repeated testing. Maier and Klee (11) found that of 10 rats which had previously developed fixations in a frustrating situation, 7 rats retained their fixations after a period of four months vacation from the situation.

Since the test program employed in this experiment was designed to be stressful in that it contained conflict and convulsion-producing factors (namely a one-window situation and metrazol injections) as well as punishment for positional responses, the failure to disturb the position fixations in a majority of the rats demonstrates their strikingly permanent nature. It is interesting to note at this point that other results in this study showed that the tendency to develop fixations and the tendency to show "neurotic attacks" (where air-blast is used to force a response) seem to be unrelated tendencies, although fixated rats show greater reduction in the frequency of attacks as testing is continued. It appeared that fixated rats were better able to adjust to the attack-producing situation, indicating that fixations are some sort of adjustment mechanism.

Another important characteristic of fixations should be noted, namely that types of responses other than positional ones can be fixated. Maier, Glaser, and Klee (10) showed that rats which had learned a discrimination response after a position fixation was broken, tended to persist in the discrimination response when the problem was again made insoluble.

A third characteristic of fixations that is worth noting is that they are not all-or-nothing affairs, but rather, they can be increased in strength through variation in the length of the frustration period. Maier and Feldman (9) compared the relative rates of learning a discrimination response through the use of an alternate trial-and-error and guidance procedure in groups of rats that received eight, sixteen, and twenty-four days of frustration in an insoluble problem, respectively.

As controls, three other groups were used and these were trained to form position responses. In these control groups, it was found that the animals gave up position responses and adopted card discrimination responses at the same rate, indicating that the period of practice was not a factor in the problem, and it was found that normal rats gave up position responses between 50 and 60 trials. However, 3 rats which were subjected to 8 days' frustration exceeded the 60 trial maximum for giving up the response; 10 rats of the 16-day group exceeded the maximum; and 10 rats in the 24-day group exceeded it. These results led to the conclusion that frustration introduces an element of fixation to a response that is being practiced at the time of frustration. It was also found that additional frustration can add at least another increment of fixation to the response, and thus make possible the further fixation of an already fixated response. It was found that the group which had 8 days of frustration required an average of 30.1 trials to abandon the position response; the 16-day group required an average of 49 trials to abandon the position response; and the 24-day group required an average of 44.4 trials to abandon the position response. The differences between the 8-day group and the combined 16 and 24-day groups are significant at the 2% level, but the 16-day and 24-day groups are not significantly different from each other. In other words, the number of trials required to break the position response shows an increased spread as we go from the motivated groups to the 8-day, 16-day, and 24-day frustrated groups. Thus, there are at least two degrees of rigidity in fixations. The first stage of frustration causes responses to be far more rigid than ordinarily learned responses, and a second stage of



frustration causes a further increase in rigidity so that the stubbornness of the response is readily observable even when guidance is used.

Behavior fixations have been given two sharply conflicting interpretations. One interpretation considers them to be simple learning phenomena, whereas the other regards them as abnormal phenomena and explicable only in terms quite independent of those applicable to learning phenomena.

One of the foremost proponents of the idea that fixation is simply due to habit-strength is Sears, who says, "As habit strength is customarily measured, it is equivalent to strength of the instrumental act, and this latter is the quantitative continuum at one end of which lies what Freud called fixation, i.e., great strength." (17, p. 81). He lists several factors which have been shown to influence the strength of instrumental acts as follows: 1. Amount of reinforcement. 2. Strength of drive at time of learning. 3. Amount of reward. 4. Interval between instrumental act and goal response. 5. Frequency of reinforcement, and 6. Punishment. These factors (17, pp. 81-85) are essentially the principal factors which govern all types of learning. Thus, Sears makes his interpretations of fixations on the basis of habit-strength, and these habits are built up according to commonly accepted learning principles.

Mowrer (16) suggests that fixations may be explained on the basis of reduction of anxiety which resolves itself according to modern learning principles. He assumes, "1. that anxiety, i.e., mere anticipation of actual organic need or injury, may effectively motivate human beings, and 2. that reduction of anxiety may serve powerfully to reinforce behavior that brings about a state of 'relief' or security." (16, p.564).

Thus, in this conception, we have an animal in a situation that leads to anxiety, either through the perception of pain from without or hunger from within the organism. The animal, upon making a response, relieves some of the anxiety that is generated by the situation. This response, then, is reinforced by the reduction of anxiety, and hence it tends to become well learned or, as Mowrer says, fixated. Therefore, it is possible to explain fixations on the basis that they are learned reactions that are adaptive in the sense that they relieve anxiety. In line with this, Farber (2) tested the hypothesis that fixation of non-adaptive responses in shock situations resulted from uncontrolled secondary reinforcement resulting from anxiety reduction. Farber believed that since fixation could occur under shock conditions, any diminution in the strength of that fixation due to feeding at the locus of shock could be ascribed to either direct interference with the fixation or to some process maintaining it. If it were shown that feeding did not interfere directly with the habit (fixation), then it could be assumed that the feeding interfered with some mechanism maintaining the fixation, and thus it is effective in reducing the fixation. To test this hypothesis, two groups of 24 rats were given 100 trials in a single unit T-maze, with food reward in the goal box on their preferred side. During the last 60 trials the animals were shocked immediately after the choice point in the maze. After the completion of this training, one group was fed at the locus of shock for two 10-minute periods. On the next day, the food was placed on the non-preferred side for each animal, and no shock was administered. The responses were then extinguished. The number of trials to extinction for the animals fed at the locus of shock and those

not fed were compared. To control the possibility that the feeding affected the original responses directly rather than by way of anxiety elimination, two other groups of 24 rats each were run through the same procedure, but no shock was applied. The following results were obtained:

1. Responses of the shocked animals showed greater resistance to extinction than did non-shocked.
2. Responses of the shocked non-fed animals showed greater resistance to extinction than did those of the shocked-fed animals.
3. The control animals showed that feeding did not disrupt the habit in progress.

Thus, feeding at the locus of shock prevented fixations, and this prevention of fixations was the result of interference with some mechanism maintaining the fixated responses. Therefore, Farber concludes, "Fixation resulting from shock may be the result of the operation of secondary reinforcement resulting from anxiety reduction, and therefore due to factors operating in the ordinary learning situation." (2, p. 131).

In radical opposition to the interpretation of fixations based on learning concepts, Maier and his colleagues (10, 13) consider fixations as abnormal phenomena not explicable by current learning theory. These authors believe that behavior is not all motivation-instigated, as modern learning theorists such as Spence assume. (18). They have demonstrated that fixations occur when the animal is placed in an insoluble problem situation which is highly frustrating to the animal. That the insoluble problem was of a highly frustrating nature was shown by Klee (6) who found that a number of rats which were motivated to jump

because of hunger rather than an air-blast, refused to respond in an insoluble problem situation, and ultimately starved to death.

As shown above, animals which had learned a new response were unable to exercise it because of the compulsive nature of the fixated response. This finding lends considerable weight to Maier's theory that fixations are qualitatively different from ordinary habits.

Further evidence of Maier's theory also may be shown by the fact that mild punishment will weaken an ordinary habit, yet it will have no effect upon the fixated response. This was demonstrated by Maier and Klee, (12), who believed that fixations occur in many trial-and-error learning problems (where there is success and failure, and where failure is sufficiently persistent). It was also believed that these fixations have remained undetected in the past because they have not been experimentally separated from ordinary habits. It was thought necessary therefore, "...to investigate the learning of different problems and introduce a variety of patterns of rewards and punishment, where problems may vary in degree of difficulty, and the punishment may be applied 50% of the time or 100% of the time. If 50% punishment is used, it may be applied in a random fashion or it may follow a definite pattern." (12, p. 378). For the purpose of this study, three groups of rats were used; one group developed a frustration-instigated position response in an insoluble problem situation; another group was trained to develop a position response by being rewarded for jumping consistently to a particular side, and the third group was trained to develop a discrimination response by being rewarded for jumping consistently to a particular card. All of the animals were then required to modify their responses as

follows: half of the animals in each group were required to shift their responses, and the other half to reverse them. By shifting a response, it is meant that those animals with position responses begin to respond in terms of discrimination, and those with discrimination responses begin to respond in terms of position. And, by reversal of response, it is meant that those animals which respond to the right side must now respond to the left side, and those animals which are responding to one card must now respond to the other. Thus, each animal which was required to shift its response received 50% punishment; while the animals which had to reverse their responses received 100% punishment. A maximum of 200 trials was allowed for the modification of the responses. The results showed that rats which had formed their responses under conditions of frustration tended to continue their responses throughout the 200 trials. Of the 20 rats, 13 (65%) failed to alter their behavior, each showing the old response throughout the 200 trials. The other groups which acquired their initial responses under conditions of motivation, showed a marked tendency to abandon them. Only 10 (25%) of the 40 rats failed to make the adjustment. Furthermore, the hypothesis that 50% punishment would be less effective for the breaking of a response than 100% punishment was found to be false. Of the sub-groups which had received 100% punishment, it was found that 17 out of 30 rats (56.7%) failed to abandon their old responses, whereas in the sub-groups where 50% punishment was received, only 6 out of 30 rats (20%) failed to abandon the old response. Furthermore, since the data indicated that the rats which abandoned their old responses did so within 148 trials and that the rats which did not abandon their responses, maintained

them for the 200 trials, a discontinuous series between those which abandoned their responses and those which did not was formed. Maier therefore says, "...This fact...was a basic reason for insisting upon a qualitative distinction between abnormal fixations and habits." (12, p. 386).

In still a further study, Maier and Klee (13) compared the effects of trial-and-error learning and guidance in the alteration of habits and fixations. Theoretically, if fixations are of the same order as habits, then they should be readily modified by ordinary trial-and-error learning techniques. In this particular study, two main groups were used; Group I, which was subjected to the insoluble problem, and Group II, which had learned a position response through differential reward and punishment. After both groups had formed their position responses, they were then required to change their responses into terms of discrimination. Two methods for learning the new response were used. One method employed the trial-and-error procedure; i.e., the animals were rewarded for choosing the correct card, and punished for choosing the incorrect card. The other method utilized guidance in conjunction with trial-and-error. The guidance procedure consisted essentially of forcing the animals to the correct window by preventing an incorrect response with the hand, and gently pushing the animal to the other side of the jumping platform so that it faced the correct window. This will be more fully explained in the section on Procedure. It was found that of the rats which had frustration-instigated position responses, 6 out of 15 solved through trial-and-error, but when guidance was used, 16 out of 16 similarly trained animals solved. The critical ratio of the difference

of percentages was 6.51 which indicates that the difference is statistically significant. However, in the case of the animals which had developed motivation-instigated position habits, 11 out of 14 solved by trial-and-error while 15 out of 15 solved by guidance. The critical ratio of this difference of percentages was 3.61 which is statistically significant. This indicates that guidance is consistently superior to the trial-and-error method, both when the response to be broken is the product of frustration, and when it is the product of motivated learning. When both methods of producing the position response are combined, the method of trial-and-error yielded 30 fixated rats out of 57 (53.2%), and the method of guidance yielded only 3 fixated rats out of 59 (5.1%). The critical ratio of this difference of percentages is 6.68. It appears, therefore, that when trial-and-error is used to break a response, its success depends upon the nature of the response--whether it was developed by means of an insoluble problem, or by differential reward and punishment. It is also important to point out the fact that all of the animals required an average of 13 to 69 trials from the time they abandoned the position responses to a time when they consistently gave a discrimination response. This showed that animals may abandon an old response and still not have a substitute to practice. Any theory of learning, according to Maier (13), which explains modifications in behavior to changes in the relative strength of two or more behavior tendencies is contrary to the evidence just cited. According to Maier and Klee, "The mere fact that an animal has learned to make a certain response in a situation does not mean that the response will be practiced. The expression of learned behavior is a matter either of motivation or frustration." (13, p. 159). Ordinarily

in a trial-and-error learning situation the animal will choose the response that leads to the greatest satisfaction, but that does not mean that no other responses have been learned. The unexpressed responses may be just as well learned but they are not practiced because no motivation brings them to expression. If an animal is dominated by frustration, however, it makes responses which are senseless from the motivational point of view. If the frustrating conditions are removed, then the learned behavior that is rewarding to the animal can be brought to expression. This merely emphasizes what has been shown in previous studies (10).

To summarize, then, the position of Maier and his colleagues, fixations are qualitatively different from ordinary habits in that a. they have the appearance of compulsions; b. they are associated with frustrating conditions; and c. they are not influenced by the motivating conditions which influence ordinary habits.

Upon examination of Maier's theory in terms of present learning concepts, it appears possible to reconcile the two points of view. If frustration causes anxiety or fear of punishment, then a definite motivational situation is created. The idea that an animal's response is not adaptive and goal-oriented when the animal is placed in a frustrating situation, refers to the fact that it is non-adaptive from the point of view of the solving of the problem. It is theoretically possible that the response which an animal makes in a frustrating situation is adaptive in that the animal's aim is to relieve the anxiety or escape from the frustrating situation. Thus, a response that allows surcease from anxiety or pain is adaptive as far as the animal is concerned.



Farber (see above) suggested that the responses became fixated through some mechanism of secondary reinforcement. That they are not alterable through ordinary trial-and-error learning may be explained also on the basis of a secondary reinforcing mechanism. In a trial-and-error learning situation, the frustration-dominated animal finds itself in a novel and somewhat trying situation. Any response that removes it from the situation, or else makes it more bearable will be seized upon, and will soon be learned. It is theoretically possible that anxiety is a greater motivating factor than hunger, thirst, or sex, and therefore the responses that tend to reduce anxiety are more dominant than those that reduce hunger. Thus, the animal will only practice those responses that rid it of anxiety (these then become strengthened through a mechanism of secondary reinforcement), rather than those which lead to the solving of the problem. We can conceive of fixations then, as some sort of adjustive mechanism to a trying situation.

In a recent study by Feldman (4), it was found that rats which had fixated a jumping response on the Lashley apparatus, also tended to fixate a walking response in a soluble discrimination problem on the same apparatus. The walking response was established by placing a runway between the jumping platform and the windows of the apparatus. The animal was given one jumping trial, then was required to make a walking response to the cards, then another jumping trial, another walking response, etc. The walking response did not necessarily fixate the same side or card as did the jumping fixation. The question is therefore raised as to the relationship of the primary or jumping fixation to the secondary or walking fixation. Are they both due to the same etiological

factors? Can guidance on jumping influence the walking response in any way? It is entirely possible that the walking fixation may be due to the fact that the stimulus configurations in both the walking and jumping responses are sufficiently alike to call for a similar type of response. For example, when the animal prepares to make the response, it may be undertaking a series of movement sequences that are practically identical with those undertaken when a jumping response is made.

Miller (15) has observed that avoidance, and hence conflict, can generalize from a device in which animals are fed when hungry to a somewhat similar device in which they drink when thirsty. He also observed that anticipatory goal responses can mediate a type of generalization which would ordinarily be described as foresightful. In all of these cases, however, it is not the conflict itself which spreads, but rather one or more of the competing tendencies responsible for the original conflict generalizes to new situations and creates new conflict there. Thus, a simple approach situation can be changed to an approach-avoidance conflict by generalized fear. Furthermore, it seems possible that the act of making a decision may produce stimuli which are relatively similar in different choice situations, so that after an individual has been severely punished for the immediate consequences of one decision, he may have anxiety about making others. Miller (14) in another study, found that rats which had been trained to strike each other upon receiving electric shock, struck a doll which had been substituted for a rat in a similar situation. This was an example of stimulus-generalization from a rat to a doll. It is therefore possible, to

interpret fixated walking responses such as Feldman (4) observed in terms of stimulus-generalization.

Certain salient features stand out in all of this material. First of all, it appears that abnormal fixations are definitely caused by frustration in an insoluble problem situation. These fixations are persistent and show total resistance to modification by ordinary trial-and-error learning techniques. Secondly, these fixations have been interpreted in two distinct fashions; one interpretation postulates current learning theory, based on an anxiety-reduction hypothesis, as sufficient for explaining the basic nature of the fixations, while the other point of view is that these fixations are qualitatively different from habits, and hence cannot be explained by learning theory. At present, there is evidence in favor of both positions, and no definite conclusion can be drawn in favor of one rather than the other.

Finally, it appears that fixations tend to generalize into related forms of behavior. The present paper will attempt to add additional information to this problem.

The Experimental Investigation

## I. The Problem

Recalling that Feldman (4) found that some rats, which had shown a history of jumping fixations, tended to fixate a walking response in the same soluble discrimination problem, it was suggested that abnormal fixations tend to generalize into related forms of behavior such as walking responses. Therefore, the present study was designed to test the above hypothesis, and to add more data concerning the specific nature of the walking fixation.

The problem was designed specifically to determine the relationship of the walking (derived) fixation to the jumping (primary) fixation, by observing the resultant walking behavior when the jumping fixation was altered through guidance procedures. For example, if the walking fixation were modified after the jumping fixation was abandoned, then it might be inferred that the walking fixation is dependent upon the jumping fixation in some significant way.

## II. Subjects

Twenty normal albino rats from the laboratory stock of the University of Massachusetts Nutrition Laboratory were used. The group consisted of 17 females and 3 males. The animals were 55 to 60 days old at the beginning of training on the apparatus.

## III. Apparatus

A modified Lashley Jumping Apparatus (see Plate 1, p. 22) which contained several automatic features designed by Feldman (4), was used.

Essentially, the apparatus consists of: a jumping-platform from which the animal jumps when making a response; a screen with two apertures in which the stimuli to be discriminated may be placed; a feeding platform behind the screen, upon which the animal gets its reward when it makes a correct response; and, a net below the screen into which the animal falls when making an incorrect response.

In this experiment, two plexiglass windows, ground on both surfaces, were inserted into the apertures, and were illuminated by electric light bulbs placed over them. The experimenter could, by throwing a switch, illuminate one of the windows and not the other, thereby presenting a bright and dark stimulus to be discriminated. It was also possible for the experimenter to lock either of the windows, or to illuminate a window and open it simultaneously, regardless of the position of the window, by merely throwing a switch.

The animals were induced to jump by means of electric shock administered through a floor-grid on the jumping platform. The shock was supplied by passing 1.5 volts from an ordinary dry-cell through an automobile ignition coil and a Ford-type condenser, thereby building up the shocking-grid voltage to 3000 volts. The animals received approximately two shocks per second on the jumping platform. The number of shocks was controlled by the experimenter who simply pressed a simple make-break push-button switch located on the control panel. This proved to be a satisfactory shocking system.

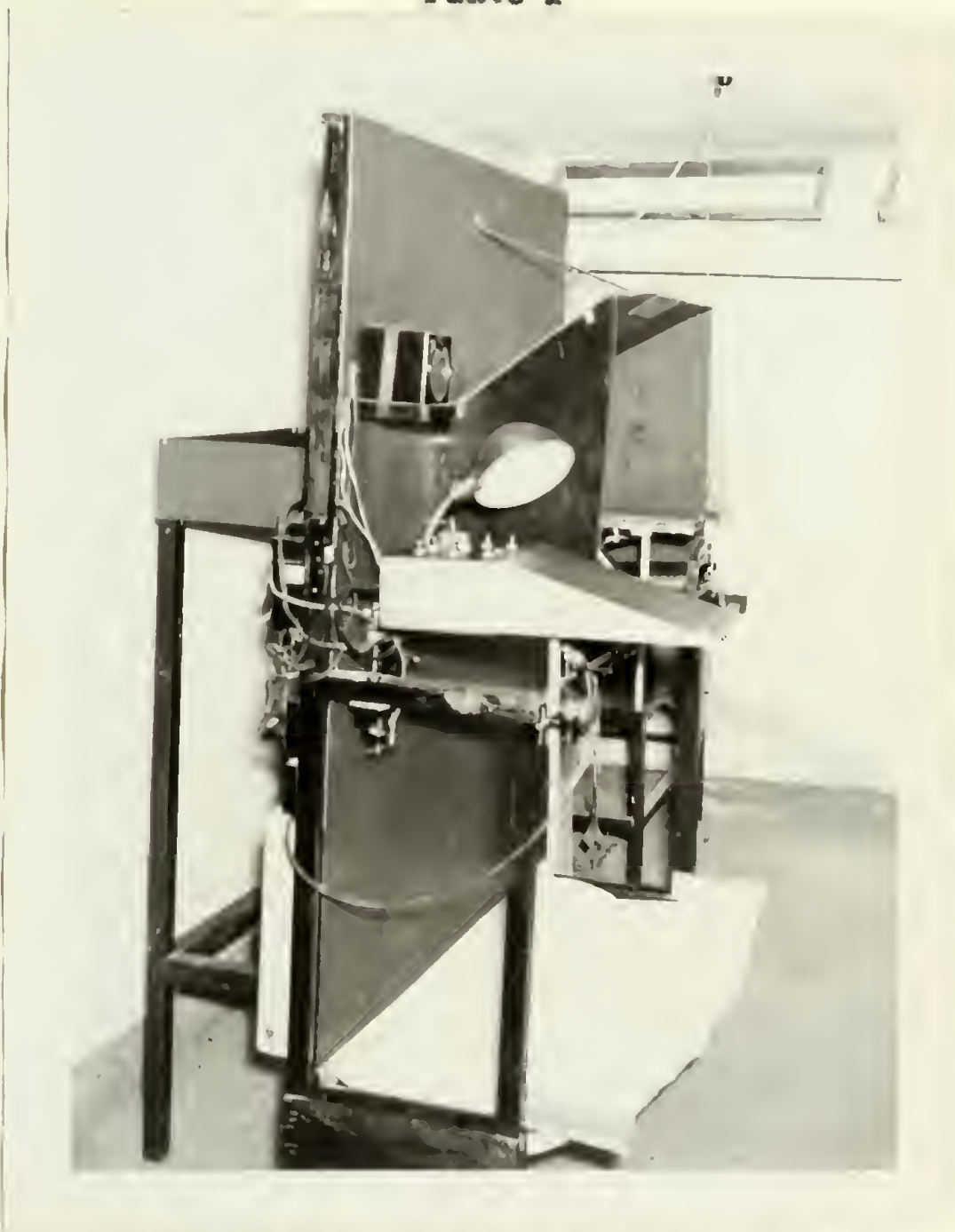
The latencies of response were measured by means of an electric timer mounted on the screen. The timer was started as soon as the animal was placed on the jumping platform, and was stopped as soon as the

animal jumped. This allowed the experimenter to get measures of latencies which were accurate to within one second.

To establish the walking response, a runway, going to each of the windows was constructed, and was fastened to the jumping platform by means of a hinge. Thus, the runway could be raised or lowered at will by the experimenter.

A hood of plexiglass, painted black, was constructed and fastened to the edges of the windows in order to minimize abortive responses. This prevented the animals from jumping straight up in the air or out to the sides, rather than to the windows.

Plate 1



Modified Lashley Jumping Apparatus.

#### IV. Procedure

##### A. Preliminary Training

All animals were tamed and given preliminary training in jumping in the following manner:

At first, the animals were fed on the feeding platform of the apparatus in order to familiarize them with the situation. This general orientation period lasted until the animals approached the food readily. This period required 3 to 4 days. The animals were then given training in jumping from the jumping platform to the apertures in the screen. This was done by moving the jumping platform back approximately 1 inch per day from a position close to the screen to a position 9 inches from the screen. The rats were given 10 trials per day. To prevent the formation of position preferences, the animals were given guidance on alternate trials. That is, if an animal jumped to the left side on one trial, it was guided to the right side on the next trial. When the animals were jumping readily and quickly to the apertures, the two stimulus windows were introduced. At first, the stimulus windows covered only part of the apertures, and as training progressed the stimulus windows were moved until they completely blocked the apertures. In this phase, the windows were not locked, and the animals had simply to jump and push aside the windows to gain access to the food on the feeding platform. The animals received 10 trials per day during this period, and the bright and dark windows were shifted from side to side to prevent the development of preferences for either of the windows. During this phase of training, the animals were also



guided on alternate trials to prevent the formation of position preferences. This procedure required 21 days before the animals were jumping readily and quickly to the windows.

The last stage of the preliminary training period consisted of introducing shock into the situation. In this stage, the animals were permitted to remain for 30 seconds on the jumping platform prior to jumping. If they did not jump within that time, electric shock was administered through a floor-grid on the jumping platform. In this stage, the bright and dark windows were shifted from side to side, but neither of the windows was locked. The animals were given 10 trials per day, with guidance being given after every three trials to the opposite side or brightness if the animal had jumped to the same position or brightness for 3 consecutive trials.

## B. Special Training

### Stage I. No-solution Situation

At the conclusion of the above training period, all of the animals were subjected to a no-solution problem for 16 days at the rate of 10 trials per day. The no-solution, or insoluble problem, situation consisted of locking the windows in a random fashion (neither a brightness nor a position was systematically rewarded or punished). In this situation, there is no response which will permit consistent escape from punishment. This provides a very frustrating situation for the animals and usually results in the formation of abnormal fixations. It has also been found in this situation that the animals, after making some variable responses, soon refuse to jump. The resistance to jumping

is overcome through the use of electric shock as described above. Under such conditions, most animals eventually settle down to a stereotyped response either to a position (left or right) or to a window (bright or dark).

Sixteen days were set as the limit for this stage of the experiment because it is to be recalled that Maier and Feldman (9) found that the optimum number of fixations and the optimum strength of fixations could be obtained with sixteen days of frustration.

### Stage II. Soluble Discrimination Situation

After the animals had completed the 16 days of the no-solution situation, they were required to abandon their position preferences or their discrimination preferences for a learned discrimination response (i.e., a response in terms of the characteristics of the windows). The animals which had developed left or right position responses in the no-solution situation were required to go to the bright window, while the animals which had developed responses to the bright window in the no-solution stage were required to go to the dark window. This provided a concrete test for fixations, for if the animals were fixated, they would not be able to modify the responses developed in the no-solution situation for the more goal-oriented discrimination responses that were required in this stage. This stage lasted for 20 days, each animal being given 10 trials per day. Animals which solved the discrimination problem, thereby giving evidence that they were not fixated, were dropped from further experimentation.

Twenty days were allowed for the modification of the no-solution responses, because animals are usually able to solve within the 200 trial limit if they are not fixated.

Stage III. Alternate Trial-and-Error Jumping and Walking Stage

In this stage, the animals which gave evidence of fixations in Stage II were trained to make walking responses in addition to the jumping responses in the same soluble discrimination situation as in Stage II. The walking responses were established by placing a runway between the jumping platform and the windows of the apparatus. The animal was allowed to jump to the windows on the first trial, then it had to walk to the windows on the next trial, then jump again, etc. Thus, a walking response was established in order to determine whether the jumping fixation of Stage II would generalize into other related forms of behavior.

The animals were given 10 trials per day for 20 days. In this situation, each animal received only 5 jumping and 5 walking trials on any one day. Animals which solved the discrimination problem on the walking response and then abandoned their jumping fixations and solved the problem on the jumping response, were eliminated from further experimentation. The animals which solved the problem on the walking response, but remained fixated on the jumping response, were given an additional 200 trials. Animals which fixated the walking response in addition to the jumping response, were placed under the conditions of Stage IV.

Stage IV. Alternate Trial-and-Error Walking and Guided Jumping Stage.

In this stage, only animals which had fixated both the walking and jumping responses were used. Each animal was given guidance

on alternate jumping responses, but not on walking responses. That is, the animal was allowed a free jumping response, then a walking response, then a guided jumping response, then another walking response, then another free jumping response, and so on. The method of guidance consisted of the experimenter's giving aid of such a nature, that the animal was prevented from practicing a fixated response. When the animal was set to jump to its fixated side, the experimenter placed his hand at the side of the rat and interfered with the jump, at the same time gently pushing the animal to the other side of the jumping platform so that it faced the alternate window. During the guidance, the animal usually struggled quite violently against making the non-fixated response, but eventually the resistance decreased, and the animal soon learned the appropriate response. In this stage, the guidance was continued until the animals made no more than one error on their free jumping trials for six consecutive days. This stage was continued until the walking fixation broke up, or until 400 trials had elapsed--whichever came first. The criterion of success for solving the problem on the walking response was set at no more than one error for six consecutive days on either the jumping or the walking responses.

Thus, this procedure enabled the experimenter to get at the relationship of the generalized walking fixation to the primary jumping fixation. For example, if the guidance on the jumping response also had an effect on the walking fixation, then it might be, that there is some causal nexus between the two responses.

Table 1 presents a complete summary of the procedures of the experiment.

Table 1

Summary of Procedures

<u>Training Stage</u>	<u>Stage I.</u>	<u>Stage II.</u>	<u>Stage III.</u>	<u>Stage IV.</u>
Animals trained to jump. Time: Approximately 20 days of training.	Frustration stage. Rats given insoluble problem. Random punishment used. 160 trials of frustration at 10 trials per day.	Soluble discrimination stage. Animals required to modify responses developed in Stage I.	Animals required to make walking as well as jumping responses in same soluble discrimination problem as in Stage II. Given 200 trials at 10 trials per day.	Animals given guidance on alternate jumping trials. Lasted until walking fixation was broken or until 400 trials had elapsed.

## V. Results

### A. Preliminary Training Stage

All of the animals learned how to jump to the windows within 30 days. The training period was somewhat long since several of the animals developed very strong position preferences that had to be eliminated. However, all animals were jumping satisfactorily to both sides when the no-solution stage was introduced.

### B. No-solution Stage

All of the animals eventually settled down to a stereotyped response. It was observed that 7 out of the 20 rats developed a preference for the bright window, while of the remaining 13 rats, 11 developed left-jumping position responses, and 2 developed right-jumping position responses. The animals which developed discrimination responses (showing preference for the bright window) practiced their responses an average of 95.7% of the 160 trials. The animals which developed left-jumping responses practiced their responses an average of 93.3% of the 160 trials, and the animals which developed right-jumping responses practiced their responses 99.5% of the time. Table 2 (p. 30) presents the data for this phase of the experiment. It shows the possible responses developed, the number of rats practicing each type of response, the average number of trials each type of response was practiced, and the average percent of the total trials each type of response was practiced. It will be seen from this table that all of the responses received practically the same amount of practice. It should be pointed out that the responses developed in this stage are not necessarily abnormal fixations. The test of a fixation is its complete resistance to modification when a more goal-oriented type of response is available.

Table 2Summary of Responses for No-solution Stage.

Number of Rats	Response*	Average Number of Trials Response Practiced	Average Percentage of Total Trials
7	Discrimination (B)	153	95.7%
11	Position (L)	149.2	93.3%
2	Position (R)	159	99.5%

\* No rat made a D discrimination response.

A study of latencies revealed that there was no appreciable difference between the latencies of responses to the bright window and the dark window in animals which had developed position preferences. Figure 1 (p. 32) shows the average latencies, per day in seconds, of animals which had developed position responses in this stage.

### C. Soluble Discrimination Stage.

In order to test for the presence of fixations, the no-solution problem of Stage I was changed to a soluble discrimination problem. Animals which had been responding in terms of position were now required to modify their position responses for a discrimination response to the bright window. Animals which had formed discrimination responses to the bright window in Stage I, were now required to abandon them for discrimination responses to the dark window. The animals were given 200 trials to modify their responses.

Table 3 (p. 33) shows the results for the soluble discrimination stage. From this table, we can see what the correct responses were, what responses were practiced, the number of animals practicing each type of response and the average number of trials each response was practiced. It is to be seen that 2 rats which had previously received 160 frustration trials, were able to modify their responses when the situation so demanded, and thus solve the problem. Two other rats which had previously developed discrimination responses to the bright window shifted their responses to a left position fixation in the new situation. Five animals fixated the bright window, while 10 animals fixated the left and 1 animal fixated the right side. Altogether, 18 animals were fixated as evidenced by the fact that they did not



Figure 1

Latencies of Responses To Correct and Incorrect Windows  
in Rats with Position Responses.

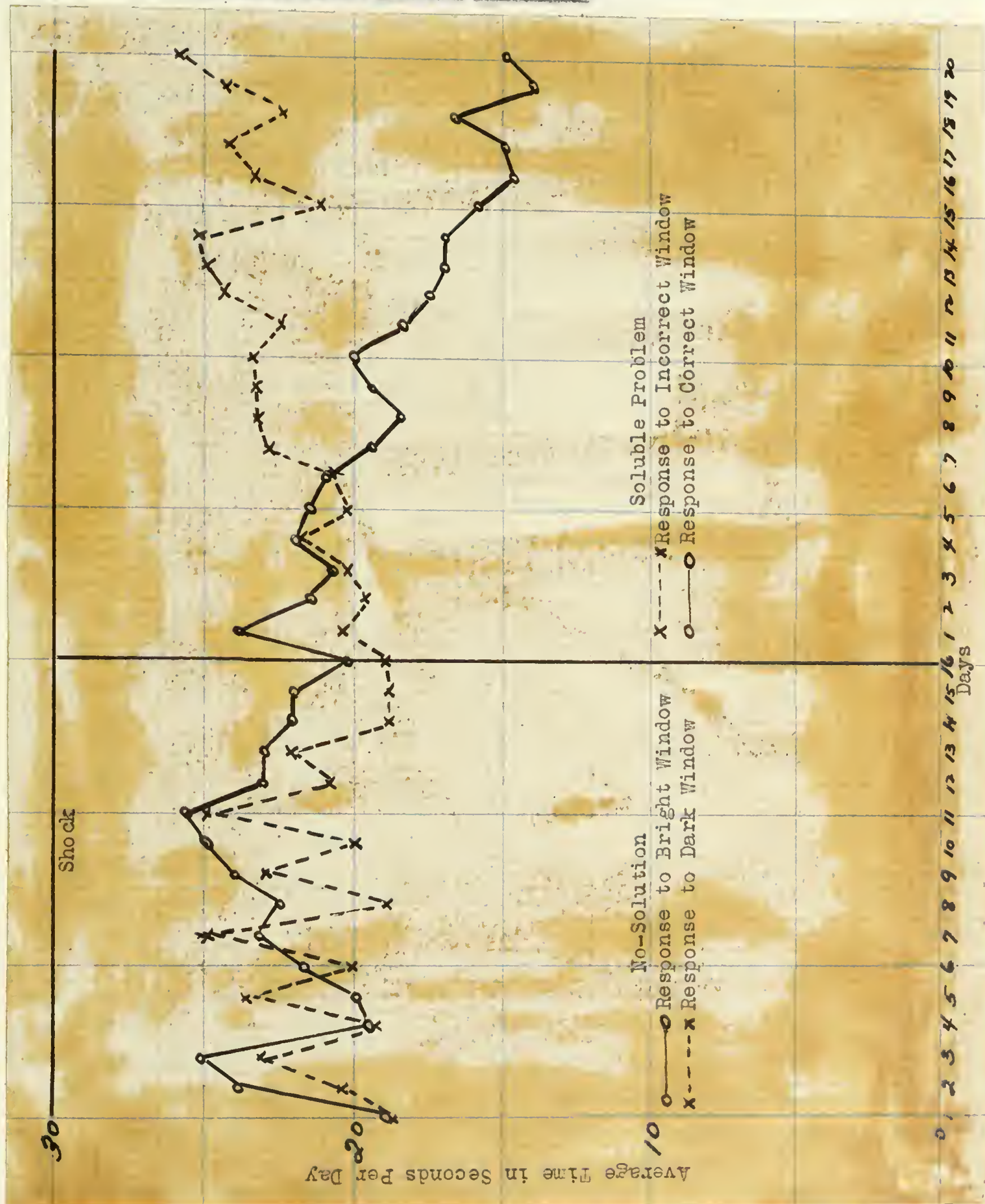


Table 3Results for Animals in Soluble Discrimination Problem.

<u>Number of Rats</u>	<u>Response Practiced</u>	<u>Correct Response</u>	<u>Average Number of Trials Response Practiced</u>
5	Discrimination (B)	Discrimination (D)	199.6
2	Position (L)	Discrimination (D)	193
10	Position (L)	Discrimination (B)	200
1	Position (R)	Discrimination (B)	200
2	Solved	Discrimination (B)	149.5

change their responses to meet the demands of the new situation. These 18 animals practiced their fixated responses practically 100% of the time, except for the animals which shifted from B to L. These two animals practiced their responses 96.5% of the 200 trials allowed for the modification of the response.

An analysis of latencies of response was made for the 13 rats which had fixated position responses. It can be seen from Figure 1 (p. 32), that it took the rats longer to jump when the incorrect window was on the fixated jumping side, than when the correct window was on the fixated side. This is evidence that the animals had learned to make a distinction between the two windows but were unable to make differential responses due to the compulsive nature of the fixation. Further, it was also observed that when the incorrect window was on the fixated side, the animals jumped abortively part of the time; whereas when the correct window was on the fixated side, the animals jumped readily and quickly to it.

During this stage, it was also observed that those animals which exhibited fixated behavior, also showed marked emotional behavior when placed on the jumping platform. This was evidenced by the excessive urination and defecation on the jumping platform, the assuming of odd poses on the jumping platform, and the exceptionally odorous and mucoid quality of the feces. This behavior was not as apparent in the two animals which solved the problem. Furthermore, observations of the behavior of the rats on the feeding platform showed that the fixated animals tended to show more avoidance of food and more crouching in the

corners of the feeding platform, than did the animals which solved the problem.

D. Alternate Trial-and-Error Jumping and Walking Stage.

After the animals completed the 200 trials allowed for solving the discrimination problem in Stage II, the 18 fixated rats were given 200 trials of alternate trial-and-error jumping and walking responses in the same soluble discrimination problem as in Stage II. The procedure was carried out at the rate of 10 trials per day. Thus, each animal received a maximum of 100 walking trials.

It can be seen from Table 4 (p. 37) that the responses of the animals fall into three discrete classes: namely, Group A, which consisted of 6 animals that solved the problem during both the walking and the jumping responses; Group B, which consisted of 7 animals that remained fixated on the jumping response, yet solved the problem walking; and Group C, which consisted of 5 animals that fixated the walking response in addition to the jumping fixation.

It is to be noted, that in Group A, the walking response was usually solved before the jumping fixation was abandoned and solved. This fact was deduced through an analysis of reduction of error curves for these animals. Figure 2 (p. 38) shows the elimination of errors for animals in Group A. We can see that the curve for walking errors was, with three exceptions, less than that for the jumping errors.

Further, an analysis of the walking behavior showed that the animals in Group A required an average of 60 trials of alternate trial-and-error walking and jumping responses to solve the walking problem,

(not including criterion trials), while the animals of Group B required an average of 107 alternate trial-and-error walking and jumping trials to solve the walking problem, (not including criterion trials). An observation of the walking behavior of the 2 rats which were not fixated at the end of Stage II was also made. One of these animals solved in 10 trials and the other solved in 20 trials, of alternate trial-and-error jumping and walking responses. The writer is aware of the paucity of these data, so no statistical analysis is attempted.

As in Stage II, an analysis of the latencies of the walking responses for animals in Group C which had walking position fixations was made. Figure 3 (p. 39) shows the latencies of responses for these animals. It is seen that the animals showed greater latencies of response when the incorrect window was on the fixated walking side than when the correct window was on the fixated walking side.

Table 4 (p. 37) presents a complete summary of the responses of the animals during this stage of the experiment. The number of rats falling into each of the three classes mentioned above, and the average number of trials that the walking response was practiced for each of the three class is shown.

#### E. Alternate Trial-and-Error Walking and Guided Jumping Stage.

In this stage, the animals which fixated both the jumping and walking responses (Group C) received guidance on alternate jumping responses. Guidance was stopped after the animals reached a criterion of no more than one error on the free jumping trials for six consecutive days.

Table 4

Results for Animals Practicing Alternate Trial-and-Error  
Jumping and Walking Responses.

<u>Group</u>	<u>Number of Rats</u>	<u>Jumping Response</u>	<u>Walking Response</u>	<u>Average Number of Trials Walking Response is Practiced</u>
A	6	Solved	Solved	88
B	7	Fixated	Solved	76
C	5	Fixated	Fixated	98.4

Figure 2

Error Elimination Curve For Animals in Group A Solving Discrimination  
Problem in Both Walking and Jumping Responses.

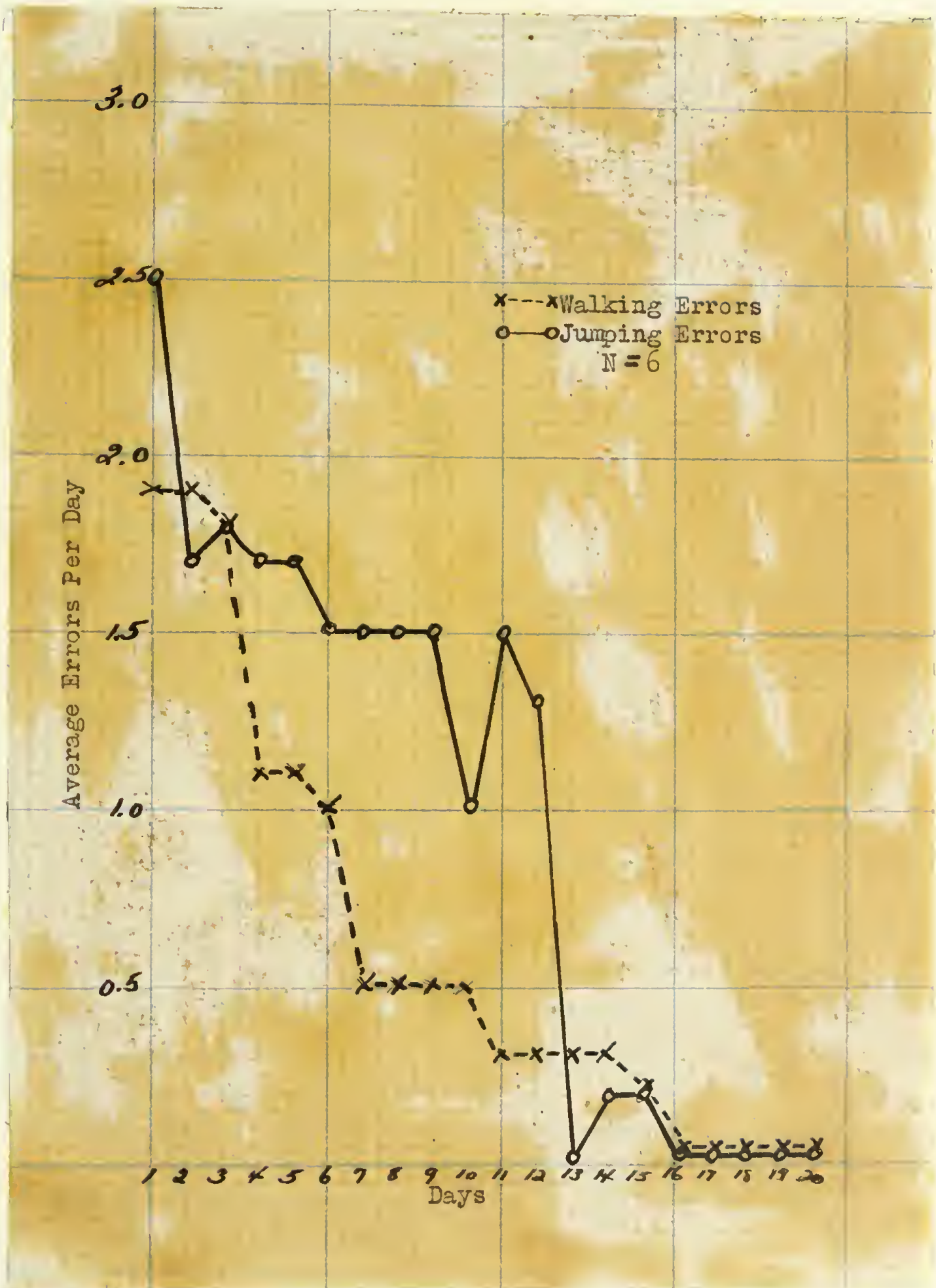
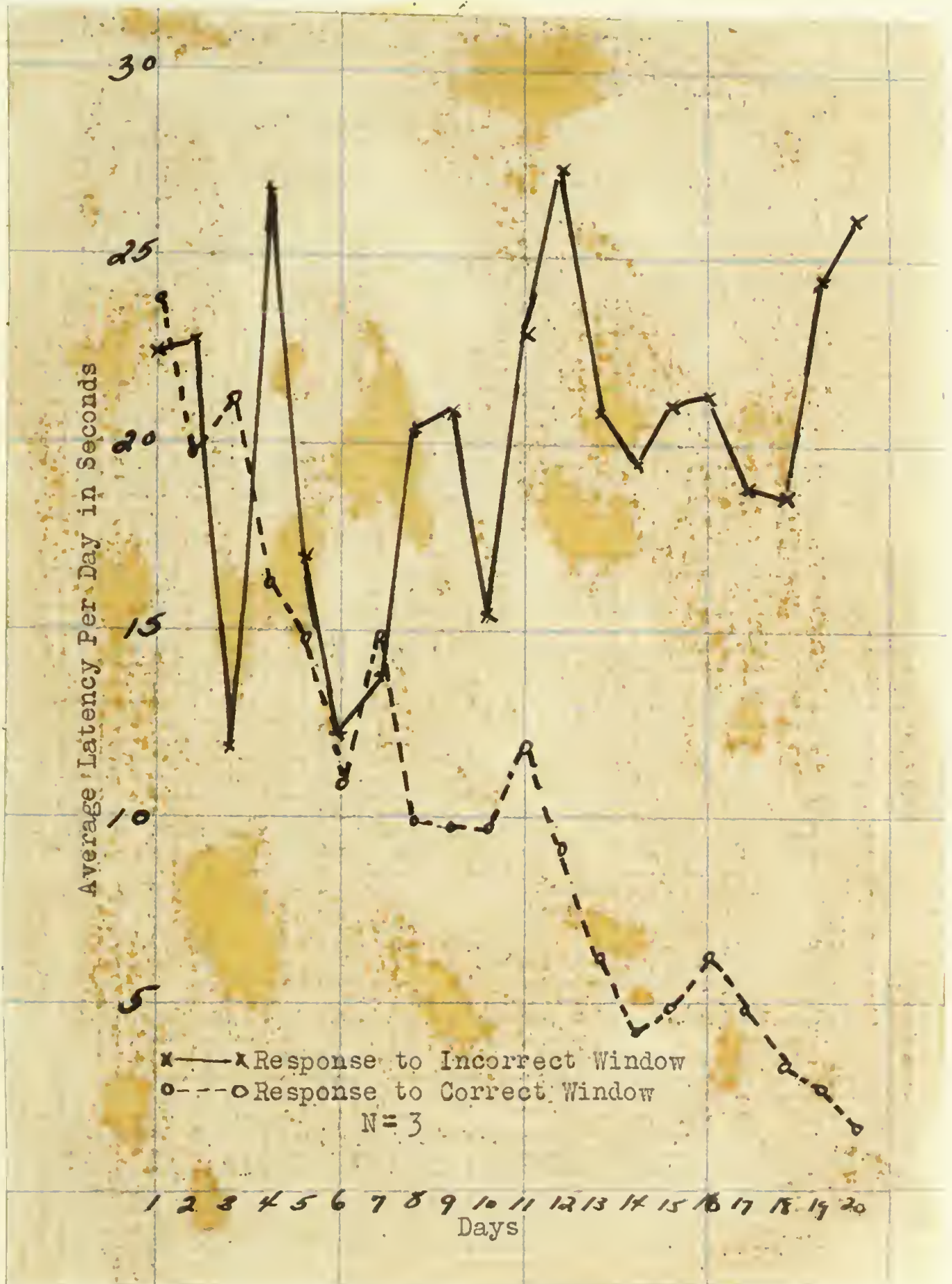


Figure 3

Latencies of Walking Responses  
for Rats with Walking Position Fixations





Of the 5 animals in Group C, 3 animals required 10 days of guidance; 1 animal required 12 days of guidance to meet the criterion; and 1 animal required 37 days of guidance before the guidance could be discontinued. Omitting the latter animal, since its score would greatly distort the average, it was found that the animals required an average of 105 trials to meet the criterion of success for guidance on the jumping trials. An analysis of the walking responses for these 4 animals showed that they required an average of 140 trials to reach the same kind of a criterion (no more than one error for six consecutive days on the walking and jumping responses). The animal that was omitted from this analysis solved the jumping response at the same time that the guidance was discontinued, since no jumping errors were made after guidance ceased, and the criterion trials are excluded in this analysis. However the animal required 390 trials to solve the walking problem (not including the criterion trials).

## VI. Discussion

Previous studies (10, 13) have shown that frustration causes many rats to develop a form of behavior that has been called an abnormal fixation. The results of this research support these studies and provide additional data clarifying the nature of the fixated response, and the relationship of this response to somewhat similar forms of behavior.

In Stage I (No-solution stage), it will be recalled that 7 rats out of 20 (35%) formed discrimination responses. Maier and Feldman (9) in a previous study, found that approximately 7% of rats in a no-solution problem formed a discrimination response. However, in all of the studies

done in Maier's laboratory, white discs on black backgrounds, and black discs on white backgrounds were used as stimulus units. In the present study however, a bright and a dark window, as described above, were used as the stimuli. It is possible that this difference accounts for the greater number of discrimination responses. The fact that the apparatus and procedures were similar in most other aspects, suggests that direct comparison of the present data with Maier and Feldman's data is justified. A critical ratio of the differences of percentages (present  $N=20$ ; Maier and Feldman's  $N=37$ ) of 2.5 was obtained, which is at the 1% level of significance. Therefore, the patterns that Maier and Feldman used might be more difficult to discriminate, and hence a lower percentage of discrimination responses would be expected.

It is also to be noted from Figure 1 (p. 32) that of the animals which developed position responses, no appreciable differences between the latencies of response to either the bright or dark window in the no-solution stage was found. This is what might be expected considering the fact that in this stage, neither a window nor a position was consistently rewarded or punished. However, when the soluble problem was introduced (the bright window was usually correct and the dark window incorrect, unless the animal in the no-solution stage showed a preference for the bright window, then the dark window was correct and the bright window incorrect), the latencies of responses to the windows changed considerably. The responses of rats with position fixations to the correct window and considerably shorter latencies, than did the responses to the incorrect window. This evidence is similar to that of Maier and his colleagues, and supports the contention that although

the animal practices a fixated response, it has nevertheless learned the difference between the two stimuli. White (19, p. 217) maintains that the "core of a neurosis lies at the point where anxiety has blocked or distorted the learning process so that new learning essential to adjustment cannot take place." In the light of the present evidence, this statement is untenable. It is quite evident that the learning process has not been blocked by anxiety, but rather the compulsive nature of the abnormal fixation is the cause of the animal's inability to practice the correct response. Therefore, it seems that Maier's contention (13) that we make a distinction between motivation and learning is justified.

Whereas Maier (13) suggests that fixated behavior cannot be explained by current learning theory and is explicable only in terms of motivational theory, Mowrer and others (16, 2), in contrast to Maier, have postulated an anxiety-reduction hypothesis based on current learning theory, to account for the extraordinary strength of those responses that Maier designates as abnormal fixations. It is possible that the motive to escape from anxiety or from an anxiety-ridden situation is greater than the motive to solve a discrimination problem for a food reward. Thus, any response that removes the animal from the anxiety-ridden situation is soon seized upon and learned. The great strength of this response may be due to some secondary reinforcing mechanism such as Farber (2) suggests. The data of the present experiment are consistent with both points of view and do not contribute to making clarifying distinctions between them.

The results summarized in Table 4 (p. 37) support Feldman's observation (4) that some fixated rats tend to generalize the jumping fixation to a walking response using the same stimulus situation. Also, the observation that the fixated walking response is not necessarily the same as the fixated jumping response, is supported. In Feldman's study (4), of 6 animals which fixated the walking response, 3 fixated the same walking response as the jumping fixation, and 3 animals fixated a different walking response than the fixated jumping response. In the present study, of the 5 animals which fixated the walking response, 4 animals fixated the same walk as the jumping fixation, and 1 animal fixated a different walk than the jumping fixation. The tentative conclusion from these results is that the generalization of stereotyped behavior may be carried to the opposite position or stimulus under the stated experimental conditions. However, this might be because the jumping response and the walking responses are not even remotely equivalent for the rat, a point that would have to be clarified by additional experimentation.

Figure 2 (p. 38) shows that although the animals had position fixations on the walking responses, they nevertheless had learned the discrimination between the two windows. As in the soluble discrimination stage with jumping responses only (Stage II) the animals when faced with the negative or incorrect window on the preferred walking side, took longer to make their responses than when the positive or correct window was on the preferred walking side. This again supports the view that the discrimination is learned but cannot be practiced because of the compulsive nature of the fixation.

Another significant relationship to Feldman's study was noted. Using 19 animals with jumping fixations, Feldman observed that all animals learned to make correct walking responses with the aid of guidance, but none of these animals altered their compulsive jumping responses. However, in the present study, 6 out of 13 rats (46%) that learned to walk without guidance broke their jumping fixations. It seems that if a walking fixation is prevented by guidance, an animal does not tend to break up his old jumping fixation; but if he is allowed to meet the problem situation by himself, and if he can solve it, then there is a greater tendency for him to break up the compulsive jumping fixation, or, that if the rat solves a related problem by himself, it has "therapeutic" value for breaking up a fixation in a related situation. Again it is to be cautioned that in Feldman's study, the stimulus cards that were used in his apparatus were different and it is possible that there were significant strain differences between the rat populations. On the other hand, the procedures in general were fundamentally similar, so that the suggested experimental variable (guidance vs. non-guidance on walking responses) can be isolated and its effects considered. It might be noted that a critical ratio of the differences between the percentages of the present study and Feldman's study, considering unrelated groups and correcting for small samples, is 3.1 which is highly significant.

It is suggested that the animals which are allowed to work the problem through by themselves will show greater tendencies to abandon their compulsive jumping behavior than those which receive guidance on the walking responses. Perhaps the non-guided animals develop some sort

of problem-solving attitude which the guided animals would not, because of the fact that the guided animals tend to depend too much on the experimenter for solving the problem. These observed differences might have some bearing in the area of psychological therapy.

In Stage IV (alternate trial-and-error walking and guided jumping stage), all of the animals were able to break their walking responses with the aid of guidance on the jumping responses. Moreover, it seems that the solving of the walking response first rests upon a successful solution of the jumping responses, since the data of all the animals show that the walking responses took longer and followed the jumping criterion scores. This hypothesis was strikingly illustrated by the animal that required 370 trials to solve the jumping problem. It is especially interesting to note in this particular case that both fixations held up for the long period of experimental manipulations, and when the guidance affected the jumping, the walking responses lost their compulsive character.

It should be recalled that Feldman (4) found that guiding the rats on the walking responses never caused the jumping fixation to be altered, and in this study, when animals learned to walk by themselves, 6 out of 13 were able to break their jumping fixations. However, in the study reported here, using animals that had fixated both walking and jumping responses, it seems that guiding the rat to make correct jumping responses is very likely to break up fixated walking responses. Even though one rat showed extreme resistance to the guidance technique and persisted in fixated jumping responses for 370 trials, the walking fixation did not break until there were definite signs that guidance

was having its effect on breaking the jumping fixation. It seems reasonable to postulate that the maintenance of the walking fixation is related in some way to the original compulsive act.

It is suggested, that, since many aspects of the walking response, such as stimulus configurations, postural sets, etc., are similar to the jumping responses, conflict and anxiety generalize into the walking situation, and hence tend to result in stereotyped compulsive walking behavior. When the conflict and the anxiety is eliminated in some way by the guidance procedures on the jumping responses, there is no longer any necessity for the rat to maintain its stereotyped walking response.

The results in Stage III showed that the animals in Group A which solved both the jumping and the walking problems required an average of 60 trials of alternate trial-and-error jumping and walking trials to solve the walking problem (not including the criterion trials). The animals in Group B, which maintained their jumping fixations and solved the walking problem required an average of 107 alternate trial-and-error jumping and walking trials to solve the walking problem (not including criterion trials). The difference between 60 trials and 107 trials seems to call for explanation.

It is possible that the animals in Group A were not as strongly fixated, thus accounting for the rapid learning of both responses. The animals in Group B might have been more rigidly fixated, thus accounting for the failure to abandon the jumping fixation, and the resistance to rapid solution of the walking problem. It would follow from these suppositions, that the animals in Group C were the most rigidly fixated of all, accounting for continued maintenance of the fixated jumping

response and the generalization of fixation to the walking response. It is also interesting to note that the two animals which were never fixated (those that solved the jumping problem in Stage II) when put on the walking problem solved the walking problem most rapidly (10, and 20 trials not counting criterion trials). The problem raised is how these relationships can be further validated and clarified.

The crucial questions raised by this study are: 1. why animals that solve walking responses first do not always solve jumping fixations, especially when the walking response is solved with the aid of guidance; 2. why some animals generalize jumping fixations to walking responses and others do not, and 3. what is the explanation of the different rates of learning of behavior, that is related to the fixated response. Perhaps the answer to the second and third questions lies in the relative strength of the original jumping fixations.

Again the writer cautions against unwarranted assumptions on the basis of the limited data that is presented here. On the other hand, it is felt that a number of important conditions related to fixated behavior have been at least exposed, and they can be clarified by additional experimentation.

## VII. Summary and Conclusions

The present study attempted to gain some more information concerning a finding by Feldman (4) that rats which had abnormal jumping fixations tended to generalize these fixations into walking responses in the same soluble discrimination problem, and hence cause the walking response to become fixated. The study was divided into four discrete stages. In the



first stage, the animals received random punishment, and soon settled down to a stereotyped form of response. In the second stage, the animals were required to modify the responses developed under random punishment and solve a soluble discrimination problem. It was found that 18 rats were unable to do so. In the third stage, the animals which were unable to solve the discrimination problem were required to develop walking responses to the same discrimination problem. It was found that the animals fell into three discrete categories in this stage: namely, those that solved the discrimination problem on the walking response, and subsequently broke their jumping fixations; those that solved the problem on the walking response, yet remained fixated on the jumping response; and those which fixated the walking response while remaining fixated on the jumping response. The latter group of animals was then given guidance on alternate jumping responses. It was found that 4 out of 5 rats so treated gave up their walking fixations soon after the jumping response was broken, and the fifth rat did so after 370 trials of guidance on the jumping responses.

The following conclusions may be drawn from the results:

1. The previous work done by Maier and his colleagues was confirmed, namely that frustration fixates certain responses, and although the animals have learned the difference between the two stimuli, they cannot exercise their preferences due to the compulsive nature of the fixation.

2. Feldman's hypothesis that some rats tend to generalize their jumping fixations to walking behavior and thus cause walking fixations was supported.
3. It was concluded that learning of the walking response may alter the jumping fixation, whereas guiding the animal to correct walking responses eliminates the tendency to change the jumping fixation.
4. Finally it was concluded that guidance on the jumping fixation allows the walking fixation to be broken up, and hence the two fixations seem to be related.

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