AN EXPLORATORY STUDY OF THE POSSIBLE DIFFERENTIAL INHIBITORY EFFECTS OF FRUSTRATION AND WORK INHIBITION

Thesis for the Degree of M. A.
MICHIGAN STATE COLLEGE
Jack Lou Maatsch
1951

This is to certify that the

thesis entitled

An Exploratory Study of the Possible
Differential Inhibitory Effects of
Frustration and Work Inhibition

presented by

Jack Lou Maatsch

has been accepted towards fulfillment
of the requirements for

Master of arts degree in Psychology

M. Ray Denny
Major professor

Date May 24, 1951

O-169

AN EXPLORATORY STUDY OF THE POSSIBLE DIFFERENTIAL INHIBITORY EFFECTS OF FRUSTRATION AND WORK INHIBITION

by

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A THESIS

Submitted to the School of Graduate Studies of Michigan
State College of Agriculture and Applied Science
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS

Department of Psychology

1951

ACKNOWLEDGEMENT

Grateful acknowledgement is made to Dr. M. Ray Denny, under whose supervision this study was carried out, for his guidance and participation in the present research. The author would like to express his gratitude to Mr. Richard A. Behan for his indispensable aid in outlining and carrying out the statistical procedures utilized.

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INTRODUCTION

Due to inadequately developed inhibitory concepts, modern behavior theory has been hindered in the successful prediction of relatively complex behavior.[1] Not only has there been a lack of sufficient quantification of these constructs but attempted integration with the response evocation[2] concepts has often been awkward and contradictory.

Hull(3), for example, has referred to "Experimental Extinction" as a behavior principle, a process, a kind of corrective mechanism, as decrement in performance or "extinction effects." While Pavlov(5) who originated the term "Experimental Extinction" used it to denote a methodological procedure.

Hull proposes two inhibitory constructs to explain all or presumably all of the phenomena in the area of inhibition: 1) Work Inhibition (I_r) which is conceived of as an antagonistic drive state, temporally labile, specific to the responses elicited, and arising from sheer reaction; 2) Conditioned Inhibition (${}_sI_r$) an antagonistic habit, in which, stimuli in the situation are conditioned to antagonistic or resting responses that are evoked by I_r and reinforced

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[1] Inhibitory concepts: those concepts that are postulated to explain decrements in attained level of performance.

[2] Response evocation concepts: those concepts that are postulated to explain increases in or betterment of performance.

by the reduction of I_r. These two constructs summate to yield Inhibitory aggregate ($\dot{I}_r$). Hilgard and Marquis(2), however, have pointed out that an adaptation type theory such as Hull's is inadequate to explain all the phenomena of inhibition.

Rohrer(6) has proposed the subsitution of Frustration Drive (FD) for I_r in Hull's theory of behavior. Frustration (F), a situation in which blocking or interference with goal oriented responses occurs, gives rise to FD. Responses other than the blocked response tend to reduce FD and are thus reinforced. These habitual reactions to FD (RF) play the role of ${}_sI_r$ in Hull's theory. FD has the same properties as I_r, that is, FD is temporally labile and an antagonistic drive state, but arises from F instead of sheer reaction. He suggests the above concepts would better explain experimental extinction.and would have far greater applicability in terms of explaining complex behavior.

The definition of frustration by Rohrer as a blocking or interence with goal oriented response leaves room for at least two somewhat different operational situations which we may find upon empirical examination to have different consequences for behavior. One operation would be the Pavlovian extinction procedure in which the only change in the situation is the removal of the goal object. The other operation would be preventing the attainment of the goal object by the introduction of a barrier or similar blocking device. One characteristic of the latter procedure which may have its unique effect is the addition of new and presumably discriminable

cues into the frustration situation.

For convenience in exposition the former frustration situation will be designated (E), as an abbreviation for extinction; the latter labeled (F), for frustration; and inhibition through sheer reaction will be called (I_r).

The purpose of the present study is to evaluate and compare these three types of inhibition conditions in terms of magnitude inhibition and rate of dissipation of inhibition with time. The methodology for this comparison will be to subject animals to one of these three situations and then to test subsequently for response at varying time intervals. An organism is assumed to carry the resulting inhibitory state with it into the test situation. Thus the measure of the amount of inhibition produced is defined as the decrease in measured performance from the first occasion to the subsequent test occasion.

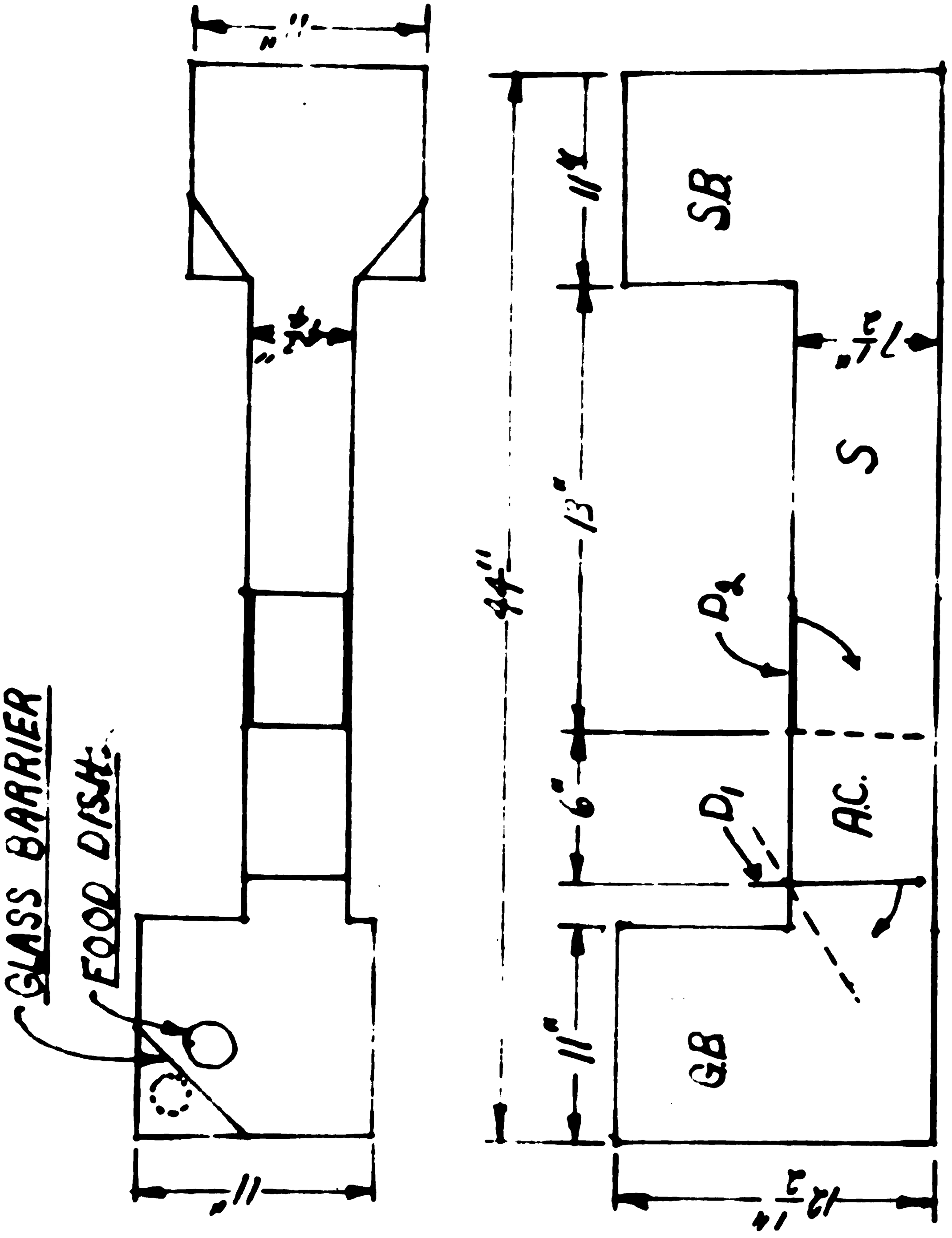

Figure I. Straight alley maze involving a starting box (SB) stem (S), approach chamber (AC), goal box (GB), solid panel door (D_1), and restraining door (D_2).

EXPERIMENTAL PROCEDURE

A. Apparatus

The apparatus used was a simple straight alley maze. The maze was constructed in four sections including a starting box, the stem, and two interchangeable goal boxes of identical shape.

The sides and bottom of the maze were constructed of ½" ply wood. The top of the stem was covered by ¼ inch screen, while the starting box and goal box were open. The starting box, stem and doors were painted flat grey.

The doors in the stem were both hinged at the top of the maze. D_1 rotated into the goal box with approximately 15 grams of pressure applied at the base of the door. This door completely hid the goal box from view until activated. The door was prevented from rotating back into the stem by a small wood stop. A movement of ½" from the vertical, closed a sliding contact which activated a door bell type electromagnet. The electromagnet powered by 3-1½ volt dry cell batteries served as a releasing mechanism for door D_2. Before being released D_2 was in a horizontal position forming part of the top of the maze. When released D_2 rotated down to a vertical position and locked. In the down position the wooden base of D_2 was 1" above the floor with most of the remaining space filled by sponge rubber. This technique prevented pinching the animals tails.

The effect of using the two doors was to "trap" the animal. An animal moves toward G with D_1 completely blocking the view of G. When D_1 is pushed slightly by the animal, D_2 is released and the animal is unable to reverse its direction. The only escape is through D_1 into G.

The interior of one goal box was painted black while the other one was painted white and had hardware cloth covering the wood flooring. Both boxes contained a removable clear glass panel which enclosed the far right hand corner and a small glass feeding dish which was either located in front of the glass panel or in an unattainable position behind the glass panel.

The maze was placed on a table and constant illumination was maintained by overhead electric lights.

B. Subjects. Thirty experimentally naive albino rats from the colony maintained by the Psychology Department of Michigan State College were used, of which seventeen were males and thirteen were females. The animals were randomly assigned to three groups to the point dictated by other controlled factors. A fourth group was composed entirely of males. All animals were between 90 and 130 days old at the beginning of the experiment.

C. Preliminary training. All animals were handled for five days prior to introduction to the maze. During this time all animals received an average of nine grams of Purina Dog Chow checkers daily at the scheduled training time. The day prior to introduction to the maze the animals received six grams of checkers. There after and throughout the entire experiment all animals were individually fed nine grams of checkers fifteen minutes after the end of the daily run.

On the sixth day the animals were introduced into the maze. Half of the animals were trained to the black goal box and the other half to the white goal box. All animals received four spaced trials.

The first two trials were without the doors present, the last two trials were with the doors gently activated as the animal approached the goal box. On the seventh day there were three trials with the animal receiving help with the doors if it became emotional. On the eighth and ninth days, the animals were run four trials daily with no help from the experimenter. During these trials the time allowed for eating was gradually diminished, as was the size of the reward.

On the tenth day, all animals received six unaided spaced trials. The time allowed to eat a pellet weighing about 1/5 gram was 20 seconds. All animals whose median running time for the six trials was over 15 seconds were eliminated from further study.

D. *General definition of groups*. Three groups were differentiated on the basis of the inhibition trial in the following manner:

Work inhibition group (I_r):

This group (N=8) was run to the same goal box on the inhibition trial as trained on and was rewarded with the same amount of food as given in the training trials.

Extinction group (E):

This group (N=8) was run to the same goal box on the inhibition trial as trained on but received no food.

Frustration group (F):

This group (N=8) ran to the colored goal box different from the one it was trained on. A food dish full of food was placed behind the glass barrier, visible to the animal but unattainable. The opposite color served as an additional cue to the "blocked" food, and presumably reduced the amount of secondary reinforcement for the unrewarded response.

Immediately following the inhibition trial, these groups were run on a test trial. All groups, on the test trial, ran to the same condition present on the inhibition trial with the exception of the I_r group which received no food. In other words all groups were non-reinforced on the test trial.

The above mentioned groups were fitted into an experimental design fulfilling the requirements for the analysis of variance technique. Given the results of these three groups it was found necessary to run a fourth group of animals.

<u>Control group (C)</u>:

This group (N=6) was comprised of 6 males all trained to the black goal box. For the results of the analysis of variance indicated that the color of goal box and sex were not relevant variables. This group received the same treatment as the I_r group on the <u>inhibition trial</u> but unlike all the other groups <u>received food on the test trial</u>. The mean running time of this group on the last six training trials was 3.9 seconds.

E. <u>Testing procedure</u>. The daily running schedule was as follows:

Trial 1: The warm-up trial.

All animals in all groups were given one rewarded trial to the same goal box with which they were trained. This "warm-up" trial served periodically to reinforce the food expectancy, keeping the running time at an asymtoptic level of performance. All rats responded with a minimum running time on this first trial of each day.

Inter-trial interval of five minutes.

Trial 2: The inhibition trial.

On this trial each group was subjected to its special inhibitory condition. It must be emphasized that all trials were "blind," that is, $Door_1$ completely blocked from view the goal box. Thus, the animal responded on each trial with only antecedent experiences influencing its behavior.

A variable time interval from 0-60 seconds, depending on the prearranged test design.

Trial 3: The test trial.

All animals including the control, were then run to the same conditions as on trial 2, excepting the I_r group which received no food for the test trial.

After a fifteen minute rest the above series was repeated. These two blocks then totaled six trials per day with two tests of inhibition at one given time interval. The two test trials were found to be independent on the basis of the analysis of variance.

The three original groups were equated for sex, color of goal box, and running time on the last six trials. Each of these groups was in turn divided into two sub-groups which were also equated for the above mentioned variables. The mean running times for all six sub-groups fell within a range of 5.2 to 7.2 seconds, while the mean running times for the three groups fell within a range of 5.3 to 6.9 seconds.

The experimental design for these groups was divided into two major parts. Each group received five days of testing on trial 3, twenty seconds after trial 2. Each group also received one day of testing, each with an interval of 10 seconds, 30 seconds, 40 seconds, and 60 seconds. These four days constitute the gradient series and within each group a counterbalancing technique was employed to control for testing sequence. One sub-group (2-1) was tested for five days with the 20 second interval and then tested on the gradient. The other (1-2) was tested on the gradient and then with the 20 second interval. This design allowed for two types of combination. The two like parts could be combined, with reference to the gradient, are as in the case of the five days of 20 second delay interval the combination could be with respect to days of testing. This would in effect give measures of inhibition for 9 consecutive days of testing, the fifth day being the same for both sub-groups. As an additional counterbalancing device for testing sequence when each sub-group was tested on the gradient two animals were tested in the following order: 10 seconds, 30 seconds, 40 seconds, and 60 seconds, while the other two animals were run in the reverse order. For example, when the scores are combined for the 10 second delay interval on the gradient the measures are from the first, fourth, sixth and ninth days of testing.

The control group was tested with a different but comparable design. These animals received the same daily test schedule with the above mentioned conditions but the test series was somewhat different. They were run on a gradient with 10, 20, 30, 40 and 60 second delay intervals and were counterbalanced for test order as the other groups were.

The control animals then received nine additional days with a 30 second interval for the entire series. On the first two days the conditions were the same as above. On the next seven days the conditions were the same except that the food on the test trial was removed. It should be noted that with the removal of food on the test trial, the control group was then being run under the same conditions as the I_r group.

RESULTS

The measure of inhibition used is the algebraic difference in total running time between trials two and three and five and six of each day. In all the graphical presentations, however, medians or median differences are used. Rat #2 (F group) is eliminated from all graphical presentations because it contributes half or more to the sums of its respective sub-group. It is, however, included in the analysis of variance. (Table 1).

The analysis of variance shows that the only variables significantly affecting inhibition are the delay interval and the sub-group order. Exploring the delay variable,(see Graph II) we find on the gradient that the amount of inhibition present with the 60 second interval is significantly less than with the shorter intervals employed at the 5% level of confidence. The amount of inhibition present with the 40 second interval is also significantly less than with the shorter intervals employed.at the 5% level of confidence. There are no significant differences between the original three complete groups throughout the experiment. With the 20 second interval (see Graph I) we find, however, that extinction sub-group (1-2) has a significantly larger amount of inhibition on days seven and nine than sub-group (2-1) on days one through five. This difference is significant at the 5% level of confidence. Furthermore, day 8 (1-2) is significantly higher than days 1 and 4 (2-1). There are no significant differences between day five (sub-group 1-2) and days 1 thru 5 (sub-group 2-1).

TABLE I.

A SUMMARY OF THE ANALYSIS OF VARIANCE OF THE I_r, F, AND E GROUPS

Source	Df	f	P
Total	427	-	-
Groups	2	1.0408	-
Sex	1	.2099	-
Goal Box Color	1	.3340	-
Delay	8	3.7219	.01
Test Trial Position	1	.0107	-
Sub-group Order	1	8.8534	.01
	Interactions		
Groups x Delay	16	1.3810	-
Goal Box Color x Delay	8	1.2716	-
Sub-group Order x Group	2	6.3164	.01
Test Trial Order x Delay	8	1.1531	-
Sub-group order x Delay	8	3.3161	.01
Error	371		

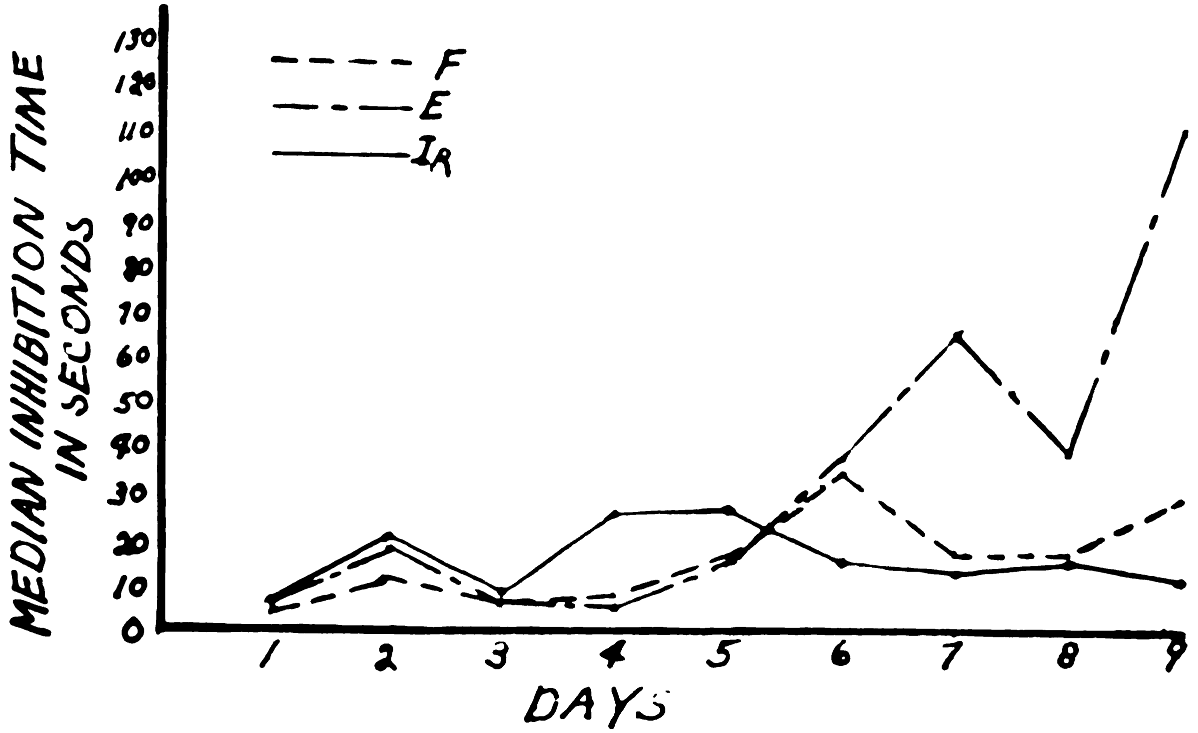

Figure 2. A comparison of the magnitude of inhibition of the sub-groups with the 20 seconds delay interval for nine consective days of testing.

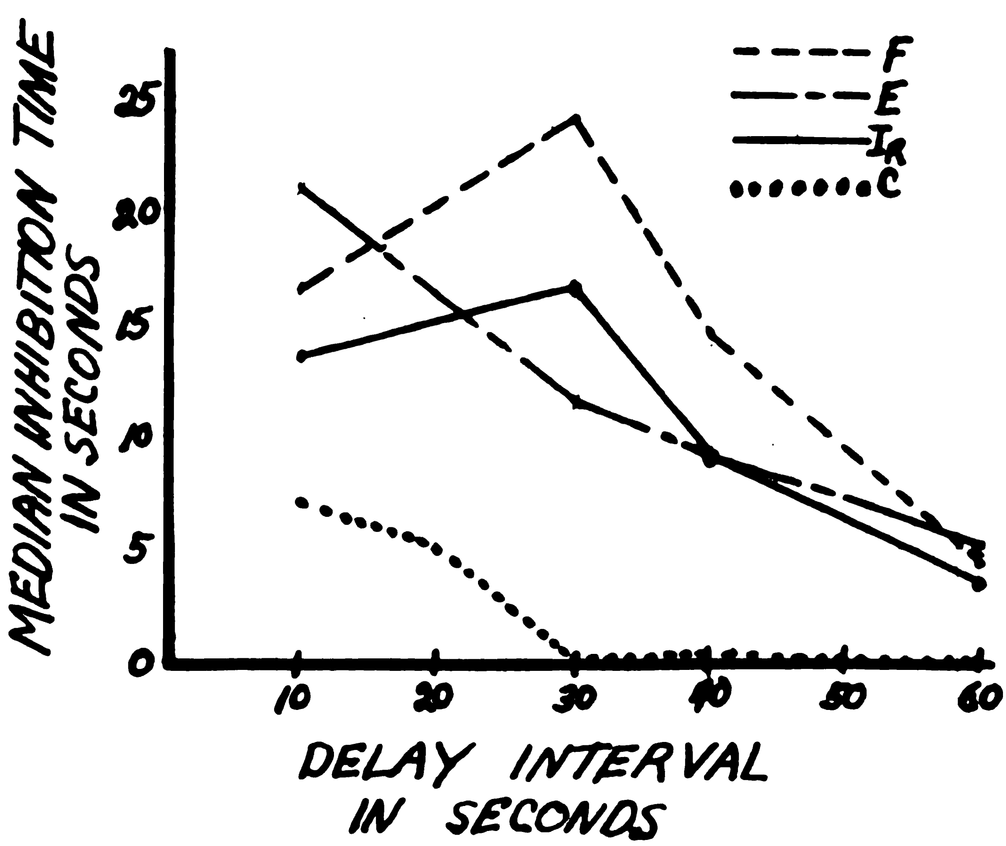

Figure 3. A comparison of the magnitude of inhibition of the I_r, F, E, and C groups on the gradient series.

The analysis of interactions shows that the amount of inhibition of groups is differentially affected by sub-group order. An inspection of Graph I indicates that the extinction group is the only one so affected. In other words, this group with the 20 second measures, shows significant differences between sub-groups 1-2 and 2-1 while the other two groups do not.

The interaction analysis also shows that the amount of inhibition with a given delay interval, is affected differentially by sub-group order. The interaction is again restricted to the 20 second measure and again to the extinction sub-group (1-2). On the same delay interval and the same sub-group order, the extinction sub-group (1-2) is significantly higher than the F and I_r groups combined on day nine (Refer to days five through nine in Figure 2). To summarize, the inhibition of these three groups is exactly the same on the gradient and on extended testing with the 20 second delay interval with the exception of the extinction group whose magnitude of inhibition tends to increase with continued testing in the present experimental situation.

The magnitude of inhibition of the control group, however, is significantly less than the other three groups on the gradient series (Figure 3), well beyond the 1% level of confidence. It will be remembered that this group differs from the others and the I_r group, in particular, with respect to reward or consequent expectancy of reward on the test trial.

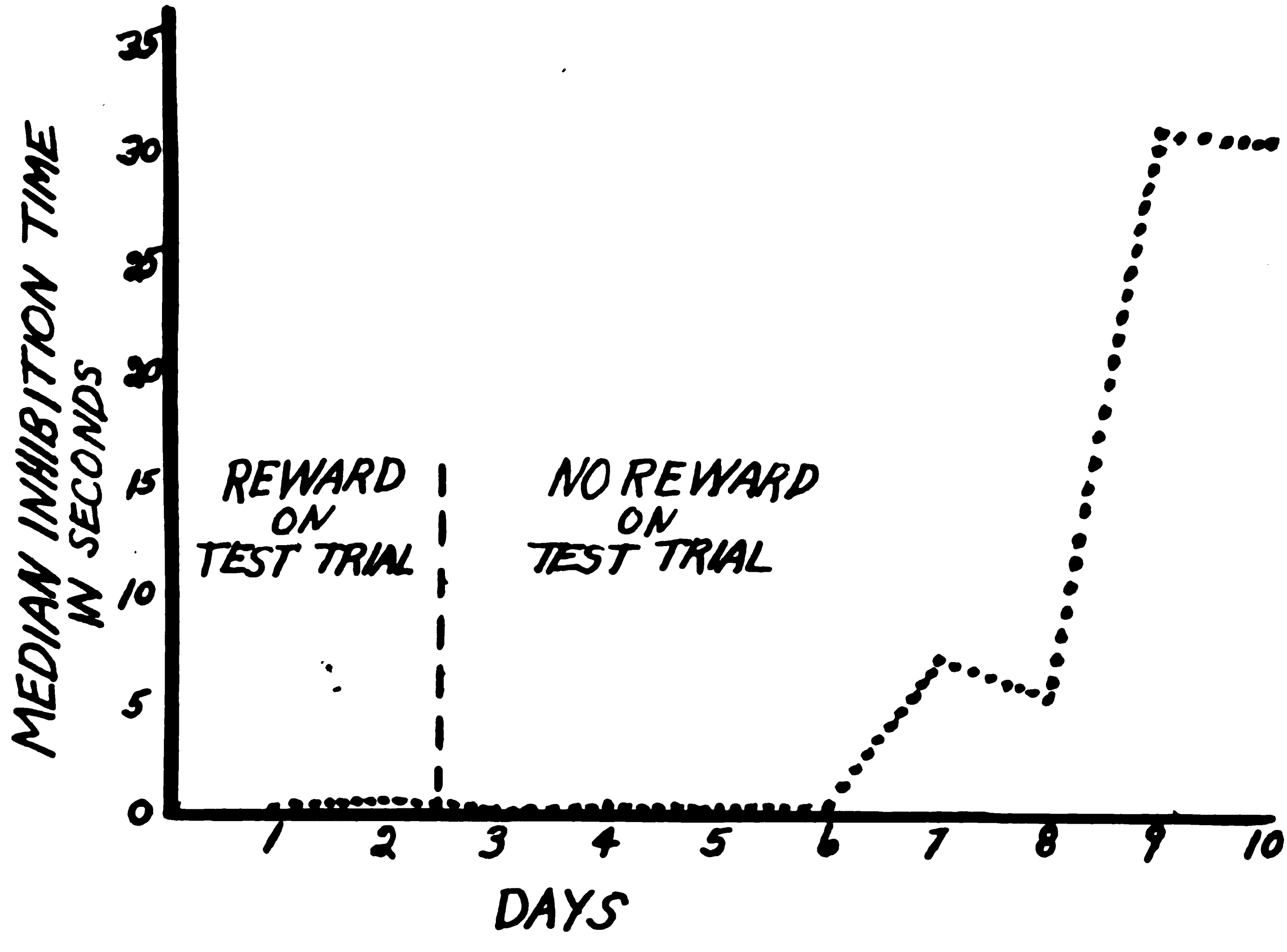

Figure 4. A comparison of the magnitude of inhibition of the C group with and without reward on the test trial.

The control group data in Figure 4 demonstrate that the magnitude of inhibition seems to be a function of a learned expectancy of reward. It should be emphasized that a negative expectancy is relearned at a delay interval that yields no inhibition originally (see Figure 3, control group, 30 second delay and the first half of Figure 4). It should be noticed in Figure 4 that inhibition with the 30 second interval with reward present is approximately zero and that after removal of reward from the test trial the magnitude of inhibition uses and levels off at an inhibition measure of about 30 seconds. This 30 second asymtope is roughly comparable to the median amount of inhibition of the three original groups with thirty second interval (Figure 2) which is about 20 seconds.

It will be noticed that the magnitude of inhibition of the control group with the 20 second interval is about 5 seconds (Figure 2). This in line with the fact that on the first day of testing, regardless of the conditions on the inhibition trial, the magnitude of inhibition of all 3 groups is roughly 7 seconds (see Figure 2). On the days thereafter the magnitude of inhibtion is roughly 20 seconds, except for B (sub-group 1-2); this compares favorably with the magnitude of inhibition on the gradient series for the three original groups for an interpolated 20 second delay interval (see Figure 2).

DISCUSSION

A criticism of an adaptation or drive theory of inhibition.

The results taken as a whole cannot be adequately explained by an adaptation theory of inhibition. Had the control group not been run, however, the results would have, for the most part, substantiated Rohrer's contention that frustration drive and allied concepts could be substituted for Hull's inhibition constructs of reactive inhibition (I_r) and conditioned inhibtion (${}_sI_r$). In other word, the basic frustration construct would appear to have drive characteristics and a dissipation rate similar to I_r. But it is also true that the two different types of frustration situations employed led to different results — a finding which is not exactly in accord with Rohrer's rather general definition of frustration. The fact that the F method adds a discriminative cue to the situation while the E proceedure does not seem to produce a greater amount of inhibition in the E group than in the F group during the latter stages of testing. (see Figure 2; compare E with F).

This progressive increase in the amount of inhibition generated for a single trial in the E group is difficult to explain. Why should a drive which arises from the blocking of a goal oriented response give rise to such diverse consequences? Why also, should a group which has not bee blocked (I_r) behave the same way as the blocked group on most of the subsequent non-reward trials. (see Figure 2, compare F with I_r).

When all the control group data are considered in more detail, it becomes apparent that the whole adaptation or drive theory must be quentioned. Why should future events or anticipated events determine the magnitude of inhibition while anticedent events seem to have little or no direct effect upon inhibition? These results are clearly inconsistant with the "antagonistic drive" state approach. In fact the only finding in accord with this interpretation is the evidence for the existance of a gradient of inhibition. This one point, a gradient of inhibition, has been one of the strongest arguments for an adaptation theory an an apparent weakness of an interference type theory.

<u>On interference theory</u>.

The interference theory of inhibition holds that extinction is a special case of learning in which the responses learned interfere with the responses of the original learning. This point of view is usually maintained by contiguity theorists who believe that the contiguity of stimulus and response is a sufficient condition for learning. The distinction between adaptation and interference theories seems to be critical only with reference to what originally initiates inhibition. Both approaches hold that learning eventually occurs, producing responses which interfere with the original responses. It seems that the different positions which theorists with respect to the conditions necessary for learning forces them into one of the two major positions on inhibition. For some theorists reinforcement is necessary for learning and reinforcement comes about primarily by "drive reduction." Thus in order for interfering responses to be learned there must exist an antagonistic drive state which is capable of being reduced.

An *antagonistic drive* to be consistant with the construct *drive* must be definable in terms of *antecedent* conditions. The results of this experiment indicate, however, that antecedent conditions in the present experiment do not directly affect behavior at a given time. The only manner in which antecedent events exert an influence upon learned goal oriented behavior at any given time is through their affect upon the expectancies elicited by current stimuli. An expectancy, however, is in reference to specific goal events in the future.

The contiguity approach emphasizing the co-existance in time of stimuli and responses find little difficulty in handling inhibition as new learning which interfers with original learning. This approach is a passive, that is, stimuli and responses need only co-exist in time. There need be no a prior connection between stimuli and responses. Thus in extinction, the animals make different responses so we say the animal learns these responses, so that, given enough trials the stimuli in the maze come to elicit the different behavior.

The main criticism to be leveled at an interference theory of inhibition is its inability to explain the dissipation of inhibition gradient or spontaneous recovery.

As previously mentioned, the reinforcement theorists' position on reinforcement has greatly influenced his position on inhibition theory. It was pointed out that Hull postulates drive reduction as necessary for learning. This approach has emotive appeal in terms of being allied with the Darwinian "survival of the fittest" doctrine which Hull takes as primitive. The author's position is that the drive reduction hypothesis is particularly unfruitful for theorizing about inhibition. Therefore an attempt will be made to re-define reinforcement in a manner which will lead to more adequate prediction and explanation.

A re-definition of reinforcement and frustration.

Three conditions are postualed as necessary for learning to occur. They are stimulus, response, and a relation obtaining between stimulus and response. The specific relation is that the stimulus must force or elicit the response. The relationship, stimulus forces response, constitutes a reinforcing state of affairs. Reinforcement refers to the increase in the associative strength between the eliciting stimuli and all other co-existing stimuli and the elicited response. The stimuli which upon first presentation have the power to elicit approach or avoident behavior will be called drive stimuli (D_s).

This reinforcement hypothesis permits the prediction of learning only when the relation of forcing or eliciting occurs between stimuli and responses. In reference to inhibition the construct frustration will be redefined as a drive stimulus state arising from

any discriminatable stimulus change for a learned response. The construct <u>frustration</u> will not apply to situations were drive stimulus (D_s), such as shock, originally evoke avoidant or emotional responses. These situations are adequately covered by the original definition of reinforcement. For example, in a situation with an established instrumental response, the removal of reward (D_s) gives rise to FD_s which elicits avoidant responses and thus reinforces the association between stimuli co-existing spatially and temporally with the <u>onset</u> of FD_s and the responses elicited by FD_s.

Thus neutral stimuli which originally were associated with the elicitation of approach responses, with introduction of FD_s receive an increment to a tendency to elicit avoidant or apposing responses. This interpretation of inhibition is an instance of <u>relearning</u>.

As an adjunct to the present study, VanDalsen (8) has shown that rats trained to expect food could not discriminate (as measured by running times) a non-reinforced trial in a series of reinforced trials when all trials were spaced. The same animals could however, discriminate the non-reinforced trial if the massing cue were present, that is, if this trial immediately followed the preceding trial when all other trials were spaced. Thus, in the case of the F and E groups, although both the inhibition and test trials were unrewarded, they were able to discriminate the absence of reward only on the test trial. In other words, the inhibition trials do not seem to contribute appreciably to the measured inhibition; thus we will treat measured inhibition soley as a function of the conditions present on the test trials. It should be noted that the maximum inhibition resulting from the utilization of this "temporally liable" massing cue is approximately twenty-five seconds. (Figure 3).

Interpretation of results.

It should be emphasized that the running times of all groups on trials 1, 2, 4 and 5 represented the fastest running times possible in this situation. However, on trials 3 and 6, the test trials, running times were markedly greater. These running times varied with delay interval employed, presence or absence of reward on the test trial, and the number of tests with a given delay interval. Although similar conditions were present on the preceding trials, 2 or 5, only the behavior on the test trials reflects inhibition. This finding is attributed to the massing cue which intervened between trials 2 and 3 and 5 and 6. It is posited that the shortened time interval between these trials served as a distinctive cue which was followed consistantly by non-reward on trials 3 and 6 for the original groups (F, E and I_r) and was never followed by reinforcement.

The decrease of inhibition as a function of delay interval employed shown in the gradient in Figure 3 may possible be accounted for by "forgetting." Denny's (1) formulation of forgetting posits that forgetting is a function of changes in external and internal stimuli that were present during reinforcement of an S-R association. This formulation permits us to predict forgetting is fairly rapid during a short time interval following the last reinforcement and that the rate of forgetting gradually decreases until there remains a smaller but relatively permanent association between the stable stimuli in the situation and the response elicited. In the present study the originally learned approach response is strong and permanent, while the massing cue which is crucial for the eliciting of avoidance behavior is temporally labile. Thus the crutical cue, a time difference between trials, becomes less discriminable the longer the delay interval employed. This fact plus stimulus generalization of positive approach behavior from the fact that spaced trials were followed by reward accounts for the decrease in inhibition with the increase in delay interval employed.

The different degrees of inhibition manifested in the control group, we now postualte are a function of the expectancy of reward or non-reward on the test trial (Figure 4). A negative expectancy, an expectancy of non-reward is developed with training as may be seen in Figure 4, days 3 through 10 and Figure 2, days 1 and 2. Because of the co-existance of the stimulus aggregate, massing cue plus stimuli in the stem, with avoident behavior which is reinforced or elicited by FD_s, this stimulus aggregate comes to elicit avoidant behavior. We can conveniently anthropromorphize and say the animal learns to "expect" no food. Up to this point our analysis holds for the F, E, and I_r groups. The control group of course "expects" food on trial 3. The gradient of inhibition present in the control group with the 10 and 20 second delay intervals may be attributed to I_r and its dissipation according to the previous stimulus analysis.

The behavior displayed with the series of 20 second delay intervals requires a somewhat more complex explanation. The assumptions required by the explanation are testable and have many implications for a theory of inhibition. An attempt will be made either to cite experimental evidence or to describe experimental tests for all of our assumptions.

There are three questions to be answered with respect to Figure 2. They are: 1) Why is there an increase of inhibition in the E group? 2) Why do not the I_r and F groups show this increase? and 3) Why does the F group behave as the I_r group does?

The first two questions will be answered together because they represent roughly the same theoretical analysis. Both of these groups are being run to conditions that lead to re-learning, that is, the same stimuli which evoked approach responses now receive an increment to the tendency to evoke avoidant responses. In the case of E and I_r, where no discrimination is possible, there is a direct inhibitory effect on the power of the stem cues to elicit approach responses. This does not mean that the expectancy associated with approach behavior is being weakened, but rather that it is being replaced by an avoidant type expecantcy for subsequent non-reward. In support of this interpretation Smith (7) found that learning in a T-maze was faster with the association of reinforcement and non-reinforcement with the distinctive cues of the T-maze than with reinforcement alone. He found when dividing his animals into two groups on the

basis of previously ascertained weak and strong preference to the wrong or non-reinforced side that the weak preference animals learned to avoid the incorrect side just as quickly as the strong preference group. We may conclude from Smith's results that the inhibitory effect mediated by the cues near the choice point was not primarily one of weakening the wrong response but a learning to avoid the cues associated with non-reinforcement.

Given the above analysis of the E and I_r data it now seems pertinent to compare the number of reinforcements of approach and avoidant behavior administered during the testing situation. The E group received 4 reinforcements associating the maze cues with avoidant behavior and only 2 to approach behavior. The I_r group received 4 reinforcements for approach and 2 for avoidant behavior. With successive days of testing follows that avoidant behavior to the maze cues in the E group would manifest itself sooner and more obviously than in the I_r group. Under the present conditions the I_r group might never show an increase in the amount of measured inhibition, because of a greater net amount of positive reaction tendency to the maze cue than in the E group.

In the introduction it was pointed out that there might be a difference between the F and E inhibition conditions and a fairly definite difference between the two groups was obtained. However, this difference is not completely understood and we offer no explanation of this phenomenon. Instead we will present an analysis of the two inhibition situations in order to test the implications of the present findings.

The F group is comparable to the E group in the number of rewarded and non-rewarded trials, but the F group does not show any progressive increase in inhibition with continued testing. All the inhibition manifested by this group can presumably be accounted for by the massing cue. In other words, the stable stem cues do not acquire the power to elicit avoidant behavior in the manner similar to the E group; therefore the amount of positive or approach tendency cannot undergo appreciable reduction. The differential element in the F group is the discriminable cues (different GB) associated with non-reward. The 4 non-reinforcements as contrasted with 2 reinforcements per day were to a different colored goal box for the F group but not for the E. Group F, in other words, entered a new, unfamiliar end box when frustrated, while the E animals were frustrated in the same situation to which the food expectancies had been learned.

A "follow-up" to the present study by Olive (4) shows that if part of the negative cues of the frustration box (whiteness) for the F group is made visible to the rats while in the stem during the test trial that the difference between E and F conditions disappears, for the F group soon learns to inhibit completely on the test trial.

The following proposed experiment attempts to check and expand the hypotheses stemming from the finding of a difference between the E and F conditions:

1. Train a large group of animals in the straight alley to to a distinctive goal box.
2. Extinquish all animals to the same criterion under the following conditions:

Group A to the same goal box trained on but now visable.
Group B to a visable but distinctive goal box.
Group C to the conditions trained on.
Group D to a distinctive goal box not visable from the stem.

3. Record latencies from the starting box and stem running times.

4. Re-train in the original learning situation.

5. The hypotheses are as follows:
    a. Group A extinquishes slower than B but faster than C and D.
    b. Group C extinquishes faster than D.
    c. An retraining, Group B, not only recovers faster but the first trial will be faster.
    d. Group D recovers initially faster than C.

SUMMARY AND CONCLUSIONS

The present study was conducted to define and compare the two inhibitory constructs <u>frustration drive</u> (FD) and work inhibition (I_r) with respect to magnitude of inhibition and rate of dissipation of inhibition. There was also a distinction made on the basis of the presence or absence of a distinctive cue between two situations included in a definition of frustration. Four groups were defined in terms of the situations employed to give rise to inhibition. The method used to measure inhibition was to set up conditions for the development of inhibition on one trial and then to present a subsequent test trial after varying time intervals. The measure of inhibition was the running time on the second trial minus the running time on the first. Three groups of 8 animals were run in a complex counterbalanced analysis of variance testing design so that comparisons could be made on a gradient of inhibition and also with reference to changes in inhibition with one delay interval over a period of nine days. A fourth group (N=6) was run to test the role of anticipated reward on measured inhibition with respect to a gradient inhibition and with respect to changes of inhibition over an extended period of time when a shift is made from reward to non-reward conditions on the test trial.

The apparatus was a straight alley maze with moveable doors that blocked from view one of two distinctive interchangeable goal boxes.

The results demonstrate a gradient of inhibition extending over about one minute, and the fact that there were no differences between the three original groups with respect to magnitude of inhibition and rate of dissipation of inhibition. There was, however, a considerable difference between these groups and the fourth group which differed from these groups in respect to anticipated reward on the test trial. This group demonstrates very little inhibition as measured and none beyond a thirty second delay interval. This group upon the removal of reward on the second trial shows a magnitudes of inhibition comparable to the three original group. With consistant testing on one delay interval, FD group with which a conventional extinction procedure was used showed progressive increases in amount of measured inhibition while the other FD group, which had distinctive cues present during frustration, did not show this progressive increase. The L_r group also shows no progressive increase.

On the basis of the results and other considerations, the following conclusions were drawn:

1. An adoptation theory of inhibition, such as Hull', cannot adequately account for all the present results.
2. If reinforcement is defined as the <u>forcing relation</u> that exists between some types of stimuli and the responses elicited, then the results can be more adequately accounted for by employing an interference theory.where the role of the cue stimulus is uppermost.
3. The theoretical position employed to explain the results is tentative and needs further experimental conformation.

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