CHOICE BEHAVIOR IN TWO-CHOICE SOLUBLE AND INSOLUBLE PROBLEM SITUATIONS

by

Kenneth L. Kampe

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Education (Educational Psychology) at the College of Education in collaboration with the Bangkok Institute for Child Study

January 1974

Chairman: Dr. Ravipan Somnapan

คณะกรรมการที่ปรึกษาประจำตัวนิสิตได้พิจารณาปริญญานิพนธ์ฉบับนี้แล้ว เห็นสมควรรับเป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาการศึกษามหาบัณฑิต ของวิทยาลัยวิชาการศึกษาได้

ประธาน

กรรมการ

ACKNOWLEDGMENT

The author wishes to express his sincere appreciation for the generous assistance and advice given him by Drs. Ravipan Somnapan and Preeja Dhunma, particularly Dr. Somnapan's benign tolerance of the author's deficiencies in numerous areas.

Thanks are given to the Primary Demonstration School attached to the Prasanmit College of Education for providing the subjects without which this investigation could not have been completed.

TABLE OF CONTENTS

TABLE OF FIGURES

Chapter I

INTRODUCTION

For a period of many years, Norman R. F. Maier and others at the University of Michigan investigated the development of "stereotyped" behavior in rats forced to respond in problem-solving situations. "Stereotyped" behavior refers to the rats' repeated responses to one of the two stimuli in a discrimination problem, regardless of the contingencies of reinforcement.

The basic experimental situation employed by Maier and his colleagues in these studies was:

> Rats were trained on a Lashley jumping apparatus which consisted of a small raised platform on which the rat was placed and another platform within the rat's jumping distance. The second platform was constructed in such a way that there were two windows at the front, each covered by a card with a different symbol and large enough for the rat to jump through. If the food deprived rat jumped towards the correct window, the card fell over on contact and the rat landed on the platform behind, finding a piece of food. If the rat jumped towards the incorrect window, it would strike a latched card, bump its nose and fall into a net below, thus being negatively reinforced.

When rats were faced with an insoluble problem (positive and negative reinforcement being varied in a random fashion with respect to the two windows and symbols), they quickly refused to respond. A strong blast of air directed to the rat's rear was then required to induce the rat to respond. Under such conditions, the rats developed one of three characteristic responses:

1) position-stereotype - a repeated response to either the left or the right window, or

2) symbol-stereotype - a repeated response to either of the two symbols, or

3) abortive response - a direct jump to the net below or some other attempt to escape.

When the problem was subsequently changed to a soluble one (reinforcement contingent upon response to one of the two symbols), seven of eleven rats continued their former stereotyped behavior or, as Maier termed it, "fixated", i.e. they were "unable" to respond to the new conditions of reinforcement.

Furthermore, it was found that if the rats were first positively reinforced for a response to one stimulus condition (such as a symbol-response), then positively reinforced for a response to another stimulus condition (such as a position-response), the stereotyped response exhibited in the following insoluble problem tended to be the last learned response (of the two preceding responses).

Statement of the Problem

The major purpose of the study was to determine whether or not the behavior of human Ss in a problem-solving situation similar to that employed by Maier would be similar to that of Maier's rats. Thus, the intention of the study was to see whether or not human Ss would:

1) develop "stereotyped" behavior in an insoluble problem situation,

2) continue in their former "stereotyped" behavior in a subsequent soluble problem situation,

3) more frequently exhibit one of two previously learned responses in an insoluble problem situation.

Review of Related Literature

Ellen (1956), Maier (1949), Maier and Ellen (1955, 1956), Maier and Feldman (1948), Maier and Klee (1941), Maier, Glaser and Klee (1940), and Wilcoxin (1952) have reported the development of stereotyped behavior in an insoluble problem-solving situation using rats as Ss.

A study representative of the major findings of these studies was conducted by Maier, Glaser and Klee (1940). They trained rats on a two-window Lashley jumping apparatus to familiarize the rats with the procedure for jumping towards the windows covered by symbol cards. During the training, manual guidance was used to ensure that the rats made an equal number of jumps to both positions (left and right) and

both symbols (white circle on black and black circle on white). Then the rats were presented with an insoluble problem situation (either window randomly latched and placement of food behind the other; symbol cards also covering either window in a random fashion). An air blast was used to induce the rats to respond. Of the 13 rats in this situation, 11 developed position stereotypes and two developed symbol stereotypes. When the problem was changed to a new and soluble one (a response to one of the two symbols was positively reinforced), seven of the rats did not solve the problem, continuing in their stereotypes. Of 20 rats previously positively reinforced for position-responses (instead of having been presented with the insoluble problem), seven rats failed to solve the new problem. Maier termed these responses "fixations", because they were non-adaptive habits maintained in spite of evidence that the rats made differential responses to the positively and negatively reinforced symbols (a jump to the negatively reinforced symbol required a longer and more intense air blast).

Maier and Klee (1943) studied three groups of rats given previous training, then presented with an insoluble problem. Two of these groups are relevant to this study. One group was first positively reinforced for position-response (left or right), then changed to positive reinforcement for symbol-responses. The other group was first reinforced for symbol-responses, then for position-responses. When presented with the insoluble problem, 90 per cent of both groups developed last-learned stereotypes.

Definition of Terms

1) Characteristic response - the response, in a two-choice problem, to either position (left or right), or either symbol (triangle or square) whose frequency is greater than that expected by chance. For example, a characteristic response requires that a S make 12 responses (of a total of 14) to either left, right, triangle, or square for that response to be greater than chance (P = .024). The probability (P) is computed from the binomial distribution function $\sum b(N,x;p)$, where N (the total number of responses) = 14, x (the number of responses not made to a particular stimulus) = 0,1,2 , and p (the probability of an "x" response) = $\frac{1}{2}$. Since any of the four characteristic responses are mutually exclusive (by design), P = 4 X $\sum b(14,x;\frac{1}{2})$, where x = 0,1,2. Thus, P = .024 . The term "characteristic" response is intended as a replacement for Maier's term "stereotyped" response.

2) Solved problem - a problem is solved if the number of responses to the positively reinforced stimulus is greater than that expected by chance. For example, a problem is solved if three or less mistakes are made on a total of 14 trials. The probability (P) is computed from the binomial distribution function. Thus, P = $\sum b(14,x;\frac{1}{2})$, where x = 0,1,2,3 .

3) Predominant response - that response, in a dichotomous response classification, made on more than half of the trials.

Theoretical Considerations

Although it was the aim to make the problem situations in the study as similar as possible to those employed by Maier, there were differences brought about in the process of adapting them to experimentation with humans.

Firstly, whereas Maier employed nose bumps and falls to a net below as negative reinforcement, a loud horn and reduced probability of winning a prize* were employed in this study. Secondly, whereas Maier employed stromg air blasts to the rat's rear as inducement to respond, this study employed a ringing bell and reduced probability of winning a prize. Thirdly, food was replaced by probability of winning a prize as positive reinforcement.

While it would be difficult to prove that Maier's positive and negative reinforcements and inducements were more intense than those of this study, it was assumed so. Nevertheless, the two experimental situations were sufficiently similar to allow for a comparison between Maier's findings with rats and those of a situation approximating Maier's and using humans.

Thus, where Maier found "stereotyped" responses in rats in the insoluble problem situation, it was expected that humans would show characteristic responses. Where Maier found that stereotyped responses continued to occur in a subsequent new and soluble problem situation (fixation), it was expected that the characteristic reponses would

---

* See Procedure for a more detailed description of positive and negative reinforcements and inducements.

also occur in a subsequent new and soluble problem situation. Similarly, Maier's finding that the last-learned of the two previously learned responses had the greatest effect on behavior in the insoluble problem situation should also take place with humans.

Experimental Plan

A diagram of the experimental plan appears in Fig. 1. One experimental group of 41 Ss was randomly assigned to two groups of 21 Ss and 20 Ss. Both groups were subjected to the same experimental situation except that the contingencies of reinforcement for one group were exactly opposite to those for the other group, i.e. on any given trial, if one group was positively reinforced for a particular response, the other group was negatively reinforced. This was done to control for position or symbol preferences and to allow for two different sequences of pretraining.

Part I Previous Experience (position-response reinforcement).

The first 25 trials were 100 per cent positively reinforced* for a position-response to one side (left for 21 Ss and right for 20 Ss). The second 25 trials were 100 per cent positively reinforced for a position-response to the opposite side (right for 21 Ss and left for

---

* When one response is positively reinforced, its opposite is negatively reinforced. For example, if a right-position response is positively reinforced, a left position-response is negatively reinforced.

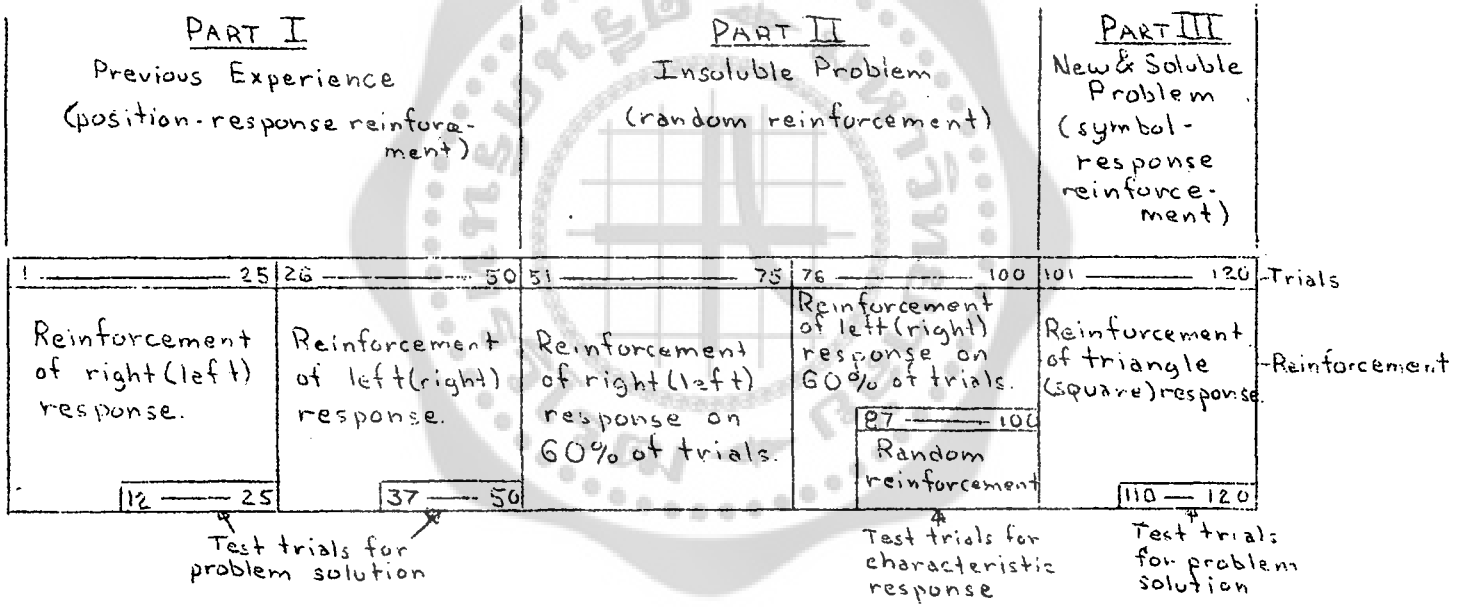


FIGURE 1. Diagram of Experimental Plan

20 Ss). This allowed for a test of the effects of previous experience on behavior in the insoluble problem situation.

Part II Insoluble Problem (random reinforcement).

The 50 trials (trials 51-100) provided for random reinforcement of left, right, triangle, and square responses. If a S consistently employed any of these four responses, he was positively reinforced on half of the trials and negatively reinforced on half. Although the random reinforcement varied somewhat within the 50 trials (the first 25 trials were 60 per cent positively reinforced for first-learned responses and the last 25 trials were 60 per cent positively reinforced for last-learned responses), the last 14 trials positively reinforced any of the four responses (left, right, triangle, or square) on exactly half of the trials. Therefore, the last 14 trials (trials 87-100) were selected as the test trials for characteristic responses.

Part III New and Soluble Problem (symbol-response reinforcement).

On the final 20 trials (101-120), 21 Ss were 100 per cent positively reinforced for responses to the triangle and 20 Ss were 100 per cent positively reinforced for responses to the square. The last 11 trials were selected to test whether or not a S had solved the problem.

(6) Hypotheses

Hypothesis 1

On the last part of the insoluble problem (trials 87-100), the probability of a S showing a characteristic response is greater than .024 .

This hypothesis is a result of Maier's finding that rats showed stereotyped behavior (characteristic response) in the insoluble problem situation.

Hypothesis 2

The conditional probability that Ss show predominant responses in the new and soluble problem to the same stimulus responded to in the last part of the insoluble problem, given that they showed characteristic responses in the last part of the insoluble problem, is greater than $\frac{1}{2}$.

This hypothesis is a result of Maier's finding that seven of eleven rats continued their stereotyped responses in the new and soluble problem.

Hypothesis 3

The conditional probability that Ss show last-learned responses in the last part of the insoluble problem, given that they also show characteristic position-responses in the last part of the insoluble problem, is greater than $\frac{1}{2}$.

This hypothesis is a result of Maier's finding that the stereotyped response of 90 per cent of the rats was the same as the last-learned response.

Chapter II

METHOD

Experimental Environment and Apparatus

The experiment was conducted in a 12' x 12' room, relatively soundproof and air-conditioned. Lighting was natural, coming through unshaded windows on the S's right. On the S's left was a one-way mirror. The S sat in an armless chair before a large desk, on the top of which was a Lafayette memory drum and two spring-loaded doorbell switches, one to the S's right and the other to his left. Behind the desk was a thick, blue curtain preventing the S from observing either E or the control and recording apparatus. See Fig. 2 for a diagram of the experimental environment.

Apparatus consisted of the following:

1) Lafayette memory drum - a standard memory drum used for the presentation of stimuli. Stimuli consisted of pairs of $\frac{1}{4}$" printed black shapes (one triangle and one square) chosen for their simplicity. Somnapan's (1968) mutually equally discriminable random shapes were not used because of their complexity and difficulty of reproduction and also because they too closely resemble the paintings of Paul Klee. The pairs of stimuli were printed on memory drum paper tape and presented to the S through one of the four shuttered slots on the front of the drum. The paper tape also contained the program for reinforce-

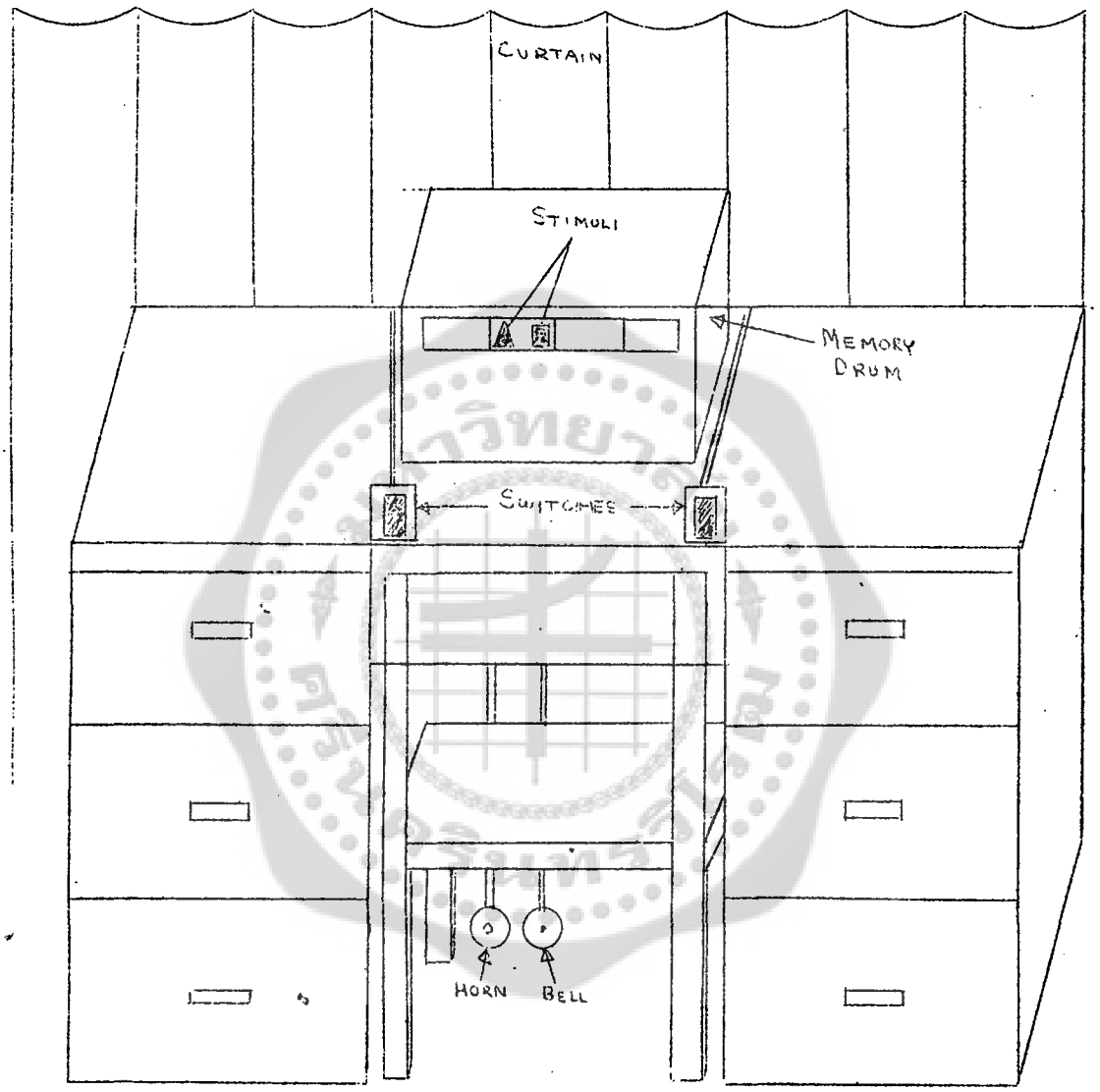


FIGURE 2. The Experimental Environment

ment, consisting of punched holes allowing wire brushes to make contact with the metal drum (and, thereby, close a circuit). See Appendix B for a diagram of the circuitry involved.

2) Switches - two spring-loaded doorbell switches, anchored to the desk in front of the memory drum.

The above was the only apparatus available to the S.

3) Horn - one motorcycle horn rated at 6 volts d.c. and operated at 11.2 volts d.c. employed as a negative reinforcer. It was located in the well of the desk at the S's feet and unseen to him.

4) Bell - one telephone-type bell rated at 6 volts d.c. and operated at 6.9 volts d.c. employed to signal the end of the three-second response period. The bell was located next to the horn, but was not as loud as the horn (very loud).

5) Two Hunter timers, model 111-B - one timer to control the length of presentation of the horn (.6 sec.) and the other to control the time between presentation of the stimuli and onset of the bell (3.0 sec.).

6) Tape recorder - Sony portable casette tape recorder/player used to present the pre-recorded instructions to the Ss.

Procedure

Instructions

The S was asked to sit at the desk and listen to the pre-recorded instructions (in Thai). The full text of the instructions may be seen

in Appendix A. Essentially, they were:

> Today you will be required to solve simple problems. The students with the highest scores will receive a prize of 20 baht (1 U.S. dollar). Before you is a metal box with a little window. In the window are two figures. You must choose the correct figure without being given the rules. If you think the figure on the right is correct, press the switch on the right. If you choose the correct figure, you will hear a click and receive two points. If you choose the incorrect figure, you will hear a loud horn and lose two points. If you do not press either switch within three seconds, you will hear a bell and lose one point. After you press either switch, the window will close and the two figures will appear again when the window reopens. Then you must choose again. Altogether, you must make over 100 choices.

The time required for the instructions was approximately three minutes. At the conclusion of the tape recorded instructions, E again explained the procedure to the S to ensure that he understood.

Experimental Procedure

Following the instruction period, the S was left to respond at his own rate until all 120 trials had been presented (this procedure has been previously explained in Experimental Plan).

Both the triangle and the square appeared on the right and left side of the unshuttered slot in a random fashion for the entire 120 trials. Each presentation consisted of two stimuli, one triangle and one square. The S was not informed that the problem was being changed during the course of the experiment. The time lapse between the S's pressing of a switch and the presentation of a new pair of stimuli was 4.2 seconds. The time required for a S was approximately 10 minutes.

Subjects

Forty-one 6th grade students from the Primary Demonstration School attached to the Prasanmit College of Education in Prakanong District, Bangkok, Thailand, served as Ss in the study. The 41 Ss comprised one complete class (of two 6th grade classes in the school) and included 25 boys and 16 girls. The ages of the Ss ranged from 11 to 14 years.

Chapter III

RESULTS

The intended α for all tests of hypotheses was .05 . However, due to the small Ns and the discreteness of measurement, it was necessary to select α values smaller than this. It was also necessary to use some of these values in computing further probability values. As a result, for convenience and consistency of values used, an α of .03 ± .006 was used in all cases.

Test of Hypothesis 1

At α = .028, four or more Ss must show a characteristic response on the last part of the insoluble problem in order to be able to reject the null hypothesis*.

Since only one S showed a characteristic response, Hypothesis 1 was not confirmed.

Test of Hypotheses 2 and 3

Since both Hypotheses 2 and 3 can be tested only if Hypothesis 1 is confirmed, they were not tested.

---

* $\alpha = 1 - \Sigma b(N,x;p)$, where N (total number of Ss) = 41, x (number of Ss showing characteristic responses) = 0,1,2,3 , p (probability of an S showing a characteristic response) = .024 .

Other Results

Several results not particularly relevant to the hypotheses stated are of interest:

1) Of the total of 41 Ss, 8 showed a predominant first-learned response and 23 showed a predominant last-learned response on the last part of the insoluble problem*. The chi square value (df = 1) for this result is 7.25 and is significant at .01 .

2) Of the total of 41 Ss, 26 showed a predominant first-learned response and 15 showed a predominant last-learned response on the first half of the insoluble problem (trials 51-75; 60 per cent first-learned response reinforced). The probability of occurrence of this result, based on an approximation to the normal distribution is .031**.

Of the total of 41 Ss, 30 showed a predominant last-learned response and 11 showed a predominant first-learned response on the last half of the insoluble problem (trials 76-100; 60 per cent last-learned response reinforced). The probability of occurrence of this result is .0025 .

---

* Ten Ss did not show a predominant response to either, i.e. scored 7:7 on the 14 test trials.

** $z = \frac{(x \pm .5) - NP}{\sqrt{NPQ}}$, where x (number Ss showing predominant first-learned responses) = 26, N (total number of Ss) = 41, P (probability of an "x") = $\frac{1}{2}$, Q = 1 − P, and .5 = correction for continuity.

3) Of the total of 41 Ss, 12 showed a predominant response to the positively reinforced symbol and 25 showed a predominant response to the negatively reinforced symbol in the new and soluble problem situation (trials 101-120). The probability of occurrence of this result, based on an approximation to the normal distribution, is .024 (one tail).

4) Of the total of 41 Ss, only 5 failed to solve either or both of the two position-reinforced problems in Part I (trials 1-50). However, 37 Ss failed to solve the symbol-reinforced problem in Part III (trials 101-120). The probability that four or more Ss would solve the problem by chance alone is .04*.

---

* $P = 1 - \sum b(N,x;p)$, where N (total number of Ss) = 41, x (number of Ss solving the problem) = 0,1,2,3 , and p (probability of a S solving the problem) = .033 .

Chapter IV

DISCUSSION

Hypotheses

Hypothesis 1 (that the probability of a S showing a characteristic response is greater than .024) was not confirmed by the experimental results. Indeed, only one S showed a characteristic response, where it would have required four Ss to produce a result significant at .028.

Since the other two hypotheses of the study were dependent upon a confirmation of Hypothesis 1, they were not tested.

The result of the test of Hypothesis 1 leads to one of two conclusions. Firstly, the behavior of humans, regarding characteristic responses, in an insoluble problem-solving situation of the type employed is unlike that of the rats reported by Maier. Secondly, the insoluble problem-solving situation employed in this study was not sufficiently similar to that employed by Maier to permit a conclusive comparison between the behavior of humans and rats. The second possibility was previously mentioned (Theoretical Considerations), noting the differences between Maier's insoluble problem situation and the one of this study with regard to the intensity of reinforcements and inducements. This possibility is somewhat supported by the fact that very few Ss (on very few trials) required any inducement to respond. Ninety-eight per cent of the Ss' responses were within the three-second pre-inducement period.

Other Results

1) The predominant responses employed in the last part of the insoluble problem were those responses last learned in Part I. This is in agreement with Maier's (1943) finding that the last-learned responses were more often employed in the insoluble problem situation (although Maier's findings were specific to those Ss showing stereotyped behavior while the results in this study were about all Ss, showing characteristic responses or not).

2) Several theorists and investigators have published theories and reported findings sometimes in opposition to Maier's findings*. According to Estes' statistical learning model (Estes, 1950, 1954), Ss learn to match their response ratios to the actual probability of occurrence of events. The Bush-Mosteller model (1955) yields the same predictions. A number of studies have reported findings in support of the predictions generated by these models (Estes and Straughan, 1954; Hake and Hyman, 1953; Jarvik, 1951). The Von-Neumann and Morgenstern model (1947) predicts that Ss will learn to maximize the expected frequency of correct predictions. Galenter and Gerstenhaber (1956), Goodnow (1955), and Toda (1956) reported findings in support of this model. For each of these three models the general prediction is that Ss will more frequently chose the more frequent event and equally frequently choose events of equal frequency. Thus, in the first half of

---

* Henceforth to be collectively referred to as decision-making theories and findings.

the insoluble problem (60 per cent positively reinforced for first-learned responses), the prediction would be that the predominant responses of the Ss would be first-learned responses. Likewise, in the last half of the insoluble problem (60 per cent positively reinforced for last-learned responses), the prediction would be that the predominant responses of the Ss would be last-learned responses. Both of these predictions were supported by the results of this study (see Results, Other Results, (2)). However, on the last part of the insoluble problem (trials 87-100), where both first and last-learned responses were positively reinforced on 50 per cent of the trials, decision-making theories would predict no predominance of first or last-learned responses. The results (see Results, Other Results), (1)) did not support this prediction, but did support Maier's finding as noted in (1) above.

Thus, decision-making theories were able to predict the results of this study in two instances, but not in one other instance.

It should be noted that decision-making studies generally do not employ either inducements to respond or negative reinforcements (other than loss of positive reinforcement). Nevertheless, inducements and negative reinforcements do not affect decision-making theory predictions.

3) The finding that the number of Ss showing a predominant response to the negatively reinforced symbol was significantly greater than the number showing a predominant response to the positively reinforced symbol in the new and soluble problem situation (trials 101-120) is

most surprising. This finding is neither predicted by decision-making theory (indeed, the exact opposite is predicted) nor is it indicated by any of Maier's findings. Unless the result is an artifact of the experiment itself, it is most difficult to explain. Although some studies have reported that certain supposed "punishments" sometimes function as positive reinforcers (Thurstone, 1931; Estes, 1944), it does not seem to be the case in this study, since, in Part I, the (same) negative reinforcer employed did not prove to be a positive reinforcer (36 Ss solved the problems in Part I and no S responded more frequently to the negatively reinforced position than to the positively reinforced position). However, according to classical learning theory, a stimulus condition contingent upon a particular response which tends to increase the frequency of that response is itself positively reinforcing. Consequently, it could be tentatively concluded that the insoluble problem situation caused the properties of the negative reinforcer (in Part I) to change from negatively reinforcing to positively reinforcing (in Part III).

4) The finding that 37 of 41 Ss failed to solve the new and soluble problem (trials 101-120) gives some support to the tentative conclusion in (3) above. Indeed, the fact that only four Ss solved the problem is no more than what would be expected by chance ($P = .04$). It appears that the effect of the insoluble problem situation was the prevention of the solution of the new and soluble problem. This conclusion is, of course, based on the assumption that the Ss could have

solved the new problem had they not undergone the insoluble problem situation.

One possibly confounding factor here is the fact that the Ss were never consistently positively reinforced (above 50 per cent) for responses to the symbols on the previous 100 trials of the experiment. It might be that the Ss, not having been previously reinforced for responses to the symbols, when presented with a symbol problem, tended not to respond on the basis of symbols. However, the fact that 25 of 37 Ss showed predominant responses to the negatively reinforced symbol makes it implausible to conclude that Ss were not responding on the basis of symbols.

Chapter V

SUMMARY & CONCLUSIONS

The aim of the study was to investigate the behavior of humans in an insoluble problem situation and a subsequent soluble situation, both of which were adapted from Maier's (1949) experiments with rats, and to observe whether certain behaviors noted by Maier also occur in humans. These behaviors were:

1) characteristic response (repeated response to one stimulus) in an insoluble problem situation,

2) continuation of a characteristic response in a subsequent new and soluble problem situation, and

3) more frequent exhibition of one of two previously learned responses in an insoluble problem situation.

Forty-one Ss were presented with 120 continuous trials of a two-choice problem in which they were given no rules for making a correct choice and were positively reinforced for a correct choice and negatively reinforced for an incorrect choice. The reinforcement contingencies for the 120 trials were as follows:

Part I Previous Experience (position-response reinforcement).

Trials 1-25 were positively reinforced for responses to one of the two positions (left or right). Trials 26-50 were positively reinforced for responses to the opposite position (right or left).

Part II Insoluble Problem (random reinforcement).

Trials 51-100 were randomly reinforced, i.e. any consistent response to position (left or right) or symbol (triangle or square) was positively reinforced on 50 per cent of the trials and negatively reinforced on 50 per cent of the trials.

Part III New and Soluble Problem (symbol-response reinforcement).

Trials 101-120 were positively reinforced for responses to one of the two symbols (triangle or square).

The hypotheses under investigation were based on Maier's findings with rats. The hypotheses and results are as follows:

Hypothesis 1 - On the last part of the insoluble problem, the probability of a S showing a characteristic response is greater than .024 .

This hypothesis was not confirmed. The author suggested that this result may have been caused by either the lack of similarity between the situation employed by Maier and that employed in this study, or the fact that human and rat behaviors in the situations employed are dissimilar.

Hypothesis 2 - The conditional probability that Ss showing predominant responses in the new and soluble problem, given they showed characteristic responses in the last part of the insoluble problem, is greater than $\frac{1}{2}$.

Hypothesis 3 - The conditional probability that Ss showing last-learned responses in the last part of the insoluble problem, given that they also show characteristic responses in the last part of the insoluble problem, is greater than $\frac{1}{2}$.

Since both Hypotheses 2 and 3 can be tested only in the event that Hypothesis 1 is confirmed, they were not tested.

Other results of interest:

1) Ss tended to exhibit predominant last-learned responses in the last part of the insoluble problem.

2) Decision-making theories predicted only some of the results of the study.

3) Ss showed a tendency to make predominant responses to the negatively reinforced stimulus in the new and soluble problem (preceded by the insoluble problem).

4) No more Ss than expected by chance solved the new and soluble problem (symbol-response reinforced), while only 5 of 41 Ss failed to solve either or both of the position-response reinforced problems.

พฤติกรรมการเลือกจากสองคำตอบต่อสถานการณ์แก้ปัญหาทั้งที่มีทางแก้และที่ไม่มีทางแก้

บทคัดย่อ และข้อสรุป

การทดลองครั้งนี้เป็นการศึกษาถึงพฤติกรรมของมนุษย์ในสถานการณ์ที่ให้แก้ปัญหาสองประเภท คือ ปัญหาที่มีทางแก้ และที่ไม่มีทางแก้ ซึ่งผู้วิจัยดัดแปลงมาจากการศึกษาถึงพฤติกรรมของหนู โดย N.R.F. Maier และนักวิจัยอื่น ๆ บางคน (2) ความมุ่งหมายของการทดลองก็เพื่อที่จะตรวจดูว่ามนุษย์จะแสดงพฤติกรรมต่าง ๆ ต่อไปนี้ดังที่ Maier ได้พบกับหนูหรือไม่

๑. การตอบสนองซ้ำแบบ (stereotyped response) ในสถานการณ์ให้แก้ปัญหาประเภทที่ไม่มีทางแก้

๒. การตอบสนองซ้ำแบบอย่างเดิมต่อสถานการณ์ใหม่ที่ให้แก้ปัญหาประเภทที่มีทางแก้

๓. การตอบสนองอย่างหนึ่งมากกว่าอีกอย่างหนึ่ง จากการตอบสนองสองอย่างที่เรียนมาก่อน ต่อสถานการณ์ที่ให้แก้ปัญหาประเภทที่ไม่มีทางแก้

ในการทดลองนี้กลุ่มตัวอย่างซึ่งเป็นเด็กนักเรียน ๔๑ คน แก้ปัญหาที่มีสองคำตอบจำนวน ๑๒๐ คู่ โดยไม่ได้บอกหลักที่ต้องใช้ในการแก้ปัญหาให้แก่เด็ก เด็กที่เลือกคำตอบที่ถูกต้องได้รับการเสริมแรงทางบวก ส่วนเด็กที่เลือกคำตอบที่ไม่ถูกต้องได้รับการเสริมแรงทางลบ การเสริมแรงพฤติกรรมสำหรับปัญหาทั้ง ๑๒๐ คู่ ถือหลักปฏิบัติดังต่อไปนี้ :-

ตอนที่ ๑ (การเสริมแรงการตอบสนองตามตำแหน่ง) สำหรับคู่ที่ ๑ ถึงคู่ที่ ๒๕ เสริมแรงการเลือกตามตำแหน่งของทั้งสองคำตอบ (ขวา หรือ ซ้าย) สำหรับคู่ที่ ๒๖ ถึงคู่ที่ ๕๐ เสริมแรงการเลือกตรงกันข้ามกับที่เลือกในคู่ที่ ๑ ถึง ๒๕ (ซ้าย หรือ ขวา)

ตอนที่ ๒ (การเสริมแรงอย่างสุ่มต่อการตอบสนอง) สำหรับคู่ที่ ๕๑ ถึง คู่ที่ ๑๐๐ เสริมแรงการเลือกตอบสนองโดยไม่มีระบบอะไรเลย หมายความว่า ไม่ว่าจะเลือกตามตำแหน่งหรือตามสัญญลักษณ์ (สามเหลี่ยมหรือสี่เหลี่ยม) ทุก ๆ ครั้งจะเสริมแรงทางบวก ๕๐ % และทางลบ ๕๐ %

ตอนที่ ๓ (การเสริมแรงของการตอบสนองตามสัญลักษณ์) สำหรับคู่ที่ ๑๐๑ ถึงคู่ที่ ๑๒๐ เสริมแรงการเลือกตามสัญลักษณ์ (สามเหลี่ยมหรือสี่เหลี่ยม)

สมมุติฐานที่ทดสอบก็ดัดแปลงจากผลการทดลองของ Maier ในการศึกษาเกี่ยวกับหนู สมมุติฐานเหล่านี้และผลของการทดสอบมีดังต่อไปนี้

๑. ในตอนสุดท้ายของปัญหาที่ไม่มีทางแก้ ความน่าจะเป็น (Probability) ที่เด็กจะแสดงการตอบสนองซ้ำแบบสูงกว่า .๐๒๔

สมมุติฐานนี้ไม่ได้รับการสนับสนุนจากการทดสอบ

ผู้วิจัยเสนอความเห็นว่า ผลที่ออกมาอย่างนี้อาจจะเกิดจากความแตกต่างระหว่างพฤติกรรมของหนู และมนุษย์ ในสถานการณ์อันเดียวกัน หรืออาจจะเกิดจากความแตกต่างระหว่างสถานการณ์แก้ปัญหาที่ Maier ใช้ และสถานการณ์ที่ใช้ในการทดลองนี้

๒. ส่วนเด็กที่แสดงการตอบสนองซ้ำแบบในตอนสุดท้ายของปัญหาที่ไม่มีทางแก้นั้น สำหรับปัญหาถัดมาจากปัญหาที่ไม่มีทางแก้ซึ่งเป็นปัญหาที่มีทางแก้ ความน่าจะเป็น (Probability) ที่เด็กจะแสดงการตอบสนองส่วนใหญ่เป็นอย่างเดิมสูงกว่า $\frac{1}{2}$

๓. ส่วนเด็กที่แสดงการตอบสนองซ้ำแบบตามตำแหน่ง ในตอนสุดท้ายของปัญหาที่ไม่มีทางแก้ ความน่าจะเป็น (Probability) ที่เด็กจะแสดงการตอบสนองอันที่สองจากทั้งสองอันที่ได้เรียนมาก่อนสูงกว่า $\frac{1}{2}$

ไม่ได้ทดสอบสมมุติฐานที่ ๒ และ ๓ เพราะว่าการทดสอบทั้งสองสมมุติฐานนี้ขึ้นอยู่กับความเป็นจริงของสมมุติฐานที่ ๑

ผลอื่น ๆ ของการทดลองนี้ที่น่าสนใจมีดังต่อไปนี้

๑. ในตอนสุดท้ายของปัญหาที่ไม่มีทางแก้ เด็กแสดงแนวโน้มที่จะเลือกแสดงการตอบสนองอันที่สองจากทั้งสองอันที่เรียนมาก่อน

๒. ทฤษฎีแห่งการตัดสินใจ ไม่สามารถที่จะทำนายผลการทดลองทั้งหมดที่ได้พบ

๓. ในสถานการณ์ใหม่ที่ให้แก้ปัญหาที่มีทางแก้ ซึ่งถัดมาจากปัญหาที่ไม่มีทางแก้ เด็กแสดงแนวโน้มที่จะเลือกคำตอบที่เสริมแรงทางลบมากกว่าจะเลือกคำตอบที่เสริมแรงทางบวก

๔. เด็กที่ประสบความสำเร็จในการแก้ปัญหาอันใหม่ที่มีทางแก้ (เสริมแรงการเลือกตามสัญลักษณ์) มีจำนวนไม่เกินจำนวนที่คาดว่าจะแก้ปัญหาได้ตามโอกาส (Chance) ในขณะเดียวกันเพียง ๕ คน ในจำนวน ๔๑ คน ไม่ได้แก้ปัญหาอันแรกของการทดลอง (เสริมแรงการเลือกตามสัญญลักษณ์)

APPENDIX A

Instructions (in Thai)

วันนี้จะให้นักเรียนแก้ปัญหาง่าย ๆ ในการแก้ปัญหาเหล่านี้ถ้านักเรียนยิ่งตอบถูกมากก็จะยิ่งได้คะแนนมาก และพวกนักเรียนที่ได้คะแนนสูง ๆ จะได้รับรางวัลคนละ ๒๐ บาท

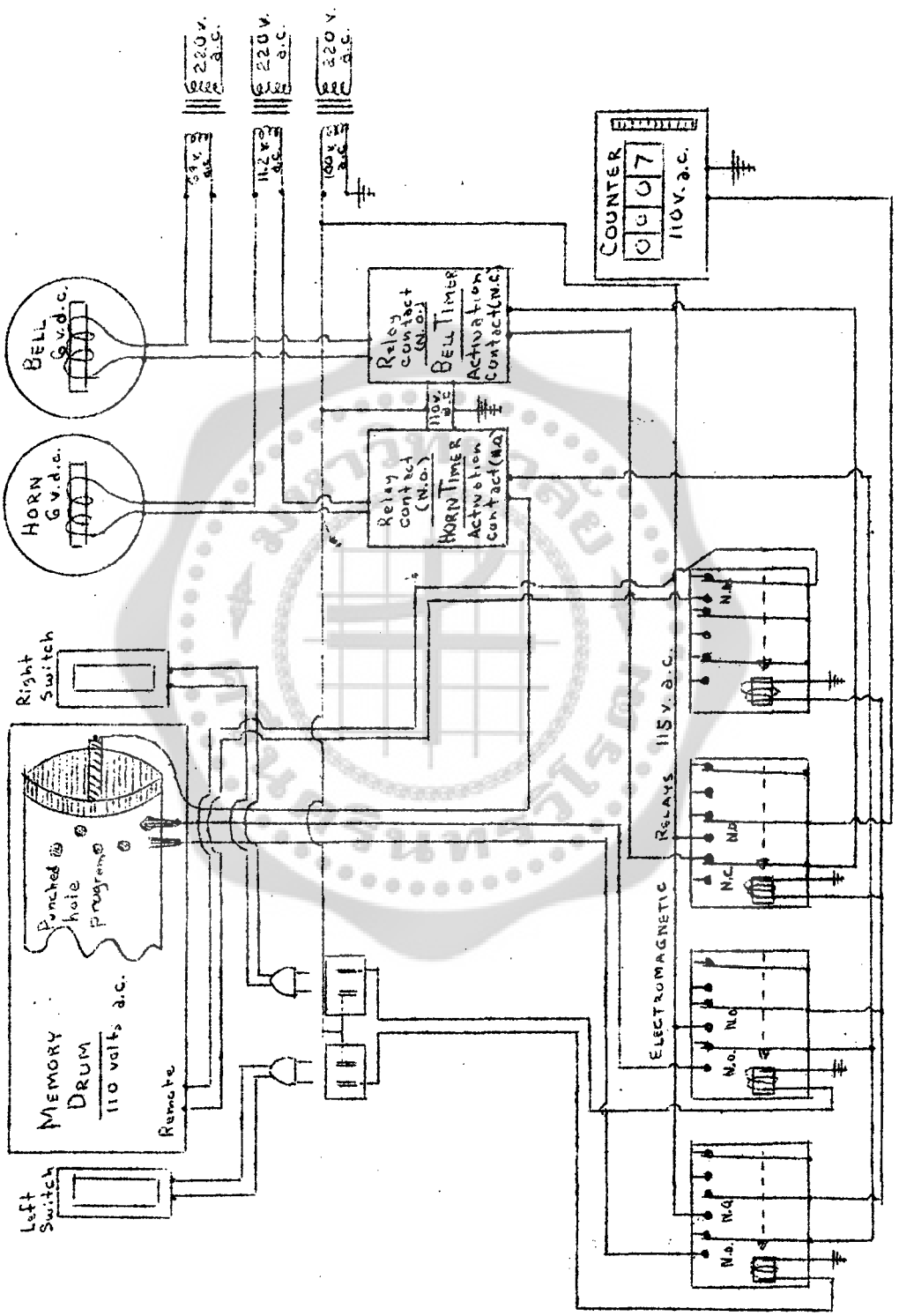
ตรงข้างหน้าของนักเรียนมีกล่องเหล็กสีเทาที่มีช่องสี่เหลี่ยมเล็ก ๆ และมีรูปสีดำสองรูปอยู่ในช่องสี่เหลี่ยมนั้น รูปหนึ่งอยู่ทางขวา อีกรูปอยู่ทางซ้าย ในการแก้ปัญหานักเรียนต้องเดาเอาเองว่ารูปไหนหรือด้านไหนถูกต้อง แล้วก็กดปุ่มที่อยู่ด้านเดียวกัน ตัวอย่างเช่น ถ้านักเรียนคิดว่ารูปที่อยู่ขวามือถูกต้องก็กดปุ่มที่อยู่ทางขวามือ หรือถ้าคิดด้านซ้ายมือถูกต้องก็กดปุ่มที่อยู่ทางซ้ายมือ โดยจะไม่บอกหลักที่ใช้ในการเลือกรูปที่ถูกต้อง ให้นักเรียนเดาหลักเอาเอง

เมื่อกดปุ่มควรกดระยะสั้น ๆ ไม่ควรถึงหนึ่งวินาที ถ้ากดถูกจะได้ยินเสียงดังกริ๊ก และจะให้ ๒ คะแนน ถ้ากดผิดจะได้ยินเสียงแตรดัง ๆ และจะถูกหัก ๒ คะแนน หลังจากได้กดปุ่มแล้วช่องสี่เหลี่ยมก็จะปิดแล้วเปิดใหม่ เมื่อเปิดใหม่จะแสดงรูปทั้งสองรูปเดิม แต่รูปนั้นอาจจะอยู่ในที่เดิมหรือกลับกันก็ได้ หลังจากช่องสี่เหลี่ยมเปิดใหม่และให้นักเรียนเลือกรูปแล้วจึงกดปุ่มอีก แต่นักเรียนอย่ากดปุ่มก่อนช่องสี่เหลี่ยมเปิด ถ้านักเรียนไม่กดปุ่มภายในเวลา ๓ วินาที หลังจากช่องสี่เหลี่ยมเปิดก็จะเกิดเสียงกริ่ง และจะถูกหัก ๑ คะแนน กริ่งจะดังจนกระทั่งนักเรียนกดปุ่มหนึ่งปุ่มใด

ช่องสี่เหลี่ยมนี้จะเปิดปิด ๑๐๐ กว่าครั้ง ทุกครั้งนักเรียนจะต้องเลือกรูปที่ถูกต้องแล้วก็กดปุ่ม ซึ่งนักเรียนแต่ละคนจะใช้เวลาในการแก้ปัญหาทั้งหมดนี้ประมาณ ๑๐ นาที เท่านั้น

นักเรียนต้องอย่าบอกหลักที่นักเรียนใช้ในการแก้ปัญหาแก่เพื่อน ๆ เพราะว่าทุกคนจะได้แก้ปัญหาที่ไม่เหมือนกัน ถ้านักเรียนมีอะไรสงสัยขอให้ถามอาจารย์ก่อน

APPENDIX B



SCHEMATIC DIAGRAM OF CIRCUITRY

REFERENCES

Bush, R.R. and Mosteller, F. Stochastic Models for Learning. New York: John Wiley & Sons, Inc., 1955.

Ellen, P. "The Compulsive Nature of Abnormal Fixations". J. Comp. Physiol. Psychol., 1956, 49, 309-317.

Estes, W.K. "An Experimental Study of Punishment". Psychol. Monogr., 1944, 57, 424-471.

Estes, W.K. "Toward a Statistical Theory of Learning". Psychol. Rev., 1950, 57, 94-107.

Estes, W.K. "Individual Behavior in Uncertain Outcome Situations: An Interpretation in Terms of Statistical Association Theory". In R. Thrall, C. Coombs, and R. Davis (Eds.) Decision Processes. New York: John Wiley & Sons, Inc., 1955, 127-137.

Estes, W.K. and Straughan, J.H. "Analysis of a Verbal Conditioning Situation in Terms of Statistical Learning Theory". J. Exp. Psychol., 1954, 47, 225-234.

Galenter, E. and Gerstenhaber, M. "On Thought: The Extrinsic Theory". Psychol. Rev., 1956, 63, 218-228.

Goodnow, J.J. "Determinants of Choice Distributions in Two-Choice Probability Situations". Amer. J. Psychol., 1955, 68, 106-116.

Hake, H.W. and Hyman, R. "Perception of the Statistical Structure of a Random Series of Binary Symbols". J. Exp. Psychol., 1953, 45, 64-74.

Jarvik, M.E. "Probability of Learning and a Negative Recency Effect in the Serial Anticipation of Alternative Symbols". J. Exp. Psychol., 1951, 41, 291-297.

Maier, N.R.F. Frustration: The Study of Behavior Without a Goal. New York: McGraw Hill, Inc., 1949.

Maier, N.R.F. and Ellen, P. "The Effect of Three Reinforcement Patterns on Positional Stereotypes". Amer. J. Psychol., 1955, 68, 83-95.

Maier, N.R.F. and Ellen, P. "Studies of Abnormal Behavior in the Rat XXIV: Position Habits, Position Stereotypes, and Abnormal Behavior". J. Genet. Psychol., 1956, 89, 35-49.

Maier,N.R.F. and Feldman,R.S. "Studies of Abnormal Behavior in the Rat XXII: Strength of Fixation and Duration of Frustration". J. Comp. Physiol. Psychol., 1948, 41, 348-363.

Maier,N.R.F. and Klee,J.B. "Studies of Abnormal Behavior in the Rat VII: The Permanence of Abnormal Fixations and Their Relation to Convulsive Tendencies". J. Exp. Psychol., 1941, 29, 380-389.

Maier,N.R.F.,Glaser,N.M.,and Klee,J.B. "Studies of Abnormal Fixation in the Rat III: The Development of Behavior Fixations Through Frustration". J. Exp. Psychol., 1940, 26, 521-546.

Somnapan,R. "Development of Sets of Mutually Equally Discriminable Random Shapes". J. Exp. Psychol., 1968, 76, 297-302.

Thorndike,E.L. Human Learning. New York: The MacMillan Co., 1931.

Toda,M. "Guessing Sequences Under Various Conditions of Payoff". Jap. Psychol. Res., 1956, 4, 11-23.

Von-Neumann,J. and Morgenstern,O. Theory of Games and Economic Behavior (2d. ed.). Princeton,N.J.: Princeton, 1947.

Wilcoxin,H.C. "'Abnormal Fixations'and Learning". J. Exp. Psychol., 1952, 44, 324-333.