# MOTOR REINFORCEMENT AS REWARD IN CONDITIONING THE AUTOKINETIC PHENOMENON

By

DONALD M. RUSSELL

Bachelor of Science

Oklahoma State University

Stillwater, Oklahoma

1965

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF SCIENCE
May, 1970

MOTOR REINFORCEMENT AS REWARD IN
CONDITIONING THE AUTOKINETIC
PHENOMENON

Thesis Approved:

Kenneth D. Sandvold
Thesis Adviser

Julia L. McHale

Mark K. MacNeil

N. Durham
Dean of the Graduate College

ACKNOWLEDGEMENTS

I wish to thank the members of my committee for their support and encouragement. I want to especially thank my major adviser and committee chairman, Dr. Kenneth D. Sandvold, for his guidance and assistance. To Dr. Mark K. MacNeil, for his help in arranging the laboratory, and to Dr. Julia L. McHale for her valuable recommendations and advice, I owe a special debt of gratitude.

## TABLE OF CONTENTS

LIST OF TABLES

# CHAPTER I

## INTRODUCTION AND REVIEW OF LITERATURE

In order to understand the effect of motor reinforcement on the autokinetic phenomenon (one kind of perceived movement of light), a review of the literature on reinforcement and its relationship to perception seems advisable. Reinforcement may generally be defined as the presentation of a stimulus (food) which is able to reduce a drive (hunger). Reinforcement which is unlearned (food) is referred to as primary, and that which is learned (money) is referred to as secondary. Secondary reinforcement will be the only kind of reinforcement discussed in the present paper.

Perception may be generally regarded as the psychological ordering or organization of any or all of the stimulus environment. A perceptual response is usually limited to a specific reaction to a certain stimulus or stimulus pattern (perceptual selection). A perception is inferred from an individual's overt response. The overt response is elicited by appropriate environmental stimuli, which may be called perceptual response cues. The association between cue and response can be strengthened by repeated pairings of the two with reinforcement following most pairings.

The autokinetic phenomenon, a certain type of perceived movement of light, may be affected by reinforcement. Reinforcement may be considered the presentation of a drive-reducing stimulus. A perceptual response, such as the autokinetic phenomenon, is usually regarded as a limited reaction to a segment of the stimulus environment. A perception, or perceptual response, is inferred from an observable response elicited by perceptual response cues. Secondary or learned reinforcement is often used to strengthen the relationship between cue and response. The following section examines the relationship of secondary reinforcement and perception.

## The Relationship of Secondary Reinforcement to Perception

In a well structured situation, one in which the stimulus environment is well ordered, i.e., perceptual alternatives are limited, secondary reinforcement will often cause a person to be selectively attentive to cues associated with the performance of a certain task. Bahrick, Fitts and Rankin (1952) investigated the relation of secondary reinforcers or incentives to the selectivity of perception. More specifically, they studied the effect of changes in quality of incentive on the tendency to respond to task-related cues. A pursuit apparatus was used as a central task with three additional peripheral tasks. The experimenters first informed the subjects that the trials were practice trials. This information may be regarded as a low quality incentive. Later, a high quality incentive, money as a reward for good performance, was presented. The results of the experiment agree with the hypothesis that a high quality incentive aids the performance of a central task but interfers with peripheral task performance. The increase in incentive quality resulted in an increase in the selectiveness of perceptual behavior for central, task-related cues.

Unstructured stimulus situations exist when the stimulus environment lacks pattern or organization. Reinforcement should contribute more to perception in the unstructured situation than in the well structured situation. Experimentation in which external stimuli act both as secondary reinforcers and perceptual response cues is reported by Bruner and Goodman (1947), Bruner and Rodriques (1953), and Carter and Schooler (1949). These experiments are mostly studies of the effect of the presumed value of objects, such as coins and disks, on estimates of their size. Subjects usually compared coin or disk size with that of a disk whose size could be changed. Brown (1961) concluded that the effect of value on estimated size is usually small when the objects to be compared with the variable-sized disk are present. When comparisons are made from memory, however, the effect appears to be greater. The latter situation is relatively more unstructured and indicates a greater influence of secondary reinforcement on perception.

Brown (1961) noted that the explanation of the effect of value on estimates of size is associative. Postman (1953) concluded that secondary reinforcers, such as money, are emphasizers which provide perception with a strong associative relationship. Both Brown and Postman, therefore, propose an associative explanation of secondary reinforcement. Postman notes that both rewards and punishments seem to enhance a person's perceptual learning. However, rewards seem to have more effect than punishments. Postman proposes that the reason rewards and punishments are effective is probably due to their acting as emphasizers. An alternative to the hypothesis of emphasis, continues Postman, is the hypothesis that rewards influence perception through need reduction.

The emphasis principle seems to be supported, and the need reduction idea refuted, in a comparison of the effects of rewards and punishments with those of "neutral" consequences. In an experiment, quoted by Postman (1953, p. 83), in which nonsense words were used as stimuli, monetary consequences in a learning period were varied as reward, punishment and neutral. During the recognition period the effects of the consequences seemed to support the hypothesis that both rewards and punishments assist in the acquisition of perceptual responses. The interpretation tends to favor an associative explanation of secondary reinforcement.

Proshansky and Murphy (1942) also studied the relationship of secondary reinforcement to perceptual behavior. Their experiment took place in a relatively unstructured stimulus setting. They hypothesized that perception is learned in the same manner as overt behavior, i.e., perception develops toward rewarded stimuli and away from punished stimuli. In the typical perceptual learning experiment, the subject learns to report correctly, but his actual perceptual processes are not known. Perceptual behavior, however, may be inferred from verbal reports as the estimation of perceptual response cues. Proshansky and Murphy used a pretraining period in which lines exposed for brief instances in a dark room, and weights, were estimated. In a training period, money was presented when certain percepts were formed and withdrawn when others were formed. The stimulus situation of a post-training period was identical to the training period. For the experimental subjects, the post-training results showed significant shifts in estimates toward the rewarded percepts against no significant shifts for the control subjects in unrewarded percepts. The distortions in perception were due to reinforcement of certain estimates of perceptual response cues.

In summary, secondary reinforcement affects a perceptual response in the same manner as it affects an overt act. In most instances, the greater the quality of reinforcement, the more pronounced is the reinforced perceptual behavior. In a well structured stimulus situation, secondary reinforcement can increase perceptual selectivity. Secondary reinforcement should contribute more to perception in an unstructured stimulus situation, than in a well structured one. Reinforcement (and punishment) probably influences perceptual behavior by providing a preceeding perceptual response with a strong associative emphasis. The response may then be more likely to recur. Perception is more than a mediator of verbal reports, it is a process related to, but separate from, verbal reports of perception. It is separately subject to modification by secondary reinforcement.

The preceeding material has indicated the general relationship of secondary reinforcement to perception. The discussion is a background for a study of the possible effect of secondary reinforcement on a certain kind of perception.

## The Effect of Secondary Reinforcement on Autokinesis

Farrow and Santos (1962) studied the effect of secondary reinforcement on apparent movement occurring in a certain area. They utilized the autokinetic phenomenon as apparent movement. The phenomenon, known as autokinesis, takes place when a fixed point of light is viewed in mostly or completely dark surroundings. With little or no structure in the stimulus background, the light appears to move. The autokinetic effect is probably not due to eye movements or other peripheral factors but is probably cortically determined (Crutchfield and Edwards, 1949, Haggard and Rose, 1944). The hypothesis tested by Farrow and Santos was that by repeatedly associating negative reinforcement (shock) with the autokinetic movement in a certain area, the movement will decrease significantly. As the autokinetic movement takes place in a new region, it should become associated with partial termination of the shock. The movement should then shift significantly from the original area to the new one.

The first of three groups in the Farrow and Santos (1962) study, Control Group I, was tested ($T_1$) on autokinetic perception in a completely darkened room and then retested ($T_2$) in four minutes. During these periods the subjects traced with a pencil, on a sheet of paper, the apparent movement of the light while it appeared to move. Control Group II observed and reported the position of a light which actually moved in an eccentric, jerky and roughly circular manner, between test and retest of autokinetic perception. The Experimental Group was treated the same as Control Group II, except that the subjects were negatively reinforced (shocked) while observing and reporting the position of the moving light. Seventy-five percent of the observations reported on the preferred or predominant side, right or left as determined by $T_1$, were negatively reinforced by shock (no-escape, no-avoidance method). Twenty-five percent on the opposite side were negatively reinforced. The percentage of total movement occurring on the predominant side in $T_1$ and $T_2$ was tabulated. The difference between the mean percentage of movement on the predominant side for $T_1$ and $T_2$ for the Experimental Group was more than $2\frac{1}{2}$ times the difference for either control group. This finding supports the hypothesis that when negative reinforcement is repeatedly associated with autokinetic movement in a certain area, that movement will significantly decrease. An explanation for the shift in the preferred spatial region may be that the smaller percentage of shocked trials on the original, non-preferred side was the partial termination of a noxious stimulus. The process of partially eliminating shock may be a type of negative reinforcement. It apparently strengthened the association between the original, non-preferred region and the perception of autokinetic movement.

Haggard and Rose (1944) studied the problem of conditioning the autokinetic phenomenon using monetary reinforcement. They also examined possible effects that mental set and active participation might have on autokinesis. In a factorially designed experiment, 16 subjects took part in two major experimental situations. In the first situation (the Passive Group), eight of the subjects only reported whether or not the light moved, and the distance and direction of movement. In the Active Group, eight subjects behaved exactly as the Passive Group but, in addition, drew, on a sheet of paper, heavy arrows the same distance and direction as they saw the light move. This procedure was termed active participation or motor reinforcement. Four of the Active Group and four of the Passive Group were told that on most of the trials the light would move (the Most Group). The rest of the subjects were told that on only some of the trials would the light move (the Some Group). The latter two units of subjects, therefore, presumably experienced two degrees of mental set or preparedness. All of the subjects were rewarded monetarily for seeing the light move to the right.

In five, identical, 28-trial sessions conditioning was established. In a subsequent session, consisting of ten trials, the subjects rated themselves on confidence in their perceptions. Also, the instructions in this session were designed to measure the stability of conditioning in the preceeding sessions. The results of the experiment support three main conclusions: (1) The Active Group saw the light move further and move more often than the Passive Group. The subjects in the Active Group were more stably conditioned and more confident in their perceptions. (2) The Most Group was comparable to the Active Group in measures of Conclusion 1, as was the Some Group to the Passive Group. (3) A "Law of Active Participation" (Haggard and Rose, 1944, p. 58) was postulated in order to explain the results supporting Conclusion 1. It stated that when an individual is active in a learning situation, he tends to learn more rapidly than when he is passive, and his responses are generally more stable.

Three major questions from the Haggard and Rose study remained unanswered: (1) Could the effectiveness of reward (monetary) reinforcement and motor reinforcement (active participation) be compared? (2) Is the pattern of motor reinforcement important? (3) Is the direction the light was conditioned to move important? Haggard and Babin (1948) designed an experiment to investigate these questions. In the experiment were two major experimental variables: (1) Motor Reinforcement: Movement With (drawing arrows the same direction and distance as the apparent movement of the light), Movement Against (drawing arrows the same distance, but in direction opposite to the light's apparent movement), and No Movement (sitting passively); and (2) Reward Reinforcement: Reward (social and monetary rewards presented), and No Reward (neither social nor monetary rewards). All subjects reported after each trial whether the light moved, and if it did, the direction and distance of movement.

Two major conclusions were drawn from the results of the experiment: (1) Motor reinforcement which is not in conflict with the apparent movement of the autokinetic light was the most effective condition facilitating the conditioning of the autokinetic phenomenon. Within the variable of motor reinforcement, the order of effectiveness of conditions was: Movement With, Movement Against and No Movement. (2) The Reward condition was more effective than the No Reward condition.

Negative reinforcement, such as that used in the Farrow and Santos study, tends to affect autokinetic perception by strengthening apparent movement consistent with the reinforcement. Monetary rewards and praise are positive (pleasant) reinforcers which seem to increase the frequency of a specific direction of autokinetic movement immediately preceeding their presentation. Motor reinforcement or active participation has also been shown to be effective positive reinforcement in the autokinetic situation. The major perceptual response investigated in the above autokinetic studies was apparent movement in a certain direction or region. The present study is focused on the possible effect of motor reinforcement upon the distance of autokinetic movement.

## CHAPTER II

## PROBLEM AND HYPOTHESES

The problem was to investigate the possible effect of motor reinforcement upon distance of autokinetic movement. Motor reinforcement, in this study, is constituted by drawing a line, on a sheet of paper, the same distance and direction as the stimulus-light appeared to move. It assumed to be the factor which promoted learning. Drawing on a given trial followed the disappearance of the light and the reporting of the distance it appeared to move.

All subjects, both control and experimental, were instructed to tell, as accurately as they could, to the nearest inch, the distance the light moved. The experimental subjects, who were motor-reinforced for seeing greater distance of movement, might have thought that they were improving upon their accuracy by drawing. This possible "self-reward" could have increased their estimates of distance of movement. If the control subjects thought their accuracy improved, increases and decreases in estimates should have cancelled out. Self-reward was indirectly assessed by asking each subject, "Do you think your estimates improved?" It was assumed, however, that self-reward was not significant.

In the Haggard and Rose (1944) study, the Active (motor-reinforced) Group saw the stimulus-light move further than did the other three groups. In the Haggard and Babin (1948) experiment, the Movement With Group, those who drew lines in the same direction as the perceived movement, saw the light move further than did the No Movement Group. It may be concluded that the motor reinforcement used in the two studies may have had an effect upon the increased distance of autokinetic movement.

The increase in movement in these studies may also be a result of monetary reward and praise. Haggard and Babin (1948) contend that such "reward" reinforcement was necessary, in addition to motor reinforcement, for the subjects to determine which responses were correct and which were incorrect. They used an index of conditioning, which they defined as "the sum of the percent change in direction, and in the orally reported distance, of the movements seen [in] the rewarded direction" (Haggard and Babin, 1948, p. 514). The index for the No Reward, Movement With subjects was 16.0, and for the No Reward, No Movement subjects was -97.4. These figures indicate motor reinforcement alone may be sufficient for conditioning, without the use of additional "reward" reinforcement.

Haggard and Babin (1948) found congruent motor reinforcement to be the major facilitating factor in conditioning autokinesis. This finding, coupled with the indication that motor reinforcement does not require additional kinds of reinforcement, leads to the assumption that motor reinforcement is of relatively high quality or effectiveness. In the present experiment, therefore, two additional assumptions were made. In identical autokinetic situations, in which individual subjects of two control groups only report distance of movement (Condition 1), distance estimates of the two groups should be similar. Presumably, the similarity would be due primarily to identical stimulus conditions. When one of these two groups remains in the control situation (Condition 1 repeated), and the other undergoes motor reinforcement for seeing greater distance of movement (Condition 2), estimates of distance for the reinforced (experimental) group should be markedly greater. Presumably, the increase would be due to motor reinforcement, the independent variable in the present experiment. The dependent variable was the oral response of the distance in inches that the light appeared to move on a given trial.

## Hypotheses

Three hypotheses, closely following the preceeding assumptions, statements, and definitions, were delineated. They are as follows:

1. Estimates of autokinetic distance, reported by each of two control groups, are not significantly different, when both groups are under Condition 1.

2. Estimates of autokinetic distance, reported by a motor-reinforced (experimental) group under Condition 2, are significantly greater than those reported by a control group under Condition 1.

3. The number of positive responses to the self-reward question is not significantly different between control, and motor-reinforced groups.

CHAPTER III

# METHOD AND PROCEDURE

## Pretesting

In order to test the hypotheses of Chapter II, an adequate autokinetic laboratory situation must exist. Subjects must be exposed to one or the other of the two experimental conditions in exactly the same manner. The reports of estimated distance must be properly given and carefully recorded. If these conditions are to be met, a lengthy period of pretesting all experimental and control variables is necessary. The present experiment was preceeded by a three-phase program of pretesting.

In the initial pretest phase there were 16 experimental subjects, mostly graduate students majoring in psychology. A flashlight continuously illuminated paper for drawing approximations of the perceived movement of the autokinetic light. The hallway leading to the autokinetic darkroom was often lighted, and extraneous light appeared in the darkroom from various sources. The overall lighting situation lent a great deal of structure to the experiment. The direction of apparent movement of the stimulus-light was reinforced for the first eight subjects. Magnitude of movement was reinforced for the rest of the subjects, because when direction was reinforced, observation variability was unattainable.

The 14 experimental subjects of the second phase volunteered from a course in basic psychology. Two table lamps illuminated the drawing surface and were on only while the subject drew. As in the first phase there were, beneath the drawing paper, more sheets, interleaved with carbon paper. The number of carbon impressions indicated how hard the subjects were pressing and were a rough indication of the degree of motor reinforcement.

In the final phase of pretesting, laboratory conditions were identical to those of the actual experiment. Five experimental and three control subjects volunteered from the same sections of introductory psychology as the subjects in the experiment proper. Subjects were asked if they saw any extraneous light or heard any extraneous noise in the darkroom. Although no subject in the previous phases had reported distance greater than 24 inches, one experimental subject had an average of 30.3 inches for Condition 1, with a maximum of 45 inches. She had an average of 33.1 inches for Condition 2, with a maximum of 48 inches. The factor or factors responsible for the deviation was not ascertained. The general results of the final pretest phase indicated that conditions were suitable for the experiment to take place.

## Method and Procedure of the Study Proper

Subjects. Fourteen naive subjects volunteered from the introductory psychology class at Oklahoma State University. There were five males and nine females ranging in ages from 17 to 21 years. Two males and five females served as experimental subjects (Group 1). Three males and four females served as control subjects (Group 2). They were accepted without qualification.

Apparatus. A white-sound generator was used to mask extraneous noise and was placed on a table at the end of the experimental room opposite the subject (S). Beside the white-sound generator was the autokinetic apparatus, which contained a timer. Four seconds before the autokinetic stimulus-light appeared, a faint warning-light, visable only to the experimenter (E), flashed, signalling E to say, "Ready". The stimulus-light consisted of a $2\frac{1}{2}$ watt bulb shining first through a translucent screen, then through a hole 1 mm. in diameter. When the stimulus-light was uncovered, the timer activated an electric alarm clock with a luminous second hand. If S did not press his button within 30 seconds, as indicated by the clock, E turned off the stimulus-light by pressing a button.

S sat about $14\frac{1}{2}$ feet from the stimulus-light. His subject-button was connected directly to the timer in the autokinetic apparatus. Four seconds after he pressed the button, the timer closed a shutter over the stimulus-light. The table illumination consisted of two desk lamps which contained $2\frac{1}{2}$ watt red bulbs and were covered with red crepe paper. The drawing surface and nine supporting sheets of paper, resting on a card table, were $29\frac{1}{2}$ x $29\frac{1}{2}$" newsprint. They were interleaved with nine sheets of pencil carbon paper.

Procedure and instructions. The procedure took place in a four phase sequence as follows:

| Group 1 (Experimental) | Group 2 (Control) |
|---|---|
| I Introduction | I Introduction |
| II Condition 1 | II Condition 1 |
| III Condition 2 | III Condition 1 (repeated) |
| IV Condition 2 (repeated) | IV Condition 1 (repeated) |

The following outline describes the details of the procedure for each phase:

I. Phase I.

A. Waiting room procedure.

S was instructed to be seated in a waiting room. E appeared and presented S with the following written instructions:

> The purpose of this experiment is to see how well you can detect the distance of movement of a point of light in a completely dark room. It is not a test of individual ability, but a method of determining how accurately people can estimate the distance a light moves in the dark, when instruments are not available. If successful, the experiment may be used to help train observers to estimate distances traveled by aircraft, artificial satelites, UFO's, and and spacecraft at night.
>
> 1. You will be seated behind a table in a completely darkened room.
>
> 2. I will give you a signal, "Ready," and show you a point of light directly ahead of you.
>
> 3. The moment you see the light begin to move, press and release the button on the box in front of you. Do not press the button at any other time.
>
> 4. A few seconds after the light begins to move, it will disappear. At this time tell me, as accurately as you can, to the nearest inch, the distance it moved.
>
> 5. There will be 15 trials and then a short pause before continuing to the second phase of the experiment.
>
> 6. Are there any questions at this time?

B. Darkroom procedure.

After answering S's questions, E showed S a small red light which E used to guide S in the darkened hallway and into the completely dark laboratory. E showed S to a chair behind a table. E answered any further questions then proceeded to his station behind the autokinetic apparatus, while S dark-adapted for approximately five minutes. E then, briefly, turned on the autokinetic stimulus-light to make sure S could see it.

II. Phase II.

E signalled the start of the experiment by saying, "Ready," and presented the stimulus-light. S pushed his subject-button as soon as he saw the light appear to move, and in four seconds the light was covered. At that time S verbally reported perceived autokinetic movement in inches, (a single observation) which E recorded. The dim light used to guide S illuminated a record sheet, upon which E entered the distances reported by S. If S did not press the button within 30 seconds, the light was covered and zero distance was recorded.

Each observation by S represented one trial. Approximately 56 seconds elapsed between trials. After 15 trials E signalled the end of Condition 1 and led S to the waiting room.

III. Phase III.

A. Group 1 (Experimental).

While S remained in the waiting room, E returned to the laboratory and rank-ordered the 15 observations from Condition 1. E had designated that certain observations made during Condition 2 be reinforced. These were any observations equal to or greater than the third observation from the top of the above mentioned rank order. If, for example, the third observation were 7 inches, he would give S the following instructions:

1. Now I want you to continue doing exactly as you have done with one additional task.

2. After you report a distance of 7 or more inches, table lights will come on. I want you to immediately draw a line the same length and direction as the light moved.

3. Draw the line anywhere on the paper in front of you, numbering consecutively each line after you draw it.

4. Indicate when you are through drawing and numbering by looking up from the paper.

5. After you report a distance of less than 7 inches, the lights will not come on, and you will not draw.

6. There will be 30 trials with a short pause to change the paper after trial 15.

7. Are there any questions?

S returned to the laboratory and continued exactly as in Condition 1 with one exception. When he reported an observation equal to or greater than the designated quantity, (7 inches in the example) E turned on dim table lights which illuminated S's drawing surface. S drew a line the same distance and direction as he perceived the autokinetic movement. After 15 trials S returned to the waiting room where he answered routine, written questions.

B. Group 2 (Control).

S returned to the laboratory and continued exactly as in Condition 1. After 15 trials he returned to the waiting room where he answered routine, written questions.

IV. Phase IV.

A. Group 1 (Experimental).

S returned to the laboratory and continued exactly as in Phase III. After 15 trials, S left the laboratory and was asked: "Do you think your estimates improved?" After answering the question S was dismissed.

B. Group 2 (Control).

S returned to the laboratory and continued exactly as in Condition 1. After 15 trials, S left the laboratory and was asked: "Do you think your estimates improved?" After answering the question S was dismissed.

V. General.

The entire experiment lasted approximately 1 hour and 15 minutes.

Fifteen minutes elapsed between Ss. Experimental Ss alternated with control Ss. Each of the 14 subjects in the experiment gave 45 estimates for a total of 630 estimates. The first 15 estimates for each subject in both Groups 1 and 2 were given under Phase II. The last 30 estimates for each subject were given under Phases III and IV.

## CHAPTER IV

## RESULTS

The raw data for the two groups are listed in the Appendix. The psychophysical method of using only judgments from 5% to 95% was employed in the statistical analysis of the data. Table I presents a comparison of the estimates given by Group 1 with those given by Group 2 while both groups are under Phase II. A test for homogeneity of variance (Winer, 1962, p. 34) was made on variances of data from each of the two groups. The hypothesis that variances are equal was supported at the $\underline{P} < .05$ level of significance. This test allowed the use of the Behrens-Fisher test of hypotheses about the difference between two means (Winer, 1962, p. 29). The hypothesis that there is no significant difference in means was supported at the $\underline{P} < .05$ level.

TABLE I

COMPARISON OF ESTIMATES IN INCHES GIVEN BY GROUPS 1 AND 2 UNDER PHASE II

| Group | $\bar{X}$ | SD | Range | df | $\underline{t}$ |
|---|---|---|---|---|---|
| 1 (Experimental) | 5.91 | 3.85 | 1-16 | 188 | 1.03 NS |
| 2 (Control) | 5.26 | 4.60 | 1-25 | | |

Table II presents a comparison of the estimates given by Group 1 with those given by Group 2 under Phases III and IV. The same tests were used that were used for Phase II, except for the application of Cochron and Cox's approximation to the Behrens-Fisher test (Winer, 1962, p. 37). The hypothesis that the variances are equal was rejected at the $\underline{P} < .05$ level of significance. The hypothesis that there is a significant difference in means was supported at the $\underline{P} < .05$ level.

TABLE II

COMPARISON OF ESTIMATES IN INCHES GIVEN BY GROUPS 1 AND 2 UNDER PHASES III AND IV

| Group | X | SD | Range | df | t |
|---|---|---|---|---|---|
| 1 (Experimental) | 6.13 | 3.56 | 1-14 | 189 | 2.55* |
| 2 (Control) | 5.11 | 4.23 | 1-20 | | |

*p < .05

Indirect determination of possible self-reward by each subject was made by asking the question: "Do you think your estimates improved?" Subjects answered in one of three ways: "Yes," a positive reply, and "No," and "Couldn't tell," non-positive replies. Table III presents a comparison of the number of replies of each kind given by Group 1 with those given by Group 2. A Fisher exact probability test (Siegel, 1956, p. 96) was used to test the significance of the difference between replies by the two groups. The hypothesis that there is no significant difference between the number of replies of each kind (positive or non-positive) was supported at the $\underline{P} < .05$ level.

TABLE III

COMPARISON OF NUMBER OF REPLIES GIVEN BY GROUPS 1 AND 2

| Group | Positive | Non-positive | $\underline{P}$ |
|---|---|---|---|
| 1 | 3 | 4 | .40 NS |
| 2 | 2 | 5 | |

Hypothesis 1 states that estimates of autokinetic distance, reported by each of two control groups, are not significantly different when both groups are under Condition 1. It is supported by the data in Table I.

Hypothesis 2 states that estimates of autokinetic distance, reported by a motor-reinforced (experimental) group under Condition 2, are significantly greater than those reported by a control group under Condition 1. It is supported, as shown by the data in Table II.

Hypothesis 3 states that the number of verbally confirmed indications of self-reward from a control group having undergone Condition 1, and from a motor-reinforced group having undergone Conditions 1 and 2, is not significantly different. It is supported by data in Table III.

Table I indicates that there was no significant difference in the estimates made by the two groups before one of them underwent motor reinforcement. But, while Group 1 had a mean of 5.91, and Group 2 had a mean of

5.26, their standard deviations were 3.85 and 4.60 respectively. The latter deviation (and the upper limit of the 1-25 range) was due largely to Subject 7 of Group 2. He asked before he entered the laboratory if he could give estimates in feet. The experimenter replied that the subject was to give estimates in inches.

Table III reveals no significant difference in the number of positive and non-positive replies to the question "Do you think your estimates improved?" This result indicates that the motor-reinforced subjects did not reward themselves by thinking they were improving by drawing lines.

Table II indicates that there is a significant difference in the estimates made by the two groups when Group 2 remains as a control group and Group 1 undergoes motor-reinforcement. Again, the above mentioned Group 2 subject (#7) had a pronounced effect upon the standard deviation of Group 2 (4.23) and the upper limit of the corresponding range (1-20). The Group 1 mean of 6.13 was significantly greater than the Group 2 mean of 5.11. The two major assumptions of the study are: (1) Motor reinforcement, rather than self-reward, leads to increases in autokinetic distance, in a motor reinforcement situation. (2) Motor reinforcement leads to significant increases in autokinetic distances. Both assumptions were substantiated.

## CHAPTER V

## SUMMARY AND DISCUSSION

In experiments in which motor reinforcement was applied to autokinetic perception, changes in perception occurred. Two major questions have arisen from these studies: (1) Are the results due to motor reinforcement (drawing the pattern of movement), or are they due to subjects thinking they are improving by drawing (self-reward)? (2) If motor reinforcement is, in fact, responsible for the change, is the change significant?

These questions resulted in three hypothesis: (1) There is no significant difference in perception of autokinetic distance by two control groups. (2) If one of these groups undergoes motor reinforcement, there will be a significant increase in perception of distance for that group. (3) There is no significant difference in self-reward between the two groups.

The results of the experiment support all three hypotheses. It was concluded that the question as to whether motor-reinforcement, rather than self-reward, influences autokinetic distance, appears to be answered affirmatively by the present investigation. Also, the question as to whether motor-reinforcement exerts a significant influence upon autokinetic distance, seems to be answered affirmatively.

The conclusions of the study are limited by several factors. First, a larger number of subjects probably should have been tested, since the within-subject estimates were not independent. Each subject tends to establish a norm or a range of estimates peculiar to himself (Sherif, 1935).

With a large number of subjects, means or medians of each norm could be adequately compared. Secondly, in order to separate learning from performance, the major conditions for each of the two groups should have been reversed immediately following the major condition. In other words, the experimental subjects should have undergone the control situation again, while the control subjects should have undergone motor reinforcement. Whatever effect the major condition might have had upon the subjects, it should persist in the reversed condition. The experimental subjects should observe significantly greater distances in the reversed condition than the control subjects. This reversal would have the advantage of eliminating effects of training such as fatigue or rest.

Thirdly, the structure of the stimulus situation was a limiting factor. The laboratory room, although completely dark and relatively soundproof, was not large. To further unstructure the experimental situation, a greater area of the building outside the room and hallway could have been darkened. Also, if the experiment had been run during that time of year which has earlier hours of darkness, the darkness would have significantly aided in unstructuring the stimulus situation within and around the experimental area. These changes might have helped increase the subjects' estimation of the size of the laboratory room and thus encouraged larger estimates of autokinetic movement.

The last major factor limiting the conclusions of the study was the subjects. Subjects used in the experiment were 17 to 21-year-old freshmen and sophomore college students in majors requiring a basic psychology course. Another category of persons, differing in age and occupation, might have reported different estimates of distance. The estimates of engineering or technical students could differ according to their training in judging units of length. The same differences might apply to trade workers, such as carpenters and mechanics. Many of the subjects commented that they were poor judges of distance. Generally, the results of the experiment are limited to young college students with socially oriented majors.

With altered experimental procedure, a more general, random selection of subjects and a more unstructured stimulus situation, the results of the experiment might have been even more positive. However, neither Haggard and Rose (1944) nor Haggard and Babin (1948) reported significant increases in extent of movement associated with motor reinforcement. Increases for motor reinforced subjects were listed only as being of greater magnitude than non-motor-reinforced subjects. The significant increases which they reported lay with their previously mentioned index of conditioning measure.

## REFERENCES


Bahrick, H. P., Fitts, P. M., and Rankin, R. E. Effects of incentives upon reactions to peripheral stimuli. J. Exp. Psychol., 1952, 44, 400-406.

Brown, J. S. The Motivation of Behavior. New York: McGraw Hill, 1961.

Bruner, J. S., and Goodman, C. C. Value and need as organizing factors in perception. J. Abnorm. Soc. Psychol., 1947, 42, 33-44.

Bruner, J. S., and Rodriques, J. S. Some determinants of apparent size. J. Abnorm. Soc. Psychol., 1953, 48, 17-24.

Carter, L. F., and Schooler, K. Value, need and other factors in perception. Psychol. Rev., 1949, 56, 200-207.

Crutchfield, R. S., and Edwards, W. The effect of a fixated figure on autokinetic movement. J. Exp. Psychol., 1949, 39, 561-567.

Farrow, B. J., and Santos, J. F. Changes in autokinetic perception as a function of the transfer of conditioning effects. Brit. J. Psychol., 1962, 53(3), 331-337.

Haggard, E. A., and Babin, R. On the problem of "reinforcement" in conditioning the autokinetic phenomenon. J. Exp. Psychol., 1948, 38, 511-525.

Haggard, E. A., and Rose, G. J. Some effects of mental set and active participation in the conditioning of the autokinetic phenomenon. J. Exp. Psychol., 1944, 34, 45-59.

Postman, L. J. The experimental analysis of motivational factors in perception. In Current Theory and Research in Motivation a Symposium. Lincoln, Nebraska: University of Nebraska Press, 1953. 59-108.

Proshansky, H. and Murphy, G. The effects of reward and punishment on perception. J. Psychol., 1942, 13, 295-305.

Sherif, M. A study of some social factors in perception. Arch. Psychol., 1935, 27, No. 187.

Siegel, S. Nonparametric Statistics for the Behavioral Sciences. New York: McGraw-Hill, 1956.

Winer, B. J. Statistical Principles in Experimental Design. New York: McGraw-Hill, 1962.

## APPENDIX A

### FREQUENCIES OF ESTIMATES IN INCHES MADE BY GROUP 1 SUBJECTS UNDER PHASE II (a) AND PHASES III AND IV (b) SUBJECTS

| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | T | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | a | b | a | b | a | b | a | b | a | b | a | b | a | b | a | b |
| 0 | 1 | | | | | | | | | | | | 2 | | 3 | |
| 1 | | | | | | | | | | 2 | 7 | 7 | 4 | 2 | 11 | 11 |
| 2 | | | | | 1 | 1 | | | 1 | 4 | 6 | 18 | 4 | 14 | 12 | 37 |
| 3 | 1 | | 1 | | 2 | 4 | | | 1 | 6 | 2 | 5 | 3 | 13 | 10 | 28 |
| 4 | | 1 | | | 1 | 5 | 1 | | 2 | 4 | | | 2 | 1 | 6 | 11 |
| 5 | 4 | 2 | 3 | | 6 | 12 | | 2 | 3 | 7 | | | | | 16 | 23 |
| 6 | 2 | 2 | | | 3 | 4 | | | 2 | 3 | | | | | 7 | 9 |
| 7 | 3 | 2 | 1 | 1 | 2 | 3 | 2 | 2 | 1 | 1 | | | | | 9 | 9 |
| 8 | 1 | 5 | 1 | 2 | | 1 | 3 | 8 | | | | | | | 5 | 16 |
| 9 | 1 | 12 | | | | | | 2 | 2 | 2 | | | | | 3 | 16 |
| 10 | 1 | 4 | 1 | 4 | | | | 8 | | | | | | | 2 | 16 |
| 11 | 1 | 2 | | 1 | | | | 1 | | | | | | | 1 | 4 |
| 12 | | | 5 | 5 | | | 3 | 4 | 2 | | | | | | 10 | 9 |
| 13 | | | | 7 | | | | | | 1 | | | | | | 8 |
| 14 | | | 1 | 4 | | | 1 | 1 | 1 | | | | | | 3 | 5 |
| 15 | | | | 4 | | | 1 | | | | | | | | 1 | 4 |
| 16 | | | 1 | 2 | | | 2 | 1 | | | | | | | 3 | 3 |
| 17 | | | 1 | | | | | | | | | | | | 1 | |
| 18 | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | |
| 24 | | | | | | | 2 | 1 | | | | | | | 2 | 1 |
| 25 | | | | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | |
| T | 15 | 30 | 15 | 30 | 15 | 30 | 15 | 30 | 15 | 30 | 15 | 30 | 15 | 30 | 105 | 210 |

## APPENDIX B

### FREQUENCIES OF ESTIMATES IN INCHES MADE BY GROUP 2 SUBJECTS UNDER PHASE II (a) AND PHASES III AND IV (b) SUBJECTS

| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | T | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | a | b | a | b | a | b | a | b | a | b | a | b | a | b | a | b |
| 0 | | | | | | | | | 1 | | 1 | | | | 2 | |
| 1 | 1 | 2 | | 2 | | | 2 | 3 | 3 | 14 | | 3 | | | 6 | 24 |
| 2 | 4 | 11 | | 5 | | 1 | 2 | 8 | 8 | 12 | | 8 | | 1 | 14 | 46 |
| 3 | 6 | 7 | | 7 | 2 | 1 | 2 | 5 | 3 | 3 | 3 | 5 | | | 16 | 28 |
| 4 | 3 | 5 | 7 | 4 | 3 | 4 | 5 | 10 | | 1 | 2 | 10 | | | 20 | 34 |
| 5 | | 3 | 2 | 4 | 3 | 4 | 1 | | | | 1 | | | 1 | 7 | 12 |
| 6 | | 1 | 3 | 6 | 2 | 7 | 2 | 3 | | | 6 | 3 | | 1 | 13 | 21 |
| 7 | 1 | 1 | 3 | 2 | 1 | 6 | | | | | | | 1 | | 6 | 9 |
| 8 | | | | | 3 | 3 | | | | | 1 | | | 2 | 4 | 5 |
| 9 | | | | | | 3 | | | | | | | | | | 3 |
| 10 | | | | | 1 | 1 | | 1 | | | | 1 | 1 | 1 | 2 | 4 |
| 11 | | | | | | | | | | | | | 1 | | 1 | |
| 12 | | | | | | | | | | | 1 | | | 1 | 1 | 1 |
| 13 | | | | | | | | | | | | | 2 | | 2 | |
| 14 | | | | | | | 1 | | | | | | | | 1 | |
| 15 | | | | | | | | | | | | | 1 | 4 | 1 | 4 |
| 16 | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | 1 | | 1 |
| 19 | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | 2 | 8 | 2 | 8 |
| 21 | | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | 1 | | 1 |
| 23 | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | 2 | 4 | 2 | 4 |
| 26 | | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | 2 | 4 | 2 | 4 |
| 31 | | | | | | | | | | | | | | | | |
| 32 | | | | | | | | | | | | | | | | |
| 33 | | | | | | | | | | | | | | | | |
| 34 | | | | | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | 1 | 1 | 1 | 1 |
| 36 | | | | | | | | | | | | | | | | |
| 37 | | | | | | | | | | | | | | | | |

APPENDIX B "Continued"

| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | T | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | a | b | a | b | a | b | a | b | a | b | a | b | a | b | a | b |
| 38 | | | | | | | | | | | | | | | | |
| 39 | | | | | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | 2 | | 2 | |
| T | 15 | 30 | 15 | 30 | 15 | 30 | 15 | 30 | 15 | 30 | 15 | 30 | 15 | 30 | 105 | 210 |

VITA

Donald Mount Russell

Candidate for the Degree of

Master of Science

Thesis: MOTOR REINFORCEMENT AS REWARD IN CONDITIONING THE AUTOKINETIC PHENOMENON

Major Field: Psychology

Biographical:

Personal Data: Born in Enid, Oklahoma, October 19, 1938, the son of Mr. and Mrs. Roy C. Russell

Education: Graduated from Enid High School, Enid, Oklahoma in May, 1956. Attended Oklahoma State University from September, 1956 to May, 1961 receiving the Bachelor of Science degree in 1961 with a major in Business Administration. Attended Oklahoma State University in 1965 receiving the Bachelor of Science degree in August, 1965 with a major in psychology. Completed requirements for the Master of Science degree at Oklahoma State University in May, 1970.