1959

A Study of Hallucinations and the Sense Modality Used in Learning.

Arthur Rogers
Louisiana State University and Agricultural & Mechanical College

Follow this and additional works at: https://digitalcommons.lsu.edu/gradschool_disstheses

Recommended Citation
https://digitalcommons.lsu.edu/gradschool_disstheses/524

This Dissertation is brought to you for free and open access by the Graduate School at LSU Digital Commons. It has been accepted for inclusion in LSU Historical Dissertations and Theses by an authorized administrator of LSU Digital Commons. For more information, please contact gradetd@lsu.edu.
A STUDY OF HALLUCINATIONS AND THE SENSE MODALITY USED IN LEARNING

A Dissertation

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy

in

The Department of Psychology

by

Arthur Rogers
B.S., University of Florida, 1950
M.A., University of Florida, 1952
January, 1959
ACKNOWLEDGMENT

The writer is indebted to Dr. Irwin A. Berg for his initial interest in the study, and to Dr. T. W. Richards for his invaluable guidance and assistance in the preparation of this dissertation.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>TITLE PAGE</th>
<th>i</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENT</td>
<td>ii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>v</td>
</tr>
</tbody>
</table>

## CHAPTER

I  INTRODUCTION  1

II  METHOD OF PROCEDURE  4

Subjects  4

Experimental Procedure  5

III  RESULTS  9

IV  CONCLUSIONS AND DISCUSSION  16

REFERENCES  21

APPENDIX A  22

APPENDIX B  27

VITA  28
<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>10</td>
</tr>
<tr>
<td>II</td>
<td>12</td>
</tr>
</tbody>
</table>

**I  Mean Error Scores Made in Each Learning Situation by the Three Groups**

**II Mean Error Decrement Scores for Groups Under Each Condition**
ABSTRACT

A study was made on the influence of the relevancy of interpolated learning on retention with normals, auditory hallucinatory schizophrenics, and nonhallucinatory schizophrenics. Particular interest was directed toward the effect of this factor as related to the type of imagery used in learning. Each individual was subjected to all of the following learning conditions:

1. Auditory initial learning, visual interpolated learning, auditory relearning;
2. auditory initial learning, auditory interpolated learning, auditory relearning;
3. visual initial learning, visual interpolated learning, visual relearning;
4. visual initial learning, auditory interpolated learning, visual relearning.

Specific hypotheses were tested and the following conclusions reached:

1. With normal subjects relevant interpolated learning exerted significantly greater retroactive inhibitory effects than nonrelevant interpolated learning;
2. nonhallucinatory schizophrenics showed minimal retroactive inhibition under all conditions;
3. hallucinatory schizophrenics showed maximal retroactive inhibition under all conditions;

4. auditory hallucinatory patients partially translate visual stimuli into auditory imagery.

Implications for the selection of candidates for psychotherapy were discussed.
CHAPTER I

INTRODUCTION

The major problem in this study is to determine whether schizophrenic patients with a recent history of auditory hallucinations tend to utilize auditory imagery in learning to a greater extent than nonhallucinatory schizophrenics and normals. The implication is that the sense modality in which the hallucinations occur assumes major importance in interpreting the environment. This would increase the patient's distortion through the interaction of percepts and hallucinations.

Previous studies (3, 4) of the relationship between imagery and hallucinations with schizophrenics have used defined stimuli, but relied on the subject's introspective report for the essential data. Such a technique makes the questionable assumption that the patient can view his own thinking objectively. Since schizophrenic patients have difficulty in formulating the boundaries between themselves and the environment, and since hallucinations are a means of avoiding "looking in one's self" the use of introspection seems to be of dubious value. The equivocal results obtained by this method suggest the need for a different approach.

A study of the differences in learning and retention between hallucinatory schizophrenics on the one hand, and
nonhallucinatory patients and normals on the other, provides a means of exploring the use of imagery without relying on introspective reports. This method, essentially, provides information about the effects of the type of imagery used rather than directly revealing the subject's appraisal of his "thinking" processes. The way in which a person learns provides information about how he sees and interprets his more general environment.

In order to evaluate the schizophrenic subjects' performance a comparison with normal subjects is necessary. It is essential to determine if schizophrenic patients generally learn in a way different than normals. Furthermore, the differences in learning between the hallucinatory and non-hallucinatory patients will then demonstrate the effects of the experimental variable, the recent history of auditory hallucinations.

Since patients with hallucinations may differ from other patients only when a particular sense modality is operative in learning, a parallel study of the learning in another major sense modality is essential.

The sensory modality used in interpolated learning (5, 6) provides a basic means for determining whether retroactive interference is differentially affected by the type of imagery used in learning. It is hypothesized that with "normal" human subjects when the sense modality used in interpolated learning is the same as that used in initial
learning the retroactive interference will be maximal. It is further hypothesized that with hallucinatory subjects interference will occur through retroactive inhibition even when a nonrelevant receptor is used peripherally in the intervening learning. The hallucinatory subject essentially translates the learning into auditory imagery regardless of the sensory stimuli.

If an auditory hallucinatory patient is presented with nonrelevant sensory stimulation in the intervening period of a learning-relearning problem and the interference is greater than with controls, this would be evidence that the subject has translated the stimuli into auditory imagery.

Hypotheses to be tested in this study.

1. In normal subjects relevant interpolated learning will exert greater retroactive inhibitory effects than will nonrelevant interpolated learning.

2. Nonhallucinatory schizophrenics will demonstrate the effects of relevancy of the interpolated learning in the same direction as normals.

3. With hallucinatory schizophrenics both relevant and nonrelevant interpolated learning will exert retroactive inhibitory effects comparable to the effects of relevant interpolated learning in normals.
 Subjects

Three groups of twelve subjects each were used: group I, auditory hallucinatory schizophrenics; group II, non­hallucinatory schizophrenic controls; group III, normal controls. All subjects were randomly selected from within their defined populations. The hallucinatory schizophrenic group (HSP) consisted of twelve patients with a primary diagnosis of Schizophrenic Reaction each of whom had in his history the report of auditory hallucinations not more than three months prior to the use of the subject in this study. These patients had no history of hallucinations other than auditory.

The nonhallucinatory schizophrenic group (NSP) consisted of twelve patients from the same hospital as HSP. These subjects had a primary diagnosis of Schizophrenic Reaction without hallucinatory symptomatology in any sense modality.

No patients with toxic psychoses, feeblemindedness, or demonstrable organic involvement were used in HSP or NSP. Three sources of information were used to determine the presence of hallucinations; the case history, the ward
psychiatrist's report, and an interview with the individual patient. If there was any reasonable doubt as to the presence of hallucinations, the patient was not used as a subject. Two additional population parameters were defined: the age range was from twenty years through forty, and the patient had to be sufficiently intact to understand and to follow the directions. Patients who were unable to comprehend the task or to follow the directions were eliminated as subjects after the first session.

The control group (CN) were selected from a population with an age range of twenty through forty years. "Normal" was defined operationally as nonhospitalized. Eleven of the twelve subjects in this group were hospital employees.

Experimental Procedure

The experimental task for the subject was the learning of twelve pairs, each of which consisted of a three letter consonant syllable and a number. Discrete consonant syllables were used for each of the eight learning tasks, the four initial learning tasks and the four interpolated learning tasks. The syllables were derived from Witmer's Tables and were equated for difficulty. A session consisted of initial learning, interpolated learning and relearning. The presentation of the learning material was either visual or auditory, and the interpolated learning was either in the relevant, or nonrelevant sense modality. There were thus
four series as follows:

<table>
<thead>
<tr>
<th>Initial Learning</th>
<th>Interpolated Learning</th>
<th>Relearning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Auditory A</td>
<td>Visual E</td>
<td>Auditory A</td>
</tr>
<tr>
<td>2. Auditory B</td>
<td>Auditory F</td>
<td>Auditory B</td>
</tr>
<tr>
<td>4. Visual D</td>
<td>Auditory H</td>
<td>Visual D</td>
</tr>
</tbody>
</table>

Each subject was assigned to each of the four situations in random order.

Immediately prior to the first session the subject was given initial general instructions outlining the tasks. This was followed by instructions specific to each new task immediately preceding the presentation. These instructions included the basic response procedure and the range of the response numbers. Each trial consisted of the twelve stimulus response pairs. In each trial each stimulus word presented was followed by a three second response time and then the correct response. A twelve second interval was used between trials. The same order of stimuli was maintained in each of the learning and relearning trials.

A maximum of twenty trials was permitted respectively on the initial learning, relearning and interpolated learning. If the criterion of five errorless trials was reached by the fifteenth to nineteenth trial respectively on the initial learning and interpolated learning tasks, no further trials were given for that task. A criterion of five correct trials was also used on relearning. If the criterion
was met and the task was completed in less than twenty trials, the remaining trials were assumed to be errorless. This was done largely to avoid fatigue, boredom and resistance.

For the visual presentation a memory drum and response panel were used. The stimulus was presented visually for three seconds during which the subject made the response. This was followed by a three second visual presentation of the stimulus syllable and the correct response number. The subject responded to the stimulus by pressing a button in front of the desired response number. The response numbers were serially listed in front of the subject.

For the auditory presentation a tape recorder was used. The syllable was spelled orally, followed by a three second response time, and then the correct numerical response was given orally. The total time for each stimulus-response pair was six seconds. The subject's response was made orally and consisted of a number. The subjects were initially told the range of the correct series of numbers for the task. These numbers were not continuously present during the trials, but the range was repeated in the intertrial interval either upon request or when the subject's responses suggested confusion in this area.

The visual and auditory tasks differed in two respects: the response numbers were continuously shown to the subject during the visual task, while not present during the auditory
task; a motor response was made to the visual stimulus, and an oral response to the auditory stimulus. These differences were made to limit the learning to one of the two experimentally relevant modalities. Creating comparable response methods would have necessitated the partial use of the other relevant modality. For example, if the response were given verbally in the visual task reinforcement would be partially auditory; the subject would hear the response. The learning would be in both of the experimentally discrete sensory modalities.

The subject's responses were recorded by the experimenter on mimeographed data sheets. The raw data consisted of the total number of errors respectively on the initial learning and relearning tasks (Appendix A). An error was defined as a nonresponse, an incorrect response, or a correct response made during the presentation of the paired number. The latter was recorded as a nonresponse. If a response were changed during the response time, the last response was recorded.

The data for statistical purposes consisted of the individual's error score on the initial learning and relearning, and the error decrement score between the initial learning and relearning. In the latter data a minus score indicated a lower error score on the initial learning than on the relearning (Appendix B).
CHAPTER III

RESULTS

The basic raw data consisted of the number of errors made by each subject respectively on initial learning and relearning for each of the four situations (Appendix A). The means for these data indicate the overall direction of the changes between the learning tasks as dependent upon or related to the relevancy of the interpolated learning (Table I). Furthermore, the differences between groups in the amount of initial learning are apparent.

By examining Table I, for example, it is seen that the auditory hallucinatory group (HSP) achieved on original auditory learning an error score of 142.5. In the relearning situation this group with relevant interpolated learning achieved an error score of 137.3, and with nonrelevant interpolated learning an error score of 91.3.

A fundamental interest of the study was the determination of the influence of the relevance of interpolated learning on retention. The error decrement score between initial learning and relearning directly reflects the amount and direction of these changes. The primary statistical analyses were made using this difference score for each individual within the groups (Appendix B). The means of these
TABLE I

MEAN ERROR SCORES MADE IN EACH LEARNING SITUATION
BY THE THREE GROUPS

<table>
<thead>
<tr>
<th></th>
<th>HSP</th>
<th></th>
<th>NSP</th>
<th></th>
<th>CN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Visual</td>
<td></td>
<td>Auditory</td>
<td></td>
</tr>
<tr>
<td>Initial learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>134.2</td>
<td>142.5</td>
<td>117.5</td>
<td>124.8</td>
<td>78.1</td>
<td>66.9</td>
</tr>
<tr>
<td>Relearning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relevant</td>
<td>85.1</td>
<td>137.3</td>
<td>63.8</td>
<td>82.2</td>
<td>32.6</td>
</tr>
<tr>
<td>Nonrelevant</td>
<td>85.4</td>
<td>91.3</td>
<td>50.2</td>
<td>58.7</td>
<td>22.4</td>
</tr>
</tbody>
</table>
scores are presented in Table II and are comparable to the error scores in Table I. These difference scores are inversely related to the degree of interference by the interpolated learning. Thus, the higher scores reflect greater retention and therefore less retroactive inhibition.

The differences in initial learning made a direct comparison between groups difficult because of its direct effect on the relearning error score (Table I). Furthermore, the considerable variance in initial learning, particularly among the schizophrenic groups, essentially added to the variance in relearning error scores. The use of difference scores eliminated the factor of the degree of initial learning and essentially made the data comparable from group to group. The initial learning error score, however, served as a limiting factor: with positive retention the difference score could not exceed the initial learning error score.

The normals (CN) learned as predicted in hypothesis I; relevant interpolated learning resulted in greater retroactive inhibition than did nonrelevant interpolated learning (Tables I and II). A two way analysis of variance of the difference scores for relevant and nonrelevant intervening learning yielded an $F = 11.2, p > .005; 1,46$ df. This difference was significant for each of the modalities used in initial learning. This analysis with only visual tasks yielded a one tail $t = 2.6, p < .01; 22$ df. The comparable
<table>
<thead>
<tr>
<th></th>
<th>HSP</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Visual</td>
<td>Auditory</td>
<td>Visual</td>
<td>Auditory</td>
<td>Visual</td>
<td>Auditory</td>
</tr>
<tr>
<td>Relevant</td>
<td>47.2</td>
<td>11.7</td>
<td>57.0</td>
<td>48.2</td>
<td>36.1</td>
<td>29.2</td>
</tr>
<tr>
<td>Nonrelevant</td>
<td>50.7</td>
<td>44.6</td>
<td>64.2</td>
<td>60.6</td>
<td>65.1</td>
<td>61.1</td>
</tr>
</tbody>
</table>

TABLE II

MEAN ERROR DECREMENT SCORES FOR GROUPS
UNDER EACH CONDITION
analysis with auditory tasks yielded a one-tailed \( t = 2.2, p < .02; 22 \text{ df}. \)

The nonhallucinatory schizophrenics (NSP) showed a trend toward greater retroactive inhibition when relevant intervening learning was used, but a two-way analysis of variance yielded chance differences (Table I & II). This failed to offer significant support to hypothesis II that nonhallucinatory schizophrenics will show differential retroactive inhibition as a product of the relevance of the interpolated learning in the same direction as normals. When the modalities were analyzed discretely, visual tasks yielded a one-tailed \( t = .6, p < .30; 22 \text{ df}; \) and auditory tasks yielded a one-tailed \( t = 1.0, p > .15; 22 \text{ df}. \) However, these scores, rather than demonstrating maximal retroactive inhibition under the two experimental conditions, appear to be the product of minimal retroactive inhibition under both conditions. An analysis of variance and two-tailed \( t \) test of the difference scores between NSP and CN when nonrelevant interpolated learning was used yielded an \( F = .014, p > .20; t = .12, p > .80; 1,46 \text{ df}. \) The comparable analysis when relevant interpolated learning was used yielded a \( t = 2.18, .05 > p > .02; 1,46 \text{ df}. \) Thus the NSP scores under all conditions tended to approximate the minimal retroactive inhibition shown by normals when nonrelevant interpolated learning was used.

HSP was similar to NSP and CN in showing only chance
differences in initial learning as a product of the modality used. However, HSP differed from NSP and CN in that the differential effect of relevant and nonrelevant interpolated learning is dependent upon the modality used in initial learning (Tables I & II). When initial learning was visual there was essentially no difference in retention as a product of the relevancy of the sense modality used in the intervening learning; the analysis yielded a $t = .24, p > .80; 22$ df. A marked trend in the direction of a differential effect from relevancy was shown when auditory learning was used, the $t = 1.85, .10 > p > .05; 22$ df. (If this trend had an equivalent $t$ with a large sample, the $p > .03$). A two-tail $t$ test using combined visual and auditory learning difference scores for relevant versus nonrelevant interpolated learning yielded a $t = 1.54, .15 > p > .10; 46$ df.

Although the differential effect of the relevance of interpolated learning is not clearly established, comparison between HSP and CN, and HSP and NSP offer some explanations of the causative factors. Since NSP and CN differed only by chance in the effect of nonrelevant intervening learning, HSP was contrasted with the combined groups. This two-way analysis of variance yielded an $F = 4.20, .05 > p > .02; t = 2.05, p < .025; 1,70$ df. Tables I and II show that HSP have greater interference from nonrelevant interpolated learning than do the other groups. Furthermore, when relevant interpolated learning was used, a comparison of HSP and
CN yielded a $t = .28, p > .70; 46 \text{ df}$; thus demonstrating equivalent retroactive interference under these conditions. This conclusion finds additional support in the $t$ test between HSP and NSP, when relevant interpolated learning was used, which yielded a $t = 2.18, .05 > p > .02; 46 \text{ df}$. Therefore, HSP differs from both CN and NSP in that HSP tends to have maximal interference from interpolated learning under all conditions. This offers support to hypothesis III that both relevant and nonrelevant interpolated learning exert retroactive inhibitory effects comparable to the effects of relevant interpolated learning in normals.
CHAPTER IV

CONCLUSIONS AND DISCUSSION

This experiment was an attempt to investigate the influence of the relevancy of the sense modality used in interpolated learning on retention. A further problem was to determine if hallucinatory schizophrenics and nonhallucinatory schizophrenics differ from each other and from normals in the way in which they learn.

The three groups show marked differences in their learning. As would be expected, normals learn with fewer errors than do the schizophrenic groups. More importantly for this study, normals show a differential effect in retention as dependent upon the relevancy of the interpolated learning. Maximal interference is shown when interpolated learning is relevant. Nonhallucinatory schizophrenics, on the other hand, show minimal retroactive inhibition regardless of the relevance of the interpolated learning, although there is a trend for relevant intervening learning to cause greater retroactive inhibition. Hallucinatory schizophrenics, in direct contrast to nonhallucinatory schizophrenics, show maximal retroactive inhibition with interpolated learning regardless of the relevance of the interpolated learning. This supports the basic hypothesis
that hallucinatory patients essentially translate learning into imagery in one dominant sense modality.

The differences in the effect of relevance in HSP as a product of the modality used in the initial learning indicates the type of imagery used in learning. If the translation of learning into a sense modality is partial rather than complete, the discrepancy between what occurred with visual and with auditory initial learning can be explained. Thus, if with initial visual learning there is a partial translation into auditory imagery there will be a comparable translation in visual interpolated learning. Therefore, interference with retention will be related to both interference with the visual and auditory imagery. The interpolated auditory learning under these same conditions will only interfere with the learning which was translated into auditory terms. The greater interference by relevant intervening learning with initial auditory learning can be explained in the same manner. In this case the same imagery modality is used in both initial and interpolated learning so that, as was shown with normals, interference would be maximal. When visual nonrelevant interpolated learning occurs there is again a partial translation into auditory imagery which results in relatively significant interference, but not as maximal an interference as when the imagery is in the same modality to a greater degree. Therefore, contrary to the results of experiments using introspection with
hallucinatory patients, it is concluded that schizophrenics with auditory hallucinations have predominant auditory imagery and do translate learning into auditory terms.

This partial translation of stimuli into auditory terms by auditory hallucinatory schizophrenics may have marked psychological effects beyond the attributing of conflictual material to the nonself. Schizophrenics, according to some theorists (1, 2), live in a basically amorphous environment in which their "reality" and egoboundaries are indefinite and subject to fluctuation. With hallucinations, as demonstrated in this study, interference with prior learning occurs relatively more easily. Therefore, in order to function these patients appear to develop a secondary symptom of schizophrenia, hallucinations, as a defense, as a mode of structuring their ill defined world. The hallucinations are perhaps the most stable facet of their environment, and are in the auditory modality. Thus, the hallucinations are literally in a place where they can and do disrupt the imagery accompanying new learning when it is not in agreement with the hallucinations. The hallucinations are more intense affectively than other perceptions, are a result of strong psychological need, are generally more frequent, and are older than learning, such as in psychotherapy, which is in conflict with the hallucinatory content. Thus, the hallucinations tend to supersede new learning by interfering with its retention. Reality is
either forced to conform to the hallucinations or is denied.

The nonhallucinatory schizophrenic is faced with essentially the same amorphous, ill defined environment as the hallucinatory schizophrenics. The results of this study suggest that their means of maintaining stability is essentially diametrically opposed to that of hallucinatory patients. The relative lack of interference from interpolated learning suggests that nonhallucinatory patients tend to compartmentalize learning so that it is minimally subject to change. The schizophrenic continues prior behavior in relatively unchanged fashion despite the impact of surrounding reality. Their reality is already established, to change is to be in an amorphous world—as in severe psychoses.

These results suggest that nonhallucinatory schizophrenic patients, who on learning tasks show a significantly greater inhibitory effect from relevant than from nonrevelant interpolated learning, would be more amenable to change, and thus be better therapeutic candidates. With hallucinatory patients those who show interference from nonrelevant learning which approximates normals would be better therapeutic prospects in that the hallucinations could not be as disruptive to new learning. The translation into auditory terms would be less.

Support for the hypothesis that significantly greater interference from relevant than from nonrelevant interpolated
learning is an important therapeutic sign is found in "normals" who approximate this. "Normals" are more amenable to change than schizophrenics who have to stabilize their environment and, therefore, avoid change.

Although the attributing of such importance for the therapeutic prognosis to the mode of learning is an oversimplification, it seems to offer sufficient merit in the difficult world of therapy case selection to warrant further investigation.
REFERENCES


VITA

Name: Arthur Rogers

Born: June 22, 1930 in Garden City, New York

Education: B.S., University of Florida, 1950
           M.A., University of Florida, 1952

Positions: Intern and Jr. Clinical Psychologist at Mansfield State Training School and Hospital,
           Mansfield Depot, Conn., 1953-54.
           Fellow in Clinical Psychology, Southeast Louisiana Hospital, Mandeville, Louisiana, 1956-1958.
           Staff Psychologist, LaRue Carter Memorial Hospital, Indianapolis, Indiana, 1958-

Professional Affiliation: Louisiana Psychological Association.
Candidate: Arthur Rogers

Major Field: Psychology

Title of Thesis: A Study of Hallucinations And The Sense Modality Used In Learning

Approved:

Thomas W. Tilden
Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

Donald J. Lewis

C. E. Young

Berg

Date of Examination:

January 6, 1959