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Visual And Stereognostic Perception Of Mentally Retarded Adolescents

Patricia Moehrig Mershon

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1968
This dissertation, directed and approved by the candidate's committee, has been accepted by the Graduate Committee of The University of New Mexico in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

VISUAL AND STEREOGNOSTIC

PERCEPTION OF MENTALLY RETARDED ADOLESCENTS

Title

Patricia Moehrig Mershon

Candidate

Education

Brian E. O'Neill

Dean

May 30, 1968

Date

Committee

Miles V. Zinz

Fred M. Chemest

Florence Schroeder

peg. M. Bece

Lorna A. Bragdon

Chairman
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BY
PATRICIA MOEHRIG MERSHON
B.S. University of New Mexico, 1960
M.A. University of New Mexico, 1965

DISSERTATION
Submitted in Partial Fulfillment of the
Requirements for the Degree of
Doctor of Philosophy in Education
in the Graduate School of
The University of New Mexico
Albuquerque, New Mexico
June 1968
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ABSTRACT

The Problem

The purpose of this study was to investigate the effect of sensory modality training on institutionalized mentally retarded adolescents. The primary investigation concerned the effect on retardates of sensory modality training with an opportunity for learning when compared to the effect on a comparable group given the same training with no opportunity for learning. The secondary investigation was the comparison of responses of three groups on the criterion task; one group having been trained with a tactual modality, one with a visual modality and one with combined tactual and visual modality. The sample included an equal number of males and females and the sex difference in performing the criterion task was investigated.

The Hypotheses

The hypotheses of the study were: (1) A group of retarded adolescents presented with a sensory task with an opportunity for learning will not score significantly different than a comparable group presented with the same sensory task with no opportunity for learning; (2) There will be no significant difference in the scores obtained by groups of subjects when subdivided according to sensory task methods, i.e., visual, stereognostic and visual/stereognostic; (3) There will be no significant difference in scores obtained by subjects of different sex when
compared by task; (4) There will be no significant difference in scores obtained by subjects of different sex when compared by method.

Procedures

The study was divided into the following parts: (1) review of the pertinent literature; (2) selection of the subjects, administration of six sensory tasks with testing and compilation of the data; and (3) presentation, analysis and interpretation of the data.

The subjects used in this study were sixty enrollees at the Los Lunas Hospital and Training school. The subjects were randomly assigned to six treatment groups: (1) Visual treatment without training; (2) Stereognostic treatment without training; (3) Visual and stereognostic treatment without training; (4) Visual treatment with training; (5) Stereognostic treatment with training; and (6) Visual and stereognostic treatment with training.

Findings

The first of the four hypotheses of the study was rejected. The retarded adolescents who had been presented a task with an opportunity for learning scored significantly higher than a comparable group presented the same task with no opportunity for learning. An F-score of 7.43 established significance at the .01 level of confidence.

The remaining three hypotheses were accepted. There was
no significant difference in the scores obtained by groups of subjects when subdivided according to sensory task methods, i.e., visual, stereognostic and visual/stereognostic. There was no significant difference in the recall of males and females, when measured by the task method (i.e., learning and no learning). Nor was there a significant difference in the recall of males and females when measured by the sensory method (i.e., visual, stereognostic, and visual/stereognostic).

**Recommendations**

In measuring the recall of dual sensory modality learning, verbalization was avoided to minimize the variables in the present research; however, it is recommended that the effect of verbalization used in conjunction with stereognostic training be investigated.

The influence of age, etiology, and institutionalization as they effect learning should be determined. In the present research, no significant difference was observed between the scores of cultural-familial retardates and those of organic retardates. This may have been caused by the small size of the sample, and it is recommended that such a study be conducted with a larger group.

Although the stereognostic sensory modality did not appear significantly more effective than the visual sensory modality in the present research, nevertheless trends in the results indicate a need for additional study in this area using
larger samples. It is also recommended that the effect of stereognostic training on pre-vocational concepts be studied.
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CHAPTER I

INTRODUCTION

The latest report to the President by the committee on Mental Retardation\(^1\) stated that 89 per cent of the total number of mental retardates are considered mildly retarded. At the present time this 89 per cent comprises no less than six million individuals in need of training for job-placement! Effective training programs initiated at an early age will enable a large proportion of these individuals to become self-sufficient.

According to Ellis,\(^2\) Spitz,\(^3\) and O'Connor and Hermelin\(^4\) one of the most serious learning problems for the retarded is his inability to assimilate data. Ellis attributes this deficiency to what he describes in the literature as "stimulus trace." His theory assumes that there is a lack of adequate reverberating circuits in the damaged brains of mentally subnormal individuals, defined in this study as those with I.Q.'s

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between 40 and 60. This lack of reverberating circuits would inhibit the individual in solving problems requiring memory skills. Ellis's theory explains the need for additional "over-learning" in the instruction of retardates. Instruction by over-learning, he theorizes, causes a structural change in the nervous system whereas short-term memory depends on a temporary reverberatory state of the unchanged nervous system.

House and Zeaman also have shown interest in the problem of attention as affecting discrimination learning. They describe discrimination learning in retarded children as requiring: ¹

The acquisition of a chain of two responses: (1) attending to the relevant stimulus dimension, and (2) approaching the correct cue of that dimension. The difficulty that retardates have in discrimination learning is related to limitations in the first, or attention phase of the dual process rather than the second.

House and Zeaman's research is based on theories of perception described by Wycoff,² Burke and Estes,³ and Bush and Mosteller.⁴ The technique was developed from Harlow's⁵ animal experiments.

The results of House and Zeaman's research indicate that learning can be rapid once the retarded subject realizes what he is expected to learn.

To explore the effectiveness of learning in retardates, it is necessary to describe the modalities utilized in learning: i.e., vision, auditory, and kinesthetic. Various authorities state that the sense of sight is the most effective means of receiving information. Wepman finds a combination of the visual and auditory to be more effective. Though kinesthesia is not considered as effective as vision and hearing, according to Wepman, nevertheless it has proved to be effective in certain individual cases when there has been an impairment of the visual and/or auditory senses.

The kinesthetic method has been known and used since the time of Plato. In 65 B. C. Horace spoke of teaching children their letters through the use of tidbits of pastry made in the form of letters. About 1800 Itard taught Victor

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first to discriminate objects (i.e.: chestnut, penny, and a key) by the sense of touch, then to identify metal letters (i.e.: B and R) by touch.

Edward Seguin,¹ one of Itard's students developed a method described as "physiological." It was Seguin's belief that when the sense receptors were bombarded with sufficiently strong stimuli the child could comprehend even though he might be mentally retarded as a result of possible brain damage. Recent research has produced evidence that the extent of the brain-damage cannot be assumed by observation of the behavior of an individual. Minimal signs may be concomitant with extensive lesions of the brain. Cohn² demonstrated that severe damage to the right cerebral hemisphere had resulted in relatively minimal clinical signs, such as mild weakness to the left side of the individual, headaches, fainting spells, and inability to learn to read or write. Even though the mentally retarded subjects may show evidence of brain-damage, it is possible for a subject with gross developmental anomalies in the cortex to show no evidence of this damage through the senses.


Berkson\(^1\) tested the difference in duration threshold between normal and subnormal subjects by measuring the length of time a stimulus had to be presented visually before it is recognized in a choice situation. He found no significant difference in the responses of normal and subnormal subjects.

It was Seguin's belief that if the child received sufficient bombardment of the stimuli - the stimuli would get through the defective parts of the nervous system and reach the brain. If these sensations were repeated often enough the retarded mental condition of the subject would be "cured."\(^2\)

Maria Montessori\(^3\) built her approach to teaching on the work of Seguin by stimulating the senses. She attempted to isolate the sense receiving the training when possible. For example, the exercise on the sense of hearing was given more successfully not only in an environment of silence but also of darkness. A leaky faucet is never so obvious as during the night when the house is both quiet and dark. For her stereognostic exercise, Maria Montessori blindfolded the subject. More recently the kinesthetic approach has been used effectively for children with special reading problems. Fernald\(^4\) described the

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\(^1\)Berkson, "Responsiveness of the Mentally Deficient," *American Journal of Mental Deficiency*, LXVI (1961), 277-86.

\(^2\)Kolstoe, *op. cit.*, p. 151.


\(^4\)Fernald, *op. cit.*
use of the kinesthetic approach with children who are mentally
defective.

The research of O'Connor and Hermelin, \(^1\) has revealed
that the use of verbalization in the training of retarded
children increases their learning. Presentation of meaning-
ful materials followed by verbal identification is equated with
"insight into situations" as described by Osgood. \(^2\) Katona \(^3\)
showed that grouping materials according to a principle facili-
tates both learning and retention, while learning by rote not
only interferes with the solution of new problems, but brings
about negative transfer.

In his research with aphasics, Emanuel \(^4\) determined that
new materials elicited more perseverative responses than famil-
lar materials; however, when a verbal symbol was utilized to
indicate the new materials a decrease in the amount of

\(^{1}\)N. O'Connor and B. Hermelin, "Discrimination and Re-
versal Learning in Imbeciles," Journal of Abnormal and Social
Psychology, LIX (1959), 409-13; N. O'Connor and B. Hermelin,
"Like and Cross Modality Recognition in Subnormal Children,"
Quarterly Journal of Experimental Psychology, XIII (1961),
48-52.

\(^{2}\)C. E. Osgood, Method and Theory in Experimental Psy-

\(^{3}\)G. Katona, Organizing and Memorizing (New York:
Columbia University Press, 1940).

\(^{4}\)Floyd W. Emanuel, "A Descriptive Study of Perservation
in a Small Group of Male Adult Aphasics" (unpublished Master's
thesis, Department of Speech, University of New Mexico, 1957).
perseveration was noted. O'Connor and Hermelin's recent research revealed that when verbal coding was utilized the visual stimulus became more meaningful to the subject.

Justification

Mention has been made of the necessity for adequate training of retarded individuals for job placement. The approach to the training of these individuals is of primary concern to the writer. How can new training methods be initiated? How can existing training methods be improved?

Little has been written on the most effective modalities for training mentally retarded subjects and there is no uniform support for any assumption that crossing sensory modalities significantly assists the memory in task achievement for these individuals.

The kinesthetic method has been utilized in training blind subjects but little experimentation has been attempted in the use of the kinesthetic methods in training mentally retarded. Nor does recent literature describe any research in the application of overlearning through the kinesthetic approach.

We have assumed, when sight is present, that this modality is the most useful for learning. A limited amount of research

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has been conducted in "cross modality" training but this re-
search has not taken into account the effect on retarded indi-
viduals of cross modality training with an opportunity for
learning.

The results of the present experiment will test whether
training in one modality and testing in a different modality is
more effective in evaluating the recall of retardates. Results
may show that stereognostic training when coupled with visual
recall is more effective than either modality used alone.

In summary, the justification of the study rests on the
recognition that the challenge of adequate training of the men-
tally retarded individuals in institutions and schools must be
met. Research is needed to determine the most effective meth-
ods of training and assessing recall. Such research should
also be used to discover alternate methods to be adopted in
the event of impairment of one or more sensory modality.

Statement of the Problem

The purpose of this study was to investigate the effect
of "cross modality" training upon the recall of mentally re-
tarded institutionalized adolescents. The study attempted to
determine the effect of this training by including two ap-
proaches to the tasks learned: Task A, without training, and
Task B, with training.

The following questions were studied:

1. What amount of recall results from a stereognostic
2. What amount of recall results from a visual task?
3. What is the effect of an opportunity for learning on the results of visual and stereognostic tasks?
4. What is the effect of sex difference on the responses to various sensory methods and tasks?

Definition of Terms

Auditory: Pertaining to the sense of hearing.

Cross modality: The shift in perception from one modality to another, i.e., identifying by sight a stimulus which has previously been felt.

Kinesthetic: Pertaining to the sense by which muscular motion, position, or weight are perceived.\(^1\)

Modality: A separate sense or sensory department, e.g., vision, audition.\(^2\)

Overlearning: Any learning beyond bare mastery.\(^3\)

Sensory task: Any test of the ability to convey nerve impulses from any of the sensory organs to the nerve centers and to interpret their meaning.


\(^3\)Ibid., p. 587.
Stereognostic: The faculty of perceiving and understanding the form and nature of objects by the sense of touch.1

Stimulus: Any objectively describable situation or event that is occasion for an organism's response.2

Perception: The process of becoming aware of objects, qualities, or relations by way of the sense organs.

Tactual: Pertaining to or accomplished by the sense of touch.3

Visual: Pertaining to vision or sight.

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2 Hilgard, op. cit., p. 596.
3 Dorlands, op. cit., p. 1504.
Hypotheses

The following null hypotheses were tested in this study at the .05 level of confidence.

1. A group of retarded adolescents presented with a sensory task with an opportunity for learning will not score significantly different than a comparable group presented with the same sensory task with no opportunity for learning.

2. There will be no significant difference in the scores obtained by groups of subjects when subdivided according to sensory task methods, i.e., visual, stereognostic and visual/stereognostic.

3. There will be no significant difference in scores obtained by subjects of different sex when compared by task.

4. There will be no significant difference in scores obtained by subjects of different sex when compared by method.

Delimitations of the Study

This study was limited to subjects who were pupils at the Los Lunas Hospital and Training School; therefore inferences made from this study should be restricted to populations of which this sample would be considered representative.

Organization of the Remainder of the Study

Chapter II presents a review of the literature related to this chapter. Chapter III discusses the method used in conducting this research. Chapter IV presents the analysis of the
data, and Chapter V the summary, conclusions, and recommendations for further research.
CHAPTER II

REVIEW OF RELATED LITERATURE

According to Osgood's language theory, the decoding process for stimuli is determined by visual, auditory and tactual methods. Encoding is expressed by speech and/or gesture.\(^1\) Decoding is determined by the extent of the development of "inner language." Myklebust describes "inner language" as: "the fundamental basis of symbolic behavior, and thereby a fundamental basis of human behavior."\(^2\) In the present research the importance of "inner language" is evident since the ability to retain the image of the non-representational stimulus is contingent upon the amount of inner language that has been developed by the subject. Since some verbalization was present in most of the subjects the ability for "inner language," as discussed by Myklebust will be assumed.

Recent writings have described verbal development as a sequence of mental processes of the highest form of internal subvocal speech which results in complex forms of judgment. According to Luria speech plays an important role in the


formation of mental processes. In fact, he states that being
given "the word" is prerequisite to developing the internal
verbal connections. He believes that the speech of the young
child has the function of planning and stimulating his activi-
ties.\footnote{A. R. Luria and F. Ia. Yudovich, \textit{Speech and the Develop-
ment of Mental Processes in the Child} (London: Staples Press,
1959), p. 11.} Piaget, on the other hand, refers to the speech of the
young child as "egocentric," merely accompanying the activity
of the child.\footnote{Jean Piaget, "Piaget's Fundamental Concepts and Strategy
of Research," \textit{Theories of Child Development}, ed. Alfred L.

The importance of verbalization in relation to task-
solving is evident from the literature. Rosenberg's research
led to the conclusion that in abstract task solution, when
using non-verbal stimulus material, the performance of normal
subjects was higher than that of the mentally defective.\footnote{Sheldon Rosenberg, "Problem-Solving and Conceptual Be-
havior," \textit{Handbook of Mental Deficiency}, ed. N. R. Ellis (New
York: McGraw-Hill, 1963).} Confirmation of Rosenberg's findings was made by O'Connor and
Hermelin. Their research showed that while trainable children
were impaired in their ability to recognize pictures which had
previously been presented to them and equally unable to dis-
tinguish between words recently heard, immediate improvement in
performance resulted when the two tasks were joined. Similar findings are reported by Spiker even when the stimuli were intrinsically similar. For example, when different names are given to two children who resemble each other, the task of discriminating their pictures is facilitated. According to this theory

... the verbal labels are responses attached to the two pictures and become parts of the stimulus pattern for later discrimination learning. Since the labels are distinct, the stimulus patterns including the labels are more distinctive than the same patterns without the labels. The research also showed that the more distinctive the names given the stimuli, the better the discrimination.²

The effect of "distinctiveness" training on a perceptual task was studied by Arnoult with negative results;³ and Cantor showed no change in results attributable to the designation of certain verbal labels attached to the stimuli. The subjects were not retarded and were able to report that they had been neither aided nor hindered in their identification of the stimuli.⁴ Due to the importance of visual and motor perception

¹ N. O'Connor and B. Hermelin, "Recognition of Shapes by Normal and Subnormal Children," op. cit., 281-84.
these two sensory modalities will be discussed separately.

**Visual Perception**

As stated in the introduction to this paper, there can be no doubt about the importance of the use of visual perception in learning. The first form of perception normally utilized is vision. An infant is able to perceive his environment visually long before he is able to explore it tactually.¹ Fantz examined infants between the ages of one week and fifteen weeks at weekly intervals to determine their interest and attention. A variety of stimuli from a simple circle to a complex scrambled face were introduced to the infant. These findings show that the attention of the infant is held longer by the "real" appearing face than by complex patterns which in turn were preferred to brightly colored circles. Using older normal adult subjects, in a visual image study, Sheehan determined that a large bright stimulus was re-constituted more clearly than a stimulus which was not as large and bright.² According to Hebb the ability to identify visual shapes is not perfected until the thirteenth year.³


Prior to his research on infant-behavior, Fantz had observed the visual behavior of newly hatched chicks. After observing the responses of 1,000 chicks to 100 different objects, he concluded that the preference for round objects is far greater than that for an odd assortment of shapes. Evidently this preference is in-born since it is evident at the time of hatching.¹

Other visual discrimination research has been conducted with chimpanzees and children. Harlow's research with chimpanzees has been extensive and informative.² House and Zeaman's studies of trainable children were conducted as a follow-up on Harlow's primate research. In an experiment to determine visual discrimination learning in young trainable children, House and Zeaman determined that mentally defective children were inferior to naive monkeys in learning a color-form object discrimination problem. Their study included thirty-seven institutionalized trainable children. The chronological ages of the subjects ranged from six years to twenty and the mental ages from two years to four and one-half years. The stimulus objects differed in form as well as color.³ The

¹Robert L. Fantz, "The Origin of Form Perception," op. cit.
techniques used were similar to those used by Harlow with naive monkeys.¹ Twenty-five trials each day were conducted until the subjects attained a score of twenty correct out of the twenty-five in one day, or failed after ten days. Only seventeen of these subjects learned the discrimination within ten days; whereas, all twelve monkeys in Harlow's comparable study learned the task within two days. Previous training had no effect on the performance of the subjects.²

Stevenson and Iscoe's research showed that normal children with mental ages from seven to eight years solve a visual discrimination problem faster than mentally defective subjects of the same mental age.³ Later research by Zeaman, et. al. testing a sample of forty-eight trainable children subjected them to several types of special training conditions to determine the nature of their discrimination learning. The findings are as follows:

Ability to name the positive and negative cues was related to ease of visual discrimination. However, a direct test of whether verbal labels mediated the discrimination learning could not be carried out because of the great amount of time it takes to teach color names to these subjects.

It was established that the introduction of novel

stimuli, either positive or negative, can facilitate discrimination learning. From this it was concluded that familiarity and novelty are discriminable aspects of stimuli.

Evidence was presented to show that failure of discrimination was not simply the result of a lack of the idea of the game (procedure), or a lack of necessary orientational and emotional habits. ¹

Zeaman's research identifies the primary requisite for the training of visual discrimination in retardates as that of gaining their attention. ² Holding the attention of retardates in a visual-recognition experiment was achieved by Hanfmann, et. al. through the use of real objects which could be put into action. Her research concluded that real objects, when offered in a mobile setting (example given: "lock with Key"), were recognized sooner than objects presented in a fixed setting. She also found that pictures representing people in action stimulated a response more readily than did pictures of objects. Hanfmann obtained a poor response in the recognition task and she attributed this result to the lack of a specific action. ³ Brabner studied the visual perception of hearing impaired children. The perceptual tasks involved the ability to


³Eugenia Hanfmann, et. al., "Case Lanuti: Extreme Conceptualization of Behavior Due to Damage of the Brain Cortex," Psychological Monographs, LVII, No. 4 (1944), 1-71
recognize "immediately" two kinds of visual stimuli (geometric line figures and geometric dot figures) projected tachistoscopically at varying exposure speed. These children showed normal recognition of line figures but were below normal in recognition of dot figures.\(^1\)

Isaac Jolles developed a curriculum to improve perception in mentally retarded and brain-damaged children using visual and motor perceptual skills.\(^2\) In comparing the results of auditory and visual intrasensory versus intersensory skills, Zigmond found that a group of dyslexic children learned visual intrasensory skills more quickly than either auditory intrasensory skills or auditory/visual intersensory skills. Zigmond attributed these findings to the inequality between auditory and visual intrasensory measures. Thus, the deficiencies in dyslexic children could be related to an auditory condition rather than specifically to intersensory difficulties.\(^3\)

Warner posed the problem of determining the most effective pairing of modes of sensory stimulation (visual, auditory and combined visual-auditory). The subjects included fifty-nine educable mentally retarded children. His conclusions are

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as follows:

1. Educable mentally retarded children demonstrate preferred modes of sensory stimulation in paired-associate learning.

2. Rate of paired-associate learning among educable mentally retarded children is superior through the visual sense. A combination of sensory stimulation is of less value and the auditory sense is inferior to both of the others.

3. Retention as measured by paired-associate learning is equally effective through the visual sense as it is through a combination of sensory stimulation among educable mentally retarded children. The auditory sense is the least effective sense modality for retention.

4. A relationship between chronological age and preferred sense modalities among educable mentally retarded children was demonstrated. As age increases, vision becomes a more effective sense modality for retention.

5. Within the limits of this study, there appears to be no significant relationship between sex and preferred sense modalities among educable mentally retarded children.1

Stereognosis and Motor Skills

Since stereognostic ability is dependent on motor adeptness it is necessary to examine this and other qualities considered essential for the training of retarded individuals in a motor skill. Whether the skill is to be developed for a short term problem, i.e., the present study, or for a long period of time involving gainful employment, the needs are

---

the same. Clarke summarized the following factors as necessary for the training of retardates in motor skills:

1. Subjects must be well motivated, and the most effective motivation seems to be the setting of a realistic goal. This, in relation to problem-solving tasks would mean the problem should not be so easy as to be boring and not be so difficult as to lead to excessive fatigue and frustration. Knowledge of results should be provided.

2. The task to be learned needs to be broken down to its basic constituents. This would imply a distinct series of steps, the successful accomplishment of each being dependent on mastering the previous one. The importance of the right sequence must be stressed.

3. Spaced learning and need for over-learning. These principles, which have been found useful for the acquisition of skills, have also proved valid for learning conceptual and abstract material.

4. The importance of verbal reinforcement.¹

Utilizing a motor task, Cegelka investigated the extent of rigidity in forty mentally retarded children when compared to forty normal children of the same mental age. The results refuted the postulated characteristic of rigidity in mentally retarded children.² Additional research,³ has supported


Cegelka's finding; therefore this characteristic was discounted as relevant and not taken into account by the researcher in the present research. Nor was "rigidity" of response noted in the Ss during the collection of data for the present experiment.

In a study concerning the different aspects of uni-modal and cross-modal coding in mentally retarded children, Rosen concluded that both uni-modal and cross-modal coding effects appear to be limited by the specific modality and type of coding tasks involved. Rosen found that the greatest inaccuracy occurred when neither signal or response contained verbal elements. On the other hand he found that the greatest accuracy of response was obtained when both codings contained verbal elements. According to Rosen, "Accurate coding is facilitated by conditions which elicit verbal formulation of the signal."

Rosen tested three modes of stimulus input (auditory, motor and verbal) and three response modes (motor, motor with auditory feedback and verbal). Each subject received the signal through one input modality and responded consecutively by all three output modes. Three response orders were counterbalanced with each input group. Fifty-four retarded adolescents

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served as subjects. Rosen found significant differences between input as well as output treatments. The use of motor signals or motor responses resulted in relatively inaccurate imitation. The most effective condition was a verbal signal-verbal response arrangement; the least effective was motor signal-motor response. The addition of auditory feedback to motor response did not significantly increase the accuracy of imitation of an auditory signal and was not consistent with a sensory matching mechanism of coding.1

Knight set out to determine that a mongoloid will show poor ability in tactual discrimination and motor tasks. The only task on which the mongoloids performed superior to non-mongoloids retardates was the visual-tactual recognition task. Knight concluded that pure motor skills of mongoloid and non-mongoloid retardates are similar when compared without regard for conceptual understanding.2

Similar findings have been reported by Nakamura who compared the performance of mongoloid and non-mongoloid retardates on the Stanford-Binet. He found that the mongoloids were significantly superior to non-mongoloids on psychomotor

1Ibid.

tasks which permitted the use of vision, namely: three-hole formboard, block bridge building and circle copying. Research previous to Nakamura's has supported the assumptions that visual and tactual modalities do not operate independently of each other\(^1\) (e.g., Jaffee,\(^2\) Ohwaki,\(^3\) and Mayer\(^4\)). The more recent study of Rierdan,\(^5\) also has confirmed these findings.

The rationale for the present research was developed from the research of O'Connor and Hermelin. This study isolated the visual and tactual-kinesthetic modalities to determine the more effective means of shape discrimination in a group of sixty trainable retardates (I.Q.'s 30-55 with chronological ages from 7-16 years). An analysis of this research indicated that performance of cross modality recognition (i.e., visual-stereognostic, stereognostic-visual), tasks did not differ significantly from that of visual like-modality tasks.

\(^1\)H. Nakamura, "An Inquiry into Systematic Differences in the Abilities of Institutionalized Adult Mongoloids," American Journal of Mental Deficiency, LXIX (1965), 661-65.


Tactile inspection and recognition resulted in a significantly better performance. O'Conner and Hermelin included a sample of normal subjects. They found that in the performance of these tasks there was no significant difference between that of the retardates and the normal subjects. The subnormals were significantly better than normals in like-modality stereognostic recognition scores according to O'Conner and Hermelin. The authors suggest that this level of mental ability does not reveal an impairment of stereognostic ability equal to the impairment of visual ability. They further state, "If this finding is supported in further experiments, implications for alternative teaching methods of imbecile children should be considered." ¹

If the ability to identify visual shapes at a glance is developed gradually, significantly better results should be obtained with a group of older retarded subjects. Since it has been proposed by Hebb that visual ability is not perfected until about the thirteenth year, the lower level of the age range was set at this chronological age for the present study in order to test this hypothesis. ²

¹ O'Connor and Hermelin, "Recognition of Shapes by Normal and Subnormal Children," op. cit., p. 234.

Summary

After reviewing the evidence pertaining to this problem, the researcher determined that there was no uniform support for the assumption that crossing sensory modalities significantly assists the memory in task-achievement for mentally retarded subjects. No studies reviewed included research in which retarded subjects were tested with cross-modality tasks after training.

The following chapter describes the selection of subjects for the study, method, investigative and statistical procedures.
CHAPTER III

DESIGN

This chapter describes the selection of subjects for the study, the investigative procedure, and the statistical procedures used in analyzing the data.

Selection of Subjects for the Study

Subjects for the study were selected from the records of enrollees at the Los Lunas Hospital and Training School, a state facility for the mentally retarded, at Los Lunas, New Mexico. Los Lunas Hospital has an average resident population of 488. The patients range in age from six months to sixty-one years.\footnote{E. S. Hirsch, "Just What is Los Lunas?" New Mexico Speech and Hearing Association Journal, I, No. 1 (January, 1963), 14.} Eighty-six children met the criteria. From this sample sixty were randomly selected and assigned to one of two task groups. Subsequently each task group was randomly divided into three sub-groups, hereinafter referred to as Method groups 1, 2, and 3. The subjects met the following criteria for eligibility:

1. All subjects had been residents of the Hospital and Training School for no less than three months.

2. All subjects selected had undergone individual intelligence tests at the Hospital and Training School, and received I.Q. scores ranging from 40 to 60.
3. All subjects had reached the chronological age of thirteen years and had not exceeded nineteen years.
4. Except for those limitations imposed by their lack of mental ability, all subjects were free of limiting physical or sensory disabilities which would have impeded their participation in the experiment or prevented their comprehension of instructions.
5. No subjects were selected who were undergoing extensive medication which might impair sensory ability or interfere with their understanding of instructions.

**Methods**

The two experimental treatment groups were employed as follows: Group A: task presented with no opportunity for learning; Group B: task presented with an opportunity for learning. Control for a difference in perceptive ability due to sex was attempted through the use of an equal number of males and females in each of the six sub-groups. Ten subjects were randomly assigned to each group. (See Table 1.)

**Apparatus**

Sensory task material consisted of ten Greek and German-Script letters. Only those letters which differed considerably from letters of the Roman alphabet were included. The letters were cut from soft pine and measured 1/4 inch thick by approximately 5 inches high. They were backed with tag-board for
### Table 1

**PLAN OF THE EXPERIMENT**

<table>
<thead>
<tr>
<th>Task</th>
<th>Method</th>
<th>Sex</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>Stereognostic-Visual</td>
<td>Male</td>
<td>n-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>n-5</td>
</tr>
<tr>
<td>No Training</td>
<td>Visual-Visual</td>
<td>Male</td>
<td>n-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>n-5</td>
</tr>
<tr>
<td></td>
<td>Stereognostic/Visual-Visual</td>
<td>Male</td>
<td>n-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>n-5</td>
</tr>
<tr>
<td>Group B</td>
<td>Stereognostic-Visual</td>
<td>Male</td>
<td>n-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>n-5</td>
</tr>
<tr>
<td>Training</td>
<td>Visual-Visual</td>
<td>Male</td>
<td>n-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>n-5</td>
</tr>
<tr>
<td></td>
<td>Stereognostic/Visual-Visual</td>
<td>Male</td>
<td>n-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>n-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>n=60</td>
</tr>
</tbody>
</table>
strength, and painted light green.

A large box was used with openings at one end to permit the subject to insert his hands and inspect the stimulus figure without seeing it.

Distraction was minimized by the use of a white table cover, plain room and elimination of all unnecessary equipment.

A testing sheet with pertinent information about each subject was used to record the responses. (See Appendix 1.)

Procedure

The sixty subjects were randomly assigned to two experimental groups; group A to be tested after one exposure to the materials, and group B to be tested after ten exposures to the materials.

Each experimental group was further subdivided into three treatment groups (1: Stereognostic; 2: Visual; and 3: Stereognostic/Visual) with ten individuals to the group. Each treatment group contained five males and five females.

Subjects from the different groups were trained in random order. A subject was brought to the experimental room and seated facing the examiner. The box containing the stimuli was on the subject's left and no stimuli were in view.

Five of the ten figures had been randomly selected for the initial tasks and were presented as follows:

Group A: Prior to testing, Subjects in Group A were allowed to make a single inspection of the test stimuli as follows:
A1 The stereognostic group was informed that they were to feel an object without seeing it. The S was requested to place his hands through the openings in the sides of the box. (The E extended her hands to the openings from the other side to reassure the more reluctant subjects.) After the subjects' hands were extended through the opening, the E placed a stimulus figure in the hands of the S. When necessary the S's hands were guided around the first figure.

A2 The visual group viewed each stimulus for ten seconds with a five second interval between presentations of stimuli.

A3 The Dual-Modality Group inspected the stimulus figures visually and tactually in the same order as presented to Groups 1 and 2.

Group B: The stimuli were presented to subjects in the same order as presented to Group A. The stimulus figure to be learned was presented to the subject ten times at five second intervals along with other figures and the subject was required each time to identify the figure to be learned. These subjects were socially reinforced for each correct identification of the stimuli.

B1 The stereognostic discrimination group inspected and learned to identify the five stimulus figures tactually.

B2 The visual discrimination group inspected and
learned to identify the five stimulus figures visually.

The Dual-Modality learning group inspected and learned to identify the five stimulus figures stereognostically and visually.

**Criterion Task**

Immediately after the initial task a recognition test was given to each of the six experimental groups. The stereognostically and visually inspected figures and five others were presented, one at a time in the same order (randomly determined) to all subjects. The subject was instructed to say whether or not he had seen and/or felt each figure on the previous task. The response was recorded on a testing sheet (see Appendix 2).

**Investigative Procedures**

The hypotheses considered in the study and the procedures used in testing the hypotheses are as follows:

1. A group of retarded adolescents presented with a sensory task with an opportunity for learning will not score significantly different than a comparable group presented with the same sensory task with no opportunity for learning.

2. There will be no significant difference in the scores obtained by groups of subjects when subdivided according to sensory task methods, i.e., visual, stereognostic and visual/stereognostic.
3. There will be no significant difference in scores obtained by subjects of different sex when compared by task.

4. There will be no significant difference in scores obtained by subjects of different sex when compared by method.

**Statistical Procedures**

Three statistical procedures were used in the present investigation:

1. Analysis of variance - Multiple Classification\(^1\) to determine the difference and interactions between task, method and sex.

2. Newman Keuls to determine the nature of the differences between treatment means following a significant over-all F.\(^2\)

3. Correlation of coefficient\(^3\) to determine the reliability of the testing instrument through the use of the split-half method.\(^4\) The result revealed a correlation of .90. The table value of \(r\) at the 1\% level is .33 for a sample of sixty subjects; therefore, for this investigation, this test instrument was considered to be a reliable one.

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\(^3\)Wert, op. cit.

Summary

This chapter has described (1) the subjects used in the study and the criteria by which they were selected; (2) the investigative procedures, the method of investigation, the apparatus, and (3) the techniques used in analyzing the data.

The data and the results of their analyses are presented in detail in the following chapter.
CHAPTER IV

RESULTS AND DISCUSSION

This chapter presents a description of the population, the analysis of the data and the findings for each hypothesis posed in the study.

Description of the Population

Sixty children who met the criteria were selected for the experimental group. The sample ranged in age from thirteen to nineteen years. The I.Q. scores ranged from 40 to 60 as measured on individual intelligence tests. Subjects with severe sensory or motor disabilities were excluded. Also those subjects who were undergoing extensive medication were excluded because of the possibility of impaired sensory ability or lack of understanding.

Analysis of Test Results

Hypothesis 1: A group of retarded adolescents presented with a sensory task with an opportunity for learning will not score significantly different than a comparable group presented with the same task with no opportunity for learning.

For this comparison the analysis of variance test was used. The sixty subjects were divided into two groups for testing; Task A group to be tested with no learning and Task B group to be tested with learning. For the one degree of
freedom in this distribution, analysis of variance is significant at the .01 level if F has a value of 7.19. The computed analysis of variance was 7.43. Table 2 presents this comparison. Since this result shows a significant relationship, the null hypothesis must be rejected. In this study there was a significant difference when one of the experimental groups received training on the task presented.

A Newman Keuls analysis was computed to determine the nature of the difference between treatment means. A significant difference was revealed by examination of the table giving the distribution of the Studentized Range statistic.¹ The table value of 28 exceeded the matrix value of 25.38. The result showed a significant difference to exist between the means of 67 and 95 - the results achieved from sensory task methods A₁ and B₁. (See Figure 1)

Hypothesis 2: There will be no significant difference in the scores obtained by subjects when subdivided according to sensory task methods, i.e., visual, stereognostic and visual/stereognostic.

Tables 3 and 4 demonstrate the means achieved for each sub-group, as well as the means combined according to the method. For the analysis of this hypothesis the analysis of variance test was used. For the two degrees of freedom in this distribution an

¹The studentized range statistic is the difference between the largest and smallest treatment means. (Winer, p. 77)
Table 2
ANALYSIS OF VARIANCE EVALUATING THE MAIN EFFECTS OF TASK, METHOD AND SEX AND THE INTERACTIONS

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>1</td>
<td>25.35</td>
<td>25.35</td>
<td>7.43**</td>
</tr>
<tr>
<td>Method</td>
<td>2</td>
<td>4.43</td>
<td>2.21</td>
<td>.65</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>.01</td>
<td>.01</td>
<td>.0026</td>
</tr>
<tr>
<td>Task x Method</td>
<td>2</td>
<td>22.20</td>
<td>11.10</td>
<td>3.26*</td>
</tr>
<tr>
<td>Task x Sex</td>
<td>1</td>
<td>.82</td>
<td>.82</td>
<td>.24</td>
</tr>
<tr>
<td>Method x Sex</td>
<td>2</td>
<td>7.04</td>
<td>3.52</td>
<td>1.03</td>
</tr>
<tr>
<td>MxTxS</td>
<td>2</td>
<td>57.59</td>
<td>28.79</td>
<td>8.44**</td>
</tr>
<tr>
<td>Within</td>
<td>48</td>
<td>163.54</td>
<td>3.41</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>280.98</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P. < .05

**P. < .01
Table 3
MEANS, RANGES, AND STANDARD DEVIATION
OF CRITERION TASKS

<table>
<thead>
<tr>
<th>Type of Task</th>
<th>Mean</th>
<th>S.D.</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task A*</td>
<td>7.67</td>
<td>2.37</td>
<td>2 - 10</td>
</tr>
<tr>
<td>(No training)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task B</td>
<td>8.97</td>
<td>1.64</td>
<td>5 - 10</td>
</tr>
<tr>
<td>(Training)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*N = 30

Difference between means 1.30  
\[ F = 7.43 \]  Sig  .01

Table 4
MEANS, RANGES AND STANDARD DEVIATIONS
OF THE CRITERION TASKS BY METHOD

(Tasks A and B Combined)

<table>
<thead>
<tr>
<th>Method</th>
<th>Mean</th>
<th>S.D.</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stereognostic-Visual</td>
<td>8.100</td>
<td>2.237</td>
<td>2 - 10</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual - Visual</td>
<td>8.105</td>
<td>2.290</td>
<td>5 - 10</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stereognostic/Visual-Visual</td>
<td>8.700</td>
<td>1.947</td>
<td>5 - 10</td>
</tr>
</tbody>
</table>

*N = 20

\[ F = .65 \]  Not significant
analysis of variance is significant at the .05 level if it has a value of 3.19. The computed analysis of variance was .65. Table 2 presents this comparison. Since this figure is below the value that is considered significant at the .05 level, we accept the null hypothesis. The three task groups each received training in a different modality. In this study there were no significant differences in the recall scores obtained in the different sensory task methods.

An analysis of the interaction between task and method revealed a significant difference at the .05 level of confidence. For the two degrees of freedom in this distribution an analysis of variance is significant at the .05 level if it has a value of 3.19. The computed analysis is 3.26; therefore we may conclude that there is a significant difference between task and method in this study. Figure 1 demonstrates this difference. Scores analyzed according to sex as a main effect revealed very little difference. For the one degree of freedom in this distribution analysis of variance is significant at the .05 level if F has a value 4.04. The computed analysis is .0026; therefore we may conclude that there is no significant difference attributable to sex in this sample.

Hypothesis 3: There will be no significant difference in the scores obtained by subjects of different sex when compared by task. In analyzing the variance for task by sex an F of 4.04 would be necessary in order to achieve significance at the .05 level of confidence with one degree of freedom. The F obtained was .24; therefore we conclude that there is no
Figure 1

Analysis of Variance: Task by Method
significant interaction between the task and sex in this study and accept the null hypothesis.

Hypothesis 4: There will be no significant difference in scores obtained by subjects of different sex when compared by method. For the two degrees of freedom in this distribution, analysis of variance is significant at the .05 level if F has a value of 3.19. The computed analysis is 1.03; therefore we conclude that there is no significant interaction between the scores of males and females on the criterion task according to method and we accept the null hypothesis. When the data was analyzed to determine whether or not there was an interaction taking place among method, task and sex, the result appeared as follows: For the two degrees of freedom in this distribution analysis of variance is significant at the .01 level if F has a value of 5.08. The computed analysis is 8.44; therefore we may conclude that there is a significant interaction taking place. This difference is presented in Table 2.

Summary of the Findings

The hypothesis that mentally retarded subjects achieve a higher score on a criterion task after a training period than they achieve without this training period was supported by these findings. This difference was determined by analyzing the results of tests given to six sub-groups after a training period encompassing two areas of learning - namely, visual and stereognostic. The raw data revealed a significant increase in the results on the criterion task when both visual and stereognostic exploration of the stimulus figures were presented in the initial
task, heretofore designated as Task A3.

It was found that recall by the subjects was usually influenced by prior training. A higher mean (8.97) was achieved by the group which had received training than was achieved by the group which had not received training. The mean for the group without training reached 7.67. Table 3 shows the means, standard deviation and ranges for these two different tasks. The training group obtained a mean of 8.8 on the method measuring visual discrimination whereas the group without training achieved a mean score of 7.5. (See Table 4)

The greatest mean difference in scores between the groups with training and those without training was observed in testing after treatment under method 1. Table 5 presents the means, standard deviations, and ranges for the method groups. Method 1 included a stereognostic exploration of the stimulus figure on the initial task with a criterion test of visual discrimination of the non-representational figures. This result would lead to the conclusion that tactual exploration of a stimulus figure, without an opportunity for visual inspection is effective when sufficient trials are presented.

Analysis of the criterion task results achieved by male and female groups revealed the lowest mean square observed and indicated no significant interaction. However analysis of a combination of sex difference with method and task revealed the highest mean square and a significant interaction. This analysis resulted in an F of 8.44, significant beyond the 1 per cent level of confidence.
### Table 5
MEANS, RANGES AND STANDARD DEVIATIONS OF METHODS - TASKS A AND B

<table>
<thead>
<tr>
<th>Method</th>
<th>Mean*</th>
<th>S.D.</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stereognostic-Visual</td>
<td>6.7</td>
<td>2.283</td>
<td>2 - 10</td>
</tr>
<tr>
<td><strong>Task A</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(No training) Visual-Visual</td>
<td>7.5</td>
<td>2.410</td>
<td>5 - 10</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stereognostic/Visual-Visual</td>
<td>8.8</td>
<td>1.887</td>
<td>7 - 10</td>
</tr>
<tr>
<td><strong>Task B</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Training) Visual-Visual</td>
<td>8.8</td>
<td>1.887</td>
<td>5 - 10</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stereognostic/Visual-Visual</td>
<td>8.6</td>
<td>1.800</td>
<td>5 - 10</td>
</tr>
</tbody>
</table>

* Possible score: 10
Discussion

At the conclusion of the analysis of the data to determine whether or not to accept or reject the null hypotheses, the researcher further analyzed the data to explore additional inferences. The questions pursued were the differences in I.Q., age and etiology. The results were studied as follows.

In order to form two comparable groups to compute an analysis of variance, it was necessary to randomly eliminate twenty subjects from the original sample of sixty. This sample of forty subjects was used to analyze the difference in test results attributable to I.Q. and age. The first analysis revealed no difference in scores attained by subjects with I.Q.'s below 50 and scores obtained by Ss with I.Q.'s above 50. For the one degree of freedom in this distribution an analysis of variance is significant at the .05 level if the result reaches 4.11. Since the F score by this analysis is 1.14 as demonstrated on Table 6 we must conclude that on the criterion task there is no significant difference between the scores attained by subjects having an I.Q. above 50 and those having an I.Q. below 50.

When scores of these same subjects were analyzed for a difference attributable to chronological age (C.A. 13-15 1/2 and C.A. 16-19 years) no significant difference was found as revealed by the results on the criterion task. To be significant at the .05 level of confidence with one degree of freedom,
Table 6

ANALYSIS OF VARIANCE EVALUATING THE MAIN EFFECTS OF
THE DIFFERENCES IN I.Q. AND AGE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Q.</td>
<td>1</td>
<td>5.625</td>
<td>5.62</td>
<td>1.14</td>
</tr>
<tr>
<td>Age</td>
<td>1</td>
<td>3.475</td>
<td>3.47</td>
<td>.705</td>
</tr>
<tr>
<td>I.Q. x Age</td>
<td>1</td>
<td>1.600</td>
<td>1.6</td>
<td>.325</td>
</tr>
<tr>
<td>Within</td>
<td>36</td>
<td>177.300</td>
<td>4.925</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39</td>
<td>188.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
variance must reach an F of 4.11. This comparison, as indicated
on Table 6 reveals a variance of .705; therefore, we may conclude
that there is no significant difference in the scores on the
criterion task as a result of a difference in chronological age.

This lack of a significant difference on the criterion
task when intelligence and age were analyzed indicated the prob-
ability that a similarity is present between the age and I.Q.
groups which comprised the sample for the present study. (See
Table 6, F = .325.)

The subjects were usually unable to discuss the ramifica-
tions of the task with each other because of the non-representa-
tional aspects of the stimulus figures, and the subjects were
called to the examining room from various sections of the campus
and usually returned immediately after the testing period.
Though the age span of the subjects included in the study ranged
up to seven years all were of relatively equal ability according
to the present analysis. A similar conclusion may be reached
for the I.Q. span. The range from 40 to 60 is not great. The
results of the evaluation of I.Q. and age indicate that the
subjects form a homogeneous group.

A review of the subjects' etiology of mental retardation
showed that twenty members of the sample were diagnosed as pri-
marily cultural-familiarily\(^1\) retarded. A random selection was

\(^1\)Rick Heber, "A Manual of Terminology and Classification
in Mental Retardation," American Journal of Mental Deficiency,
Monograph Supplement (April, 1961), 3.
made from the number of organically retarded to form a comparable group, and an analysis of variance - single classification was computed to determine whether or not a difference existed in the criterion task results. For the one degree of freedom in this distribution, an analysis of variance is significant at the .05 level of confidence if the result reaches 4.20. Since the computed analysis is .9155 as demonstrated on Table 7, we may conclude that there is no significant difference in the responses on the criterion task given by the Ss when grouped according to the diagnosed cause of mental retardation.

Chapters I and II made reference to the research of O'Connor and Hermelin. In reviewing this study the researcher took into account their results in setting up the present design. Since visual acuity is believed to be achieved by the age of thirteen years, this age was taken as the lower limit in the present research. The findings revealed that visual acuity showed an increase in task scores with an increase in exposure; (Task B); however, in addition to this finding, a higher result was obtained on the initial task (A) when compared with the results on Task A (stereognosis). When we compare the results of O'Connor and Hermelin a reverse result is revealed, i.e., the research of O'Connor and Hermelin showed higher results on the

\[1\] O'Connor and Hermelin, "Recognition of Shapes by Normal and Subnormal Children," op. cit., 281-84.
Table 7

ANALYSIS OF VARIANCE EVALUATING THE MAIN EFFECTS OF ETIOLOGY OF MENTAL RETARDATION

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td>1</td>
<td>4.033</td>
<td>4.033</td>
<td>.9155</td>
</tr>
<tr>
<td>Within</td>
<td>28</td>
<td>123.334</td>
<td>4.405</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>188.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
task involving stereognostic perception than the Ss achieved on the visual perception task. The Ss chronological ages for this study were seven to sixteen years. Figure 2 shows the results of the above research as well as the results of the present research. This comparison arouses interest in the possible outcome of research conducted along the present lines with subjects the age of those used by O'Connor and Hermelin.

Throughout the testing the researcher noted a desire to attach a verbal symbol to the stimuli by the subjects, in spite of the fact that the testing stimuli were essentially non-representational in shape. This tendency to verbalize did not form a pattern. However, it is the writer's belief that if there had been an appropriate verbal symbol for the stimuli an increase in scores would have resulted. Since the purpose of the present research was the elimination of extraneous stimuli in order to measure the effect on the sensory modalities of vision and stereognosis, verbalization was not taken into consideration. Some of the subjects evidenced a compulsion to make a verbal response even when they had been informed by the examiner that a verbal response was not necessary nor expected.

Implication

The present research indicates a need for additional training to implement greater recall among retardates. Task B scores (Training) were higher than Task A scores (No Training).
Results: N. O'Connor and B. Hermelin Research

Results: Present Research

Figure 2

Comparison of Results of Research of O'Connor and Hermelin with Present Research.

aN. O'Connor and Hermelin, "Recognition of Shapes by Normal and Subnormal Children," op. cit., 281-84.
Figure 1 shows the wide difference in the results of Method 1 on Tasks A and B. The difficulty of establishing recall with one exposure to a stereognostic task is clearly evident; however, with additional stereognostic training a higher level of recall is achieved (i.e., Task B). The novelty of the initial learning task may have influenced the scores on the criterion task following Method 1.

The results on the visual task (Method 2) indicate previous training in this modality. Training in school is primarily through vision and the above may be assumed for subjects training at Los Lunas Hospital and Training School as well as those pupils in the Public Schools.

Method 3 (visual/stereognostic) revealed results on the criterion task at a higher level for the group which had received less exposures to the stimuli. (See Figure 1) This observation seems to indicate that in learning a task more viewing of the desired response will produce more positive results but that when a task needs to be grasped in a short presentation period, utilizing the visual stimulus with a stereognostic opportunity will increase learning in mentally retarded subjects.

The similarity of results on the criterion tasks observed between groups of different sex, age, and I.Q. is noteworthy. This similarity of results may be explained by the common training program used for both sexes or by a close level
of achievement attributable to both sexes in this particular age group. The length of confinement in the institution was not taken into account in recording the ages of the subjects. Some subjects may have become "institutionalized" after a long stay, and this could have contributed to similar results on the criterion task for both age groups. The lack of a significant difference in I.Q. (40 to 60 points among the test groups) may largely account for the closeness of scores among these groups.

Although the significance of a difference in the etiology eluded the statistics, the researcher is not convinced that a difference does not in fact exist.

Summary

The purpose of this chapter was to present the data obtained in the study and to discuss the analysis and interpretations of the data which would permit acceptance or rejection of the four hypotheses stated at the outset of the study. Instruments used in gathering data for the testing of the hypotheses were reviewed. Methods of compiling and analyzing data were described, and the results of each analysis were interpreted. Results of the analyses of the data permitted rejection of one of the four hypotheses of the study. The following chapter will outline the conclusions warranted by these results, and present recommendations for further research.
CHAPTER V

SUMMARY

The purpose of this study was to investigate the effect of sensory modality training on institutionalized mentally retarded adolescents. The primary investigation concerned the effect on retardates of sensory modality training with an opportunity for learning when compared to the effect on a comparable group given the same training with no opportunity for learning. The secondary investigation was the comparison of responses of three groups on the criterion task; one group having been trained with a tactual modality, one with a visual modality and one with combined tactual and visual modality. The sample included an equal number of males and females and the sex difference in performing the criterion task was investigated.

Sixty subjects, pupils at the Los Lunas Hospital and Training School, were included in the experiment. The Ss were randomly assigned to six treatment groups:

1. Visual treatment without training.
2. Stereognostic treatment without training.
3. Visual and stereognostic treatment without training.
4. Visual treatment with training.
5. Stereognostic treatment with training.
6. Visual and stereognostic treatment with training.
Findings

The findings will be reported in the same order that the hypotheses were stated in Chapter IV.

Hypothesis 1

The hypothesis was: A group of retarded adolescents presented with a sensory task with an opportunity for learning will not score significantly different than a comparable group presented with the same sensory task with no opportunity for learning.

The retarded adolescents who had been presented a task with an opportunity for learning scored significantly higher than a comparable group presented with the same task with no opportunity for learning. An F of 7.43 established significance at the .01 level of confidence. The hypothesis was rejected.

Hypothesis 2

The hypothesis was: There will be no significant difference in the scores obtained by groups of subjects when subdivided according to sensory task methods, i.e., visual, stereognostic and visual/stereognostic.

There was no significant difference in recall among three groups of mentally retarded adolescents after each group had been trained by one of the above task methods, therefore, the null hypothesis was accepted.
Hypothesis 3

The hypothesis was: There will be no significant difference in scores obtained by subjects of different sex when compared by task.

There was no significant difference in recall between males and females; therefore, we accept the null hypothesis.

Hypothesis 4

The hypothesis was: There will be no significant difference in scores obtained by subjects of different sex when compared by method.

There was no significant difference between male and female subjects in the interaction of methods; therefore, the null hypothesis was accepted.

Conclusions

Based on the results of the analysis of variance-multiple classification, some conclusions may be drawn. These conclusions apply only to this population and inferences to other populations are neither suggested nor implied.

1. The subjects who had received training (Task B Group) achieved a significantly higher score on the criterion task than a comparable group who had not received training (Task A Group). The amount of recall seemed to be influenced by the amount of prior training. This was true for all task B groups when
training was visual only, tactual only, or visual and tactual.

2. There was evidence that a pre-learned stereognostic sensory task (Task B₁) contributed to greater recall. This conclusion supports previous findings of greater stereognostic ability in individuals of this intellectual level. It is possible that mental deficiency does not affect stereognostic perception to the extent that it effects visual perception. The greatest difference in task scores attributable to pretraining was found to exist between groups trained in the stereognostic modality (Task B₁). The second most effective use of pretraining was in the visual modality (Task B₂). The most unexpected results were found in analyzing the groups which had received pretraining with both visual and stereognostic modalities (Task A₃ and B₃). Those subjects who had no pretraining achieved higher scores on the criterion task than did those subjects who had pretraining. This may be an indication that when both sensory modalities are utilized "over-learning" of a task loses it's impact. The possibility of sensory modality interference when a task is repeated in present. Fatigue may have influenced the scores of the group with the training task in both modalities (Task B₃); however,
the unusual administration (see Procedures) of the stereognostic learning may have influenced the results.

3. Considering both age and intelligence while comparing the responses of males and females leads to the conclusion that there is no difference in response attributable to a sex difference.

4. Comparing the responses of males and females of comparable age and I.Q. to a visual and/or stereognostic sensory task reveals similar results. In this sample, the male subjects responded to the tasks in the same manner as female subjects.

5. Retarded adolescents' age achieve greater recall on a visual task than on a stereognostic task. It is possible that a certain level of visual acuity is reached by this chronological age range.

Recommendations

For Training Programs

On the basis of the results of this study, it is recommended that:

1. Teachers of young mentally retarded (C.A. below 13 years) utilize stereognostic as well as visual and auditory teaching methods to develop concepts, or reinforce previous inadequately learned concepts.
2. When the method of stereognostic-learning is pursued, the effect of such training on pre-vocational concepts should be investigated.

3. In preparing retarded adolescents for a long period of concentrated work activity the following training technique could be initiated on a trial basis: fifteen minutes at a task, fifteen minutes relaxed activity, increased to twenty minutes working at a task and fifteen minutes off. The length of time working at a task could be increased until the working time includes one or one and one-half hours of concentrated activity.

For Further Research

The results of this investigation emphasize the need for the following types of research:

1. It is recommended that a similar study be conducted using a larger sample.

2. It is recommended that a similar study be conducted utilizing a sample of Ss who are disabled in at least one sensory modality (i.e., visual, auditory) to determine whether compensation does in fact take place in the sensory modalities not effected.

3. It is recommended that a long-range study be conducted by modification of the teaching methods based on the results of the findings of the present study.
(i.e., stereognostic and visual training). In a study of this type pre-testing and post-testing could be used to determine the effect of the training methods. No less than two years should be considered adequate for a reasonable evaluation of the methods.

4. It is recommended that a similar study be conducted with a large sample of mentally retarded Ss differentiated as to etiology (cultural-familial or organic retardation).

5. It is recommended that a study be conducted to determine the effect of institutionalization on the sensory abilities of retarded individuals. A study of this nature could include a comparison of mentally retarded pupils in public schools with mentally retarded pupils in a state institution.

6. Because of the conclusion that stereognostic ability is more outstanding at a younger age, value could be obtained from a study determining the youngest possible age at which to begin this type of training with mentally retarded children.

7. It is desirable that further investigation be made into the effect of training without learning in two modalities as opposed to training with learning in two modalities. The possibility of sensory modality
interference should be investigated further.

8. It is recommended that the present study be duplicated with the addition of a verbal label designated for each stimuli. Thus, a comparison of the results derived from the second study could measure the effect of verbalization in training mentally retarded adolescents.

9. Finally, it is recommended that a younger group of mentally retarded children be included in a comparable study to measure the effectiveness of stereognostic ability.
Appendix 1

VISUAL AND STEREOGNOSTIC PERCEPTION
OF MENTALLY RETARDED ADOLESCENTS

<table>
<thead>
<tr>
<th>Name</th>
<th>Sex</th>
<th>M</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronological Age</td>
<td>Intelligence Quotient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cottage</td>
<td>Social Quotient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Etiology</td>
<td>Drugs</td>
<td></td>
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</tr>
</tbody>
</table>

GROUP A  (NO LEARNING)  TYPE TASK

1. Stereognostic-Visual
2. Visual-Visual
3. Stereognostic/Visual-Visual

GROUP B  (LEARNING)  TYPE TASK

1. Stereognostic-Visual
2. Visual-Visual
3. Stereognostic/Visual-Visual
Appendix 2

VISUAL AND STEREOGNOSTIC PERCEPTION
OF MENTALLY RETARDED ADOLESCENTS

Order of Presentation
of Stimuli:

ORDER OF INITIAL TASK

1. \( S \)
2. \( \Omega \)
3. \( \bigcirc \)
4. \( \Pi \)
5. \( \sigma \)

ORDER OF CRITERION TASK

1. \( \Omega \)
2. \( \bigcirc \)
3. \( \Pi \)
4. \( \sigma \)
5. \( S \)
6. \( \Theta \)
7. \( \phi \)
8. \( \psi \)
9. \( \phi \)
10. \( \sigma \)

Reactions During Testing:

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________


Hirsch, E.S. "Just what is Los Lunas?" New Mexico Speech and Hearing Association Journal, I, No. 1 (January, 1963), 14-16.


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